HW

REPORT OF THE SIXTEENTH MEETING OF COORDINATION OF GEOSTATIONARY METEOROLOGICAL SATELLITES

CGMS XVI

Washington, DC

28 September - 2 October 1987

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AGENDA FOR CGMS XVI, 28 SEPTEMBER - 2 OCTOBER 1987

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A. PRELIMINARIES

CGMS XVI was convened at 9:40 a.m. on September 28, 1987 by Mr. Larry Heacock, Chief of the Office of Satellite Operations, NOAA/ NESDIS.
Mr. Russell Koffler, Acting Deputy Assistant Administrator for Satellites welcomed the CGMS members on behalf of the United States. Mr. Koffler noted, with pleasure, the informal approach of the CGMS and its contribution over the past fifteen years to the geo-stationary satellite programs of the world community. Representatives from India and the USSR were unable to attend this session of CGMS.

A.1 ELECTION OF THE CHAIRMAN

A.1.1 Election of the Working Group Chairman

Mr. Larry Heacock, nominated by Mr. John Morgan, was unanimously elected chairman.

A Drafting Committee was appointed, which included representatives from each delegation. (Mr. Gordon Bridge and Mr. Carl Staton agreed to co-chair the committee, in keeping with past CGMS meetings.)

Working hours were established for Monday - Wednesday, 9:00a.m. to 12:00 noon and 1:30 - 3:30 p.m. Thursday was scheduled for review of the minutes and tours, with Friday reserved for the meeting of the Senior Officials.

A.1.2 Election of Senior Officials Chairman

Mr T Pyke, Assistant Administrator for Satellites and Data, was unanimously elected Chairman of the Senior Officials meeting.

A.2 ADOPTION OF THE AGENDA

The agenda was adopted, with items corresponding to the section numbers of this report. Working papers submitted to CGMS XVI are listed in Annex XII.

A.3 REVIEW OF ACTIONS FROM PREVIOUS MEETINGS

A.3.1 Circulation of Satellite Operations Quarterly Reports

Operations reports from Japan and USA (WEFAX bulletin) have been regularly circulated.

A.3.2 Quarterly Exchange of Photography

Photographs have been regularly exchanged.

A.3.3 Intercomparison of Extracted Winds

International comparisons of satellite winds have been performed by the USA.

A.3.4 Satellite Anomalies

All satellite operators to provide NOAA NESDIS with information on unexplained anomalies for study, and NOAA to provide solar event information to the satellite operators on request and a status report on the correlation study at each meeting.

Information has not been sent to NOAA on any regular basis however what has been received by NOAA is included in the various status reports.

A.3.5 Action 1 from CGMS XV

ESA to provide all other CGMS members with key results of the workshop and studies related to the Meteosat Second Generation (MSG).

Documents from the Ravenna workshop have been distributed.

A.3.6 Action 2 from CGMS XV

Each CGMS member (except ESA) to comment upon the above mentioned documentation.

No specific comments received to date.

A.3.7 Action 3 from CGMS XV

EUMETSAT to convene a Working Group to study the four recommendations set out in EUMETSAT Working Paper 1 (WP-1) with the aim of presenting a homogeneous set of recommendations for adoption at

CGMS XVI as guidelines for satellite systems to be operated and developed during the rest of the century.

Responses received from India, USA and WMO. This subject is addressed later in this report (see Section C.7).

A.3.8 Action 4 from CGMS XV

Each satellite operator to send specific detailed technical information about interference on the DCS frequency band to WMO with copy to other satellite operators.

Reports have been received.

A.3.9 Action 5 from CGMS XV

WMO to inform the ITU informally about the interference on the DCS reported by the satellite operators and report progress at the next meeting.

For further details, see Section E.1.

A.3.10 Action 6 from CGMS XV

Each admitting authority to inform ESA on all the DCPs admitted to the IDCS since November 1986.

Details have been exchanged.

A.3.11 Action 7 from CGMS XV

Each admitting authority to inform ESA each time a new DCP is in the process of being admitted to the IDCS.

Details have been exchanged.

A.3.12 Action 8 from CGMS XV

USA to issue quarterly to all other admitting authorities the consolidated DCP assignment.

A report was recently distributed.

A.3.13 Action 9 from CGMS XV

ESA and USA to evaluate the level of interference on IDCS channels and propose accordingly the channels to be used to support ships and ASDAR and to notify accordingly all other admitting authorities.

Other authorities have been informed.

A.3.14 Action 10 from CGMS XV

EUMETSAT and ESA to continue the study of the digital WEFAX concept and to propose a standard for submission to CGMS.

Further information on this subject can be found in Section F.1.4 of this report.

A.3.15 Action 11 from CGMS XV

ESA to inform SFCG about the interference reported by satellite operators with the aim of improving the protection of the DCS frequency band.

SFCG have been informed. It is proposed that EUMETSAT will become a member of the SFCG.

A.3.16 Action 12 from CGMS XV

WMO to evaluate with the operational ASDAR programme the feasibility of changing channels.

Channel change is technically feasible, however, such changes can be costly in both time and money if performed when the ASDAR is operationally deployed on an aircraft.

A.3.17 Action 13 from CGMS XV

ESA to coordinate with all CGMS members the date of CGMS XVI and confirm.

Completed.

A.4 REVIEW OF CONSOLIDATED REPORT

Working papers identifying modifications and corrections to the draft eighth edition of the CGMS Consolidated Report were presented by ESA, Japan, USA and WMO. The group agreed to a suggestion made by the WMO that much of the historical information could be summarized significantly. It was proposed that this summary should largely be confined to the three most recent meetings.

The Secretariat agreed to collate all the comments provided by the members and amend the draft document accordingly. WMO volunteered to assist in preparing the amended draft.

In addition, any modifications arising from discussions at CGMS XVI would be included in the eighth edition.

ACTION: 16.1 The Secretariat to update and distribute the eighth edition of the CGMS Consolidated Report to all members.

B. REPORT ON THE STATUS OF SATELLITE SYSTEMS

B.1 EUMETSAT

In WP-1 EUMETSAT presented a summary status report on Meteosat-1 and Meteosat-2.

i) Meteosat-1

This satellite has no fuel for station keeping and is no longer used as an operational satellite.

ii) Meteosat-2

Continues to be operated as the prime satellite (now more than six years old) providing the image taking and dissemination missions. The DCP mission, which failed at launch, is provided by means of the GOES-4 satellite, positioned at 43 degrees West.

The DCP mission will be operated through the P2 satellite once it is successfully placed in orbit, in order to provide the nominal telecommunications coverage.

Details of the status of Meteosat-2 can be found in Annex II of this report.

B.2 INDIA (report received by mail after the meeting)

INSAT-IB, launched on 31 August 1983 and operational since 15 October 1987, is functioning satisfactorily. INSAT-IB represents the first three-axis stabilized geostationary satellite carrying a Very High Resolution Radiometer (VHRR) for operational service. The VHRR payload as well as the satellite attitude control performances have been excellent and are according to the design. The VHRR on INSAT-IB has joined that very select club of geostationary orbit VHRR instruments whose members have successfully completed four years of continuous operation without exercise of any redundancy or any failures. As of now, since the day INSAT-IB VHRR was first switched on in September 1983, about 18000 VHRR images have been commanded. Eleven (11) full earth-disc scans are obtained daily as routine. Additional hourly and half-hourly images are commanded during special activity periods such as monsoon months or adverse weather/cyclone situations. So far, the maximum number of imagings commanded on a single day has been twenty seven (27).

The 400 MHz Data Relay Transponder (DRT) on INSAT-IB is in operation. 100 Data Collection Platforms (DCPs) are in the INSAT-IB DCP network. INSAT-IB DRT does experience certain external interference -- certain modulated signals as well as a sweeping signal. This interference often results in a data gap period. The whole system is under evaluation.

The INSAT meteorological data are processed at the INSAT Meteorological Data Utilization Centre (MDUC) located in New Delhi. INSAT-IB meteorological data are received at the Delhi earth station of INSAT and transmitted in real-time to MDUC on a microwave link. Cloud analysis of the INSAT-IB images is carried out regularly and bulletins are issued after every observation. Cloud Motion Vectors (CMVs) giving a measure of winds in the upper atmosphere are being derived regularly at 06Z using cloud pictures taken in the visible band half-an-hour apart for the following areas:

06.00 Z

Arabian Sea
24 deg. N - 10 deg. N
52 deg. E - 73 deg. E

Bay of Bengal
21.5 deg. N - 8 deg. N
84 deg. E - 93.5 deg. E

Indian Ocean
10 deg. N - 3 deg. S
72 deg. E - 85 deg. E

Indian Ocean (E)
8 deg. N - 5 deg. S
85 deg. E - 98 deg. E

Indian Ocean (S)
3 deg. S - 16 deg. S
72 deg. E - 85 deg. E

Indian Ocean (W)
10 deg. N - 3 deg. S
58 deg. E - 72 deg. E

The winds at 06Z at 850, 500 and 200 mb levels are transmitted over the National Meteorological Telecommunications Network for utilization within India and over the Global Telecommunications System (GTS) of WMO for international utilization. 03 Z full-disc IR pictures are also transmitted as radio facsimile broadcast on HF every day for reception in the neighboring countries.

Sea Surface Temperatures (SSTs) over the Bay of Bengal, Arabian Sea and Indian Ocean are derived as an experimental measure twice daily (03Z and 06Z) using IR data.

The INSAT weather pictures in analog facsimile mode are being transmitted every three hours to 20 Secondary Data Utilization Centres (SDUCs) in the country using leased communication links.

Under the INSAT Disaster Warning System (DWS) which provides cyclone disaster warning in a selectively addressable mode in selected cyclone prone regions of India (presently on an experimental-cum-demonstration mode). 100 DWS receivers are presently deployed in field.

B.3 JAPAN

The status of GMS-3 VISSR observation was reported in Japan WP 3-1. Particular note was made regarding the special observations contributing to the Australian Monsoon Experiment. The objectives, methods, etc., of these observations were described.

The status of GMS, GMS-2 and GMS-3 was reported. GMS-3 has operated normally except for lubricant hang-up problems. Because GMS-2 has defects in VISSR, TTC and Communication subsystems, a study to de-orbit this satellite is under consideration.

Details of Japanese GMS spacecraft can be found in Japan WP-3-2 (Annex III).

B.4 USA

USA WP-3 was presented; see Annex IV for details of the GOES status and anomalies.

GOES-7 was successfully launched in February 1987 which allowed the USA to return to a normal two satellite operation after two years with only one GOES satellite.

Discussions were held regarding fuel capacity of GOES-6 as well as the status of the encoder lamps. There is sufficient fuel to allow for north/south station keeping within a 1.8 degree inclination through 1989; the inclination of GOES-6 will then gradually increase. This should allow overlap with the launch of GOES-I.

GOES-6 was reported to be operating in the VISSR mode (i.e., not taking multi-spectral images or soundings). This was done to maximize the life of the current encoder lamp. This is the third of four lamps and is operating at step 4. None of the GOES encoder lamps have survived beyond step 4. The USA announced that GOES-6 VAS operations would begin during October 1987. If problems arise with the encoder, VAS operations will be suspended until the fourth bulb is switched on. As a result of VAS operations on GOES-6, WEFAX products transmitted through GOES-6 will be degraded during the time of simultaneous VAS and WEFAX transmissions.

C. REPORT ON FUTURE SATELLITE SYSTEMS

C.1 EUMETSAT

C.1.1 Status of the Meteosat Programmes - Space Segment

Under the ESA Pre-Operational Meteorological Programme, the two satellites Meteosat-1 and Meteosat-2 have been built and launched. Meteosat-2, launched in 1981, is still providing the image and dissemination missions, whilst the DCP mission is performed via GOES-4 positioned at 43 degrees West.

A prototype satellite, Meteosat P2, has been upgraded to flight standard as a temporary replacement for Meteosat-2. This model, which has been in storage since 1981, has completed pre-flight tests and is now in store awaiting launch as passenger on the first ARIANE-4 flight scheduled for launch in February 1988.

Under the METEOSAT Operational Programme, three more satellites are being built. The launch dates are as follows:

MOP-1	October 1988
MOP-2	1990
MOP-3	1992*

* The launch date of MOP-3 will depend upon the performance of MOP-1 and MOP-2.

If there should be a failure during launch or early in the life of one of the MOP satellites, the programme foresees the manufacture of a set of spare sub systems which would be integrated into an additional satellite (MOP-4) and launched when possible. The basic philosophy remains however that where possible one satellite will be maintained in orbit as a spare.

The Meteosat Operational Programme will extend until at least 1995.

The operational status of Meteosat P2 will be decided after launch. Since the supply of orbit keeping fuel on Meteosat-2 is low, this satellite probably will remain the prime satellite (at 0 degrees North, 0 degrees East) for as long as practicable.

C.1.2 Second Generation Meteosat

EUMETSAT has started to define its requirements for the Second Generation of Meteosat Satellites (MSG) (EUMETSAT WP-3 refers). The final version of this document will serve as the basis for the mission requirements specification to be submitted to ESA industry for phase-A studies planned for 1988.

The planned operational missions remain:

- an imaging mission
- a sounding mission
- a data circulation mission

These operational missions would be supplemented by a package of ESA scientific experimental payloads.

C.2 INDIA (received by mail after the meeting)

INSAT-IC is ready and in storage awaiting call for launch campaign. Its launch is presently scheduled in June 1988 on an Ariane flight. Located at 93.5 deg. E, INSAT-IC would be an active on-orbit spare satellite in the Multi-purpose INSAT-I network.

INSAT-ID is at an advanced stage of construction and is expected to be ready in third quarter of 1988. Its launch is scheduled in March - April 1989 with a Delta 4925 launch vehicle. Intended to be first placed at 83 deg. E, it is intended eventually to replace INSAT-IB.

The Indian built INSAT-II satellites will replace foreign procured INSAT-I satellites in a gradual manner during the 90s. The first two INSAT-II satellites are already in thirtieth (30th) month of their construction programme. The first INSAT-II satellite under construction is expected to be launched in Mid-1990 and the second in end-1991. The plans call for three more INSAT-II satellites to follow. Like INSAT-I, INSAT-II satellites too are multi-functional three-axes stabilized spacecraft. However ,they are larger and much heavier than INSAT-I. Like INSAT-I, the VHRR instruments on board INSAT-II will provide imagings in visible as well as IR bands but with slightly improved resolution -- 2KMs in visible and 8 KMs in IR at the sub-satellite point. The INSAT-II VHRR instruments too are being built in India.

INSAT-II satellites will continue to carry the 400 MHz Data Relay Transponder (DRT). On each of the first two INSAT-II Spacecraft that are already under construction, at 406 MHz distress alert detection transponder is also being incorporated to aid the international satellite-aided search and rescue programme.

C.3 JAPAN

GMS-4 is being prepared for launch in the summer of 1989.

Japan has submitted a draft budget for the launch of GMS-5 in 1993. JMA is studying a water vapor sensor and an IR split window instrument as primary instruments for the GMS-5 mission. The platform type (spinning or 3 axis stabilized) has not yet been decided.

C.4 PEOPLES REPUBLIC OF CHINA (PRC)

The PRC is considering the construction of its first geosynchronous weather satellite, planned for launch in the mid 1990's. In addition PRC is making preparations for its first polar-orbit weather satellite FY-1 which is expected to be launched before 1990.

All data formats for the new polar satellite will be compatible with those of the NOAA polar-orbiting spacecraft, thus allowing new Chinese ground stations to receive U.S. weather satellite data. Many Chinese stations already receive images from existing NOAA spacecraft.

C.5 USA

The USA reported a re-scheduling of the launch of GOES-I from October, 1989 to March 1990. The change was caused by launch vehicle considerations. It has not been determined which expendable launch vehicle will be used. The USA will notify all CGMS operators when this decision is reached. GOES-I is still currently scheduled for delivery in October 1989.

At the Senior Officials meeting the USA announced that the release of the Technical Specification for the GOES I - M Telemetry and Command System (GIMTACS) had been authorised.

ACTION: 16.2 USA is to inform all CGMS members of the type of vehicle to be used to launch GOES-I.

ACTION: 16.3 USA to mail information package on GIMTACS to all CGMS members within 30 days.

Following the presentation of USA WP-4, some discussion was held regarding the usefulness of the new GOES Variable (GVAR) data format, a candidate for a common format. The USA reported that the G format was flexible (similar to packet networks) and could be used for other satellite data.

It was noted, however, that considerable changes or re-design of existing ground equipment and software would be required by any current operator who wished to switch to this format.

No payload changes have been made to GOES-I since the last report.

C.6 USSR

The USSR reported at the WMO Congress X, held in May 1987, that the launch of GOMS will be prior to the end of the current five year plan. It is understood that the current five year plan extends through 1990.

The Secretariat agreed to contact the USSR in order to obtain more details of future launch plans.

C.7 COMMON BACK-UP SATELLITES

Working papers dealing with several aspects of commonality of services provided by the geostationary meteorological satellites were presented by EUMETSAT, Japan and the USA.

In its WP-4, EUMETSAT described a preliminary examination of the problems associated with the operation of its satellites by a neighbouring satellite operator. Whilst feasible from a technical point of view, the provision of full facilities to operate a neighbouring satellite cannot at present be justified from a financial point of view. CGMS agreed that all satellite data must be accessible by the "borrowing" agency.

The group considered that the provision of core sets of products between neighbouring operators via commercial satellites is also possible but very expensive.

CGMS decided that the whole subject would have to be studied in greater detail, bilaterally between neighbouring operators, and globally within the CGMS. It proposed that this agenda item should be modified to cover the issues raised above within the framework of operational continuity and reliability, e.g., inter-regional planning, global planning, common standards, etc.

ACTION: 16.4 CGMS Secretariat to incorporate this proposal when preparing the agenda for the next CGMS session.

EUMETSAT agreed to study the proposed data format for GOES-I, to ascertain whether adoption of a similar format for MSG might be possible.

The USA announced that a revised launch schedule for GOES I - M would be released in the near future.

ACTION: 16.5 USA to provide CGMS members with the revised launch schedule (GOES I - M) as soon as it becomes available.

D. GEOSTATIONARY SATELLITES AS PART OF WMO PROGRAMMES

Satellite-related items discussed during the Tenth WMO Congress (4th to 29th May 1987) were summarized in WMO WP-1. The CGMS was informed about budget matters and the scientific and technical programmes for the tenth financial period 1988-1991 in relation to the WMO Second Long-term Plan. The Congress requested the Executive Council to continue its role in the overall Coordination of WMO satellite activities and to continue its efforts to ensure satellite continuity. The Executive Council re-established its Panel of Experts on Satellites.

The CGMS was also informed about the possible future participation of China, Brazil, and Australia in the global satellite network of the WWW.

D.1 OWSE

The CGMS was informed about the WMO plans for the Operational WWW Systems Evaluation-North Atlantic (OWSE-NA) and for Africa (OWSE-AF). Both of these programmes will rely heavily upon the services provided by the polar orbiting and geostationary meteorological satellites.

The use of Data Collection Platforms (DCP) to collect observational data from within Africa and to relay the data between National Meteorological Centres will be evaluated as the first part of OWSE-AF activities. The OWSE-AF will thus rely heavily on the use of the METEOSAT DCS capability, and is projected to take place during the period July 1988 to June 1990.

D.2 OTHER PROGRAMMES

WMO, in its WP-3 (see Annex V), provided a summary of the present status of the International Satellite Cloud Climatology Project (ISCCP). The ISCCP completed the fourth year of its data collection phase on 30 June 1987. Radiance data from all operating meteorological satellites, with the exception of INSAT, were being routinely collected and processed. As an example of ISCCP research products, details of the First ISCCP Regional Experiment (FIRE) were provided. Some sample products based on ISCCP data provided by the ISCCP project manager were presented.

EUMETSAT WP-6 described the support provided to the ISCCP and the Global Precipitation Climatology Project (GPCP). ESOC continues to act as the ISCCP Sector Processing Centre (SPC) for Meteosat. For the GPCP, ESOC will provide the Climate Analysis Centre (CAC) Washington with tapes of Precipitation Index (PI) information on a regular basis.

The USA reported that it continues to support WMO programmes through a variety of activities including the geostationary and polar-orbiting space-based systems. In particular, the USA noted it contributes to the WWW program through (a) the Global Observing System which includes the production of satellite Sea-Surface Temperatures (SST), wind observations, satellite-derived soundings, and (b) the distribution of data via the GTS, DCS and WEFAX. The USA also provides satellite data to the World Climate Research Program (WCRP) and provides training in satellite use, often in conjunction with the WMO. NESDIS has recently been consolidating its training activities to deal with the time constraints of USA employees. The USA suggested that "dial up" bulletin boards, such as the one currently operated by NOAA, should be considered as one means which satellite operators can use to notify satellite data users of any changes in satellite products or operations.

E. COORDINATION OF DATA COLLECTION

E.1 STATUS AND PROBLEMS OF IDCS

ESA reported a gradual increase in the number of platforms which it had to support. This has necessitated the purchase of some additional receivers. By mid 1988, a new development of 32 receiver channels should be available for use; the full complement of 66 channels plus spares is foreseen for 1990. Currently ESA has admitted almost 300 DCP to the system with approximately one third of these reporting each month.

Significant interference problems have been experienced by ESA on channel I16 and to a lesser extent on I17. I16 is partially used for ASAP reports and I17 is reserved for ASDAR. With the present level of interference on these channels it will be difficult to support either the ASAP or ASDAR programmes to an acceptable level of performance.

The interference on channel I16 has been monitored by ESA and it is concluded that the source of the interference is most likely to be an uncontrolled DCP.

JMA described current and future GMS DCP allocations in its WP-6. JMA also described the support system it has established for balloon experiments. JMA proposed that the CGMS Secretariat coordinate the procedures for experiments such as balloon flights.

In discussion regarding coordination of the currently proposed NCAR balloon experiment, the CGMS agreed with the suggestion from Japan to involve the CGMS Secretariat in all future requests for IDCS support to such projects. Specifically, projects will make requests through one of the operators who will forward the request to the CGMS Secretariat. The Secretariat will ensure all necessary documentation has been provided and disseminate it to all other CGMS members. Final coordination of the project amongst the CGMS members will come from the Secretariat.

After presenting its WP-5, the USA discussed the status of the new GOES DCS Automated Processing System (DAPS). The DAPS contract was awarded on the 30th September 1987. Full implementation would be implemented by approximately July 1989. At this time the USA will have the capability to expand its support of the IDCS.

WMO, in its WP-5, reported the results of the informal discussions with the ITU concerning the interference to IDCS operations.

It was recognized that the projected rapid expansion in use of the IDCS could be seriously jeopardized by harmful interference on the IDCS which could not be controlled because of its secondary status under ITU regulations.

CGMS agreed to take all necessary actions to reduce the risk of future harmful interference affecting IDCS operations.

Some possible actions were discussed particularly with regard to getting the meteorological satellite service in the 401-403 MHz band allocated as a primary service in co-existence with METEOROLOGICAL AIDS.

ACTION: 16.6 CGMS members to discuss this topic and express concern over the resulting problems with appropriate organizations or agencies of their country and to report on this matter at the next meeting of CGMS.

E.2 SHIPS

Japan described its current and future DCP program for ships, buoys, and marine radars. The CGMS members took particular interest in the new use of the DCS for transmission of ship-based marine radar data at 1200 bits per seconds (bps) and asked JMA to provide CGMS members with further information. The radars will be installed on JMA's marine observing ships.

ACTION: 16.7 JMA to distribute the technical information about GMS ship radar DCP and data transmission scheme to the CGMS members.

The USA presented information on the Shipboard Environmental Data Acquisition System (SEAS). The SEAS system acquires and delivers data in near real time from ships of opportunity to shore-based users via the DCS. World-wide dissemination of the data is provided by the GTS.

The SEAS system handles two types of data: ship's weather data, and bathymetric data. The ship's weather data are observations by a ship's crew that are made in conformance with the World Meteorological Organization program. The weather data are entered either as direct observations or may be transcribed directly off the standard observation sheet. The bathymetric data are entered either

manually or automatically, depending on whether a SEAS manual or semi-automatic system is being used. The manual SEAS uses a separate XBT system to launch, graph, and determine significant data points. The manual SEAS then makes it easy to enter the significant data, and automatically formats the data for transmission. The semi-automatic system comes with a device to control the launch of bathymetric probes and to acquire the bathymetric data. The controller can also produce graphs of the data and automatically compute significant data, and format the data for transmission.

Currently, there are 107 SEAS units deployed worldwide with plans for 35 additional installations through 1988. The appeal of the SEAS unit lies in its being portable, inexpensive, reliable, easy to install and able to provide data in near real time.

Baseline Upper Air Network (BUAN)

WMO WP-8 presented a feasibility study plan for the BUAN. The basic purpose of the BUAN evaluation is to determine what improvements could be made to satellite-derived vertical profiles if selected radiosonde and rocketsonde stations were to make soundings coincident with the polar-orbiting satellite passage over the observing station. The ASAP operators are asked to make a minimum of five coincident soundings per week (if possible) when the ships are at sea. The data are to reach WMC Washington within four hours of completion of the sounding. To do this each ship requires a primary time slot allocation at 06 UTC and 18 UTC on the same schedule as currently authorized allocations at 00 UTC and 12 UTC.

The BUAN evaluation is scheduled to begin on 1 January 1988 and continue for a period of six months. CGMS members agreed that the BUAN evaluation was very important to increasing the quality and utility of satellite-derived upper air soundings. It further agreed that every effort would be made to provide each ASAP equipped ship with a primary time slot allocation at 06 UTC and 18 UTC on the same schedule as currently authorized for allocations at 00 UTC and 12 UTC.

ACTION: 16.8 EUMETSAT, Japan and USA to inform the WMO not later than 1 November 1987 if they are not able to provide the 06 UTC and 18 UTC time slot allocations for ASAP ships during the BUAN evaluation period beginning 1 January 1988. No reply will be interpreted as an agreement to provide the time slots.

WMO-WP4 (see Annex VI) informed the CGMS that the operational ASAP has 11 systems in operation with at least an additional four expected in 1988-1989.

The CGMS was informed of the ASAP Coordinating Committee (ACC) meeting held in Hamburg, 22nd and 23rd September 1987. By the end of 1988 approximately 15 ASAP vessels are expected to be making routine observations in various regions of the Atlantic Ocean. Considerable concern was expressed by the group over the level of interference on

IDCS channels, and in particular on I16, used by ASAP ships. Provisional allocations to I14 for some ASAP operators had been largely successful in the resumption of interference free message reception. However, I14 has already become congested and the ACC requested the introduction of another channel for ASAP use. I12, currently free of interference, had been proposed.

CGMS agreed that an urgent solution to the problem was necessary, especially for ASAP ships operating in the Atlantic region.

CGMS further agreed, as an interim measure, to open up EUMETSAT/GOES 4 channel I12 specifically for ASAP use in the North Atlantic. The remaining satellite operators would continue to use I16. EUMETSAT would continue to monitor I16 with a spare receiver, and the allocations of I16 and I12 to ASAP would be reviewed again once Meteosat P2 is successfully placed in orbit and becomes the primary transponder for the DCS.

ACTION: 16.9 EUMETSAT to inform the CGMS on the level of interference on IDCS channels once P2 becomes the primary transponder for the DCS.

E.3 ASDAR

JMA, in its WP-8, stated that both of the proposed operational and prototype ASDAR DCP formats were acceptable.

USA WP-10 and WMO WP-5 reported on the progress of the ASDAR system. The assignments of channels I17 and I18 on GOES-West is within the capacity of the current system. This is not possible on Goes-East where either I17 or I18 can be assigned, but not both.

The WMO reported that a new contract for the supply of ASDAR equipment and services was signed with Marconi Defence Systems Ltd. (U.K.) in March 1987 for the completion of development and delivery of seven units. An additional six units were ordered in April 1987. Negotiations are in progress for delivery of up to a further 29 units making a total of 42.

The hardware and software specifications for the operational ASDAR have been finalized and a prototype constructed. IDCS and aircraft certifications are scheduled to begin in late 1987. The first seven units will be ready for operational deployment in the third quarter of 1988. WMO reported that it was technically feasible to change both channel and time slot allocations at either the factory before the installation kit is delivered or when it is installed on-board the aircraft. Time slot allocations are fairly easy to change, but channel allocations are more difficult. In addition, it is estimated that the cost of making channel changes in the field is at least $3000 per unit.

CGMS members, responding to the WMO request to provide WMO with the channel and time slot information, decided to

- make a channel allocation at this session; and
- request the USA to provide the time slot allocation to WMO in accordance with normal procedures.

CGMS agreed to use channel I18 for the operational ASDAR allocations. Due to the fact that the prototype ASDAR units are expected to continue operations until the end of 1989, the channels will be supported as follows:

GMS	-	Will support both the prototype ASDAR and the operational ASDAR units on channels I17 and I18, respectively.
GOES-W	-	Same as GMS.
GOES-E	-	Can support either prototype or operational ASDAR units but not both.
METEOSAT	-	Will support operational ASDAR and will make best efforts to support prototype ASDAR as resources permit.

ACTION: 16.10 WMO to inform USA on the preferred ASDAR support by GOES-E.

E.4 REVIEW OF IDCS USER'S GUIDE

The Secretariat took note of recommendations expressed by CGMS members and agreed to amend the document accordingly.

CGMS proposed that this document, in the past distributed as an annex to the CGMS Consolidated Report, be regarded as a separate publication. References to it would, however, remain in the Consolidated Report.

ACTION: 16.11 The Secretariat to complete and distribute Issue 6 of IDCS Users Guide to all CGMS members.

USA WP-11, which includes a list of all USA certified DCP manufacturers as well as direct-readout ground station manufacturers, was presented. CGMS agreed that this paper should be included as an Annex to the IDCS Users Guide.

F. COORDINATION OF DATA DISSEMINATION

F.1 DISSEMINATION VIA SATELLITE

F.1.1 High Resolution Dissemination

In its WP-2, ESA reported that, with the start of operations of its first operational satellite (MOP-1), digital transmissions will be transferred from channel 2 (1691 MHz) to channel 1 (1694.5 MHz).

The installation of new equipment at CMS Lannion, for reformatting GOES-AAA formats into METEOSAT standards, has enabled the continuation of the service whereby selected GOES-E transmissions are relayed via Meteosat. The new equipment also provides the capability of transmitting administration messages in formats transmitted from Lannion. This effectively provides a back-up to the service provided by ESOC to inform users about scheduling and operational news via the satellite.

JMA reported on the status of S-VISSR ground facilities, and noted that four countries are now developing the S-VISSR receiving systems: Australia, PRC, South Korea, and the Philippines at their own expense (with the exception of the Philippines which will be developed and provided by Japan.

After a presentation of USA WP-12, discussion focused on the different imaging/sounding schedules operated by the USA. GOES-East is currently operated in one of three support modes (operational plans); normal (no severe weather), hurricane support or severe thunderstorm (tornado) support. Since it is of interest to users outside the USA (particularly western Europe) which plan is in operation, the USA agreed to disseminate to CGMS members, the detailed schedule of imaging/sounding used in each of the plans.

ACTION: 16.12 The USA to distribute to all CGMS members a detailed schedule of imaging/sounding used in the normal, hurricane support and tornado support modes of dissemination.

F.1.2 Low Resolution (WEFAX)

ESA reported that corresponding to the change of high resolution dissemination to channel 1 with the start of operations of MOP-1, WEFAX dissemination will be transferred to channel 2 (1691 MHz). Routine operations for transmitting GOES-E formats via Meteosat, using GOES-AAA transmissions, came into force on 1 July 1987 at Lannion.

The USA presented WP-13, WP-14, and WP-15. In WP-13, the USA recommended that EUMETSAT and the USA investigate modifying all WEFAX images to include a digitally encoded header. The Japanese headers will be presented as "the standard". Working Paper 15 also made a suggestion for modification to WEFAX images. The USA

suggested incorporating an enhancement wedge which would be a representation of any enhancement used on the image.

ACTION: 16.13 The USA to investigate and present a proposal to CGMS members outlining the implementation of a digitally encoded header and an enhancement wedge for WEFAX imagery.

USA WP-14 detailed the new two-satellite WEFAX schedules.

F.1.3 DCP Data

JMA reported on the current status of data collection from China and New Caledonia, and the future plan of Australia and New Zealand to use the GMS DCS. A new DCP, which will be installed at Syowa base an Antarctica, will be supported by the Meteosat Regional DCS from 1989.

F.1.4 Digital WEFAX

EUMETSAT WP-7 provided some further considerations on digital WEFAX. A preliminary analysis of the RF link showed that a ground station, using approximately a 2 meter antenna, could easily be adapted to receive a WEFAX type image digitally encoded. A preliminary set of requirements for digital WEFAX was presented. It was stressed that modifications to the ground station should be kept to a minimum and at relatively low cost.

It was pointed out by the WMO that digital WEFAX could increase the reliability and quality of the received image products and could make the derivation of quantitative observations from satellite data available to users with only low resolution satellite direct readout stations.

CGMS noted that the present set of direct readout satellite data is fulfilling the needs for "weather-image data" for a large population of users. It agreed that the decisions on future changes to the satellite readout capability must take into account the effects on this large population of users.

The need for further study of digital WEFAX was endorsed by the CGMS, however, it agreed that a sufficient change-over period would have to be considered. The need for parallel dissemination of analogue WEFAX and test digital WEFAX over several years was paramount. CGMS stressed that they would not implement changes to existing WEFAX standards without coordination amongst members.

ACTION: 16.14 CGMS members to continue to develop proposals for digital WEFAX and a change-over scenario for consideration at CGMS XVII.

F.2 DISSEMINATION VIA THE GTS

JMA presented WP-13 which described GMS data disseminated via the GTS. The Japanese satellite wind data dissemination has increased from two times to four times per day (00, 06, 12, 18 UTC), and JMA noted that the reporting of tropical cyclones (SAREP) had improved.

F.3 OTHER DISSEMINATION

The current status of the NOAAPORT data dissemination projects was addressed by the USA in USA WPs 16 and 17. NOAAPORT is being implemented in two phases. Phase I is scheduled to be implemented in the next 18 months and will carry research data (PROFILER), conventional weather data (for NWS Automation of Field Operations and Services (AFOS)-Z), ocean data (from the U.S. Naval Fleet Numerical Oceanography Center) and the GOES DCS DCP Reply (DCPR) data. CGMS members inquired about the method of dissemination and were informed that the requirements for Phase I do not specify a particular method. CGMS noted that any current direct read-out user of GOES DCS would be unaffected by NOAAPORT Phase I.

NOAAPORT Phase II is in the latter stages of planning. WP-17 detailed the scope of this phase of NOAAPORT.

JMA described its plan for disseminating WWW data via GMS. In this new system, analyzed meteorological data will be multiplexed with the existing LR-FAX signal. Without upgrading the current meteorological telecommunication system, the WWW data can be received by an SDUS, provided that the additional demodulation equipment, etc. are attached to the existing LR-FAX receiving system. JMA is now experimenting to determine which method will accomplish this multiplexing without affecting the characteristics of the existing LR-FAX signal. Even if there was some power reduction, the standard LR-FAX receiving station will be able to receive the signal which is expected to remain within the specified margin.

G. COORDINATION OF SATELLITE DATA CALIBRATION

An overview of GOES-I calibration and normalization was discussed in USA WP-18. Differences between current methods used on GOES-6 and 7 and those to be incorporated on GOES-I were highlighted. For visible data, 10 bit as opposed to 6 bit will be used to increase the intensity scale used for normalizations. The imager and sounder will have separate IR black body calibration targets outside the entire optical train. This will improve the calibration because it includes the telescope optics. Of some minor concern to the USA is the frequency at which calibration measurements may have to be taken. It

may be required that the imaging/sounding sequence be interrupted for some 20 to 40 seconds to perform calibration ingests; the affects of this interruption are being investigated.

ESA introduced its WP-4 which described recent changes in the calibration techniques used for the Meteosat IR and Water Vapour channels. Absolute calibration of the IR channel is now performed by comparing Meteosat derived SST data with the forecast surface temperature field provided by the European Centre for Medium Range Weather Forecasts.

A new technique for WV calibration makes use of software developed for a new radiation scheme. The scheme has been adapted to provide a physically consistent calibration of the WV channel and takes into account the contribution function of that channel.

Due to contamination of the IR detectors, by a thin layer of ice, it was necessary to perform a decontamination exercise in April 1987.

H. COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

H.1 SATELLITE WINDS

The USA informed the CGMS that it has identified a potential problem with the Earth location and image registration expected from the GOES-I type sensors. This could make it difficult to compute cloud motion vectors during certain times of the day.
This information is of significant concern to EUMETSAT and Japan who are considering the use of a three-axis spacecraft for their next generation geostationary meteorological satellites. The CGMS agreed that there is an urgent need for the satellite operators to get some direct experience in the processing and analysis of real data from a three-axis stabilized spacecraft.
In light of the general interest in this question among CGMS members, the CGMS asked WMO to prepare a proposal for such a cooperative study task and to circulate this proposal among CGMS members. The CGMS members consider this question should be treated with urgency in the light of the need for satellite operators to make decisions about their future geostationary meteorological satellites.

ACTION: 16.15 WMO to prepare a draft proposal for a study of the analysis and processing of data from a three-axis stabilized spacecraft and to circulate this proposal to CGMS members by the end of December 1987.

WMO WP-6 presented a summary description on the quality and quantity of satellite winds, and the importance of these measurements to both operational numerical weather prediction and the WCRP. The working paper also included a compilation of a number of ways to

improve the quality and quantity of satellite winds. The WMO recommended that CGMS include, in its regular agenda item on satellite winds, a review of progress made on improving the quality and quantity of operational satellite winds, in terms of global, regional and national requirements.

CGMS members recognised the importance of acquiring additional winds in data sparse areas, even if they did not meet the full criteria for accuracy. CGMS further agreed that WMO WP-6 be included as an Annex to this report (see Annex VIII).

CGMS members felt that there have been a number of recent improvements in both the quality and quantity of satellite winds. Examples of this include those described in the ESA WP-8 and Japan WP-15. CGMS agreed that there needed to be more emphasis on the comparison and presentation of satellite wind evaluations over a period of time. This would enable a better determination of the satellite operator performance in obtaining this important type of information from geostationary meteorological satellite data.

ESA reported that winds for 06 UTC are now being derived and disseminated on a regular basis. ESA also reported on a new scheme used for processing high level wind data. This involved the use of 'windowed' radiances for the tracking of high level clouds and the scheme is intended to be extended to the derivation of winds at all levels.

JMA described the status of GMS wind derivation. The total number of low level and high level wind vectors increase due to an increase in wind observations and recently adopted automatic/man-machine interactive methods. JMA also presented the results of the international comparison of GMS cloud motion winds using the vector difference between GMS winds and radiosonde winds. CGMS members agreed to continue this kind of research and to provide up-to-date reports at future CGMS meetings.

The ESA and JMA reports can be found in Annex VII.

The USA recognized and supported the concern of CGMS members over the accuracy and quantity of satellite derived winds. In WP-19, the USA presented its approach to investigating improvements to satellite winds. NOAA/NESDIS had formed a Research Panel on winds which would:

- Provide scientific review of algorithms,
- Recommend scientific approaches for new products and changes to existing products,
- Review Quality control procedures, and
- Recommend ground-truth studies.

Information exchange from CGMS members directly to the chairman of this panel was recommended and encouraged by the USA.

It was suggested that at future CGMS meetings all operators include in their reports on winds a summary of any advances which had been made since the last meeting.

ACTION: 16.16 CGMS members are requested to include graphical presentations on the history of the quality and quantity of satellite winds for working papers prepared for CGMS-XVI. CGMS members are also requested to highlight any improvements made since the last CGMS session in their satellite winds products.

ACTION: 16.17 USA to provide time series of satellite to satellite wind comparisons for CGMS XVII.

H.2 SEA SURFACE TEMPERATURES

The USA presented current and planned SST activities in its WP-20. In late 1987, the resolution of the global satellite SST analysis will be increased from 100km to 50km. This will improve the usefulness of the global analysis to oceanographic studies and hurricane forecasting.

Current development activities in support of the next generation of polar and geostationary operational environmental satellites will lead to improved resolution and accuracy of satellite SST. An aerosol optical thickness product will be used to correct for the effects of stratospheric and tropospheric aerosols. A high resolution (2km) SST observation capability will be developed and used, for example, to generate surface temperature charts of the Great Lakes. Geostationary imagery data will be evaluated for use in generation of daily local-scale SST analyses of the U.S. coastal zone. Target dates for USA product developments were presented as follows:

1) HRPT (2km) SST Observation ---------- 1988

2) Aerosol Optical Thickness ---------- 1990

3) Geostationary Imager Data ---------- 1990

H.3 OTHER PARAMETERS

The USA described recent VAS product data processing changes since CGMS XV. In particular, the responsibility for generating and quality controlling experimental cloud drift winds, VAS soundings, and derived products has been moved from the Advanced Satellite Products Project (ASPP) at Wisconsin to the Camp Springs, Maryland, VAS Data Utilization Center (VDUC). The VDUC system, with its own McIDAS, will take over support of the national center which had been provided by the University of Wisconsin and the ASPP. All VAS products are currently considered experimental and are being distributed only to the NWS, the National Severe Storms Forecast Center (NSSFC), the National Hurricane Center(NHC), and the National Meteorological Center (NMC).

ACTION: 16.18 USA to provide CGMS members with information on the products derived from the VAS Data Utilisation Centre.

JMA, in its WP-16, described the Satellite Cloud Information Charts (SCIC) derived from satellite images. The basic data set for SCIC is "grid point cloud data set" which contains several kinds of physical parameters extracted from each 0.25 lat. x 0.25 long. box. The physical parameters are, for example, cloudy/clear indication, mean Tbb, mean albedo, cloud top Tbb, total cloud amount, low level cloud amount, high level cloud amount, etc. They are calculated from the basic histogram data set which is prepared in the primary image data processing system referring to the numerically predicted atmospheric vertical profile data and the objectively estimated surface temperatures from GMS image data taken 24 hours before. These MSC products are sent to the central computer switching system which distributes the data to JMA's local stations via land line.

A new atmospheric correction scheme for the IR channel has been introduced by ESA. The scheme also provides information on the semi-transparency correction applied to thin high level cirrus clouds and on the relationship between IR and WV radiances for determining the relative humidity in the cloud free upper troposphere. A minor change to the calculation of the upper tropospheric humidity product has been introduced by ESA whereby a value is no longer produced in areas where medium or high clouds are existing.

I. COORDINATION OF ARCHIVING AND RETRIEVALS

ESA WP-09 described the investigation into an archiving system based on digital optical disks. The study indicated that the technology had now developed to a level which allows such a system to be considered as a candidate for an operational satellite archive. However, despite the obvious advantages in terms of durability of the disks and considerably reduced storage space there is a major disadvantage in the cost, currently two to three times of storage on magnetic tape.

The USA reported in its WP-23 difficulties in the implementation of the GOES Archive and Retrieval System (GARS). GOES image data could not be economically ingested (input) by GARS; and therefore the GOES archival/retrieval function will be continued by the University of Wisconsin and tne Sector Processing Center (for ISCCP) will remain at Colorado State University. The Satellite Data Services Division (SDSD) of NESDIS would continue as the ISCCP Central Archive and maintain a catalog of data and products for the ISCCP. This catalog is available from SDSD.

JMA presented a new archiving and retrieval system in its WP-17. CGMS members expressed interest in the archiving method which used digital cassette tapes.

ACTION: 16.19 JMA to provide CGMS members with the specification of the digital cassette tape storage system.

J. TELECOMMUNICATIONS

EUMETSAT stated that it was considering full membership of the Space Frequency Coordination Group (SFCG). At present it has observer status. The interests of the CGMS would thus also be represented within that group. Reports of SFCG meetings,of interest to CGMS members, would be distributed when available.

K. MISCELLANEOUS

A presentation was given by the USA summarizing a 406MHz SARSAT experiment on GOES-H. The experiment will be conducted from mid-1987 through mid- 1989 in order to demonstrate the utility of integrating a near instantaneous distress alerting capability achievable by geostationary satellites with the demonstrated distress beacon location capability of low altitude near-polar orbiting satellite systems such as the SARSAT/COSPAS system. The experiment will be conducted in two phases. The first phase will be to characterize the technical performance of the system. The second phase will consider the operational aspects of the integrated geostationary and low earth-orbiting systems in order to determine the optimum use of the early alerting data in support of the search and rescue mission. Each experiment phase will last about one year. The experiment will be conducted using maritime and land based emergency locator beacons in a variety of environmental conditions.

In USA WP-25 details were given on the satellite anomaly database being established by the USA. It was noted that this was a "first of its kind" attempt to collect and correlate data regarding satellite anomalies and the solar-terrestrial environment. The USA recommended that CGMS operators disseminate future satellite anomalies, and if possible, retro-active anomalies, directly to the

National Geophysical Data Center (NGDC) which maintains and processes the data. The NGDC does not currently charge a fee for information requested from its database and will work with CGMS operators to investigate trends in satellite anomalies.

ACTION: 16.20 CGMS members to send all reports of spacecraft anomalies (retroactively where possible) to the NGDC.

JMA described the new data processing system and the renewal plan for GMS ground telecommunication facilities. The new computer system consists of four main frames which began operation in March 1987 with 3 hourl full disk and hourly images of the Northern Hemisphere. Principle product changes and FAX dissemination changes were provided. JMA presented corrections to the "Information on transmission of the Stretched VISSR Data of the GMS" distributed at CGMS XV. The corrections will be sent to all concerned countries and CGMS members.

L. DATE AND PLACE OF NEXT MEETING

EUMETSAT's proposal to host CGMS XVII in Darmstadt in October 1988 was unanimously supported.

A tentative date of October 3-7, 1988 was proposed by EUMETSAT.

ACTION: 16.21 EUMETSAT to coordinate with all CGMS members the date of CGMS XVII and confirm.

The CGMS expressed its appreciation to NOAA for hosting CGMS XVI and the excellent organization of the meeting.

LIST OF ACTIONS

ACTION: 16.1 The Secretariat to update and distribute the eighth edition of the CGMS Consolidated Report to all members.

ACTION: 16.2 USA is to inform all CGMS members of the type of vehicle to be used to launch GOES-I.

ACTION: 16.3 USA to mail information package on GIMTACS to all CGMS members within 30 days.

ACTION: 16.4 (Commonality of satellites). CGMS Secretariat to incorporate this proposal when preparing the agenda for the next CGMS session.

ACTION: 16.5 USA to provide CGMS members with the revised launch schedule (GOES I - M) as soon as it becomes available.

ACTION: 16.6 (Interference on the IDCS). CGMS members to discuss this topic and express concern over the resulting problems with appropriate organizations or agencies of their country and to report on this matter at the next meeting of CGMS.

ACTION: 16.7 JMA to distribute the technical information about GMS ship radar DCP and data transmission scheme to the CGMS members.

ACTION: 16.8 EUMETSAT, Japan and USA to inform the WMO not later than 1 November 1987 if they are not able to provide the 06 UTC and 18 UTC time slot allocations for ASAP ships during the BUAN evaluation period beginning 1 January 1988. No reply will be interpreted as an agreement to provide the time slots.

ACTION: 16.9 EUMETSAT to inform the CGMS on the level of interference on IDCS channels once P2 becomes the primary transponder for the DCS.

ACTION: 16.10 WMO to inform USA on the preferred ASDAR support by GOES-E.

ACTION: 16.11 The Secretariat to complete and distribute Issue 6 of IDCS Users Guide to all CGMS members.

ACTION: 16.12 The USA to distribute to all CGMS members a detailed schedule of imaging/sounding used in the normal, hurricane support and tornado support modes of dissemination.

ACTION: 16.13 The USA to investigate and present a proposal to CGMS members outlining the implementation of a digitally encoded header and an enhancement wedge for WEFAX imagery.

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ACTION: 16.19 JMA to provide CGMS members with the specification of the digital cassette tape storage system.

ACTION: 16.20 CGMS members to send all reports of spacecraft anomalies (retroactively where possible) to the NGDC.

ACTION: 16.21 EUMETSAT to coordinate with all CGMS members the date of CGMS XVII and confirm.

LIST OF ANNEXES TO CGMS XVI REPORT

I. List of abbreviations and acronyms

II. Status of satellites and anomaly reports - EUMETSAT WP 1.

III. Status of satellites and anomaly reports - Japan WP 3-1, 3-2.

IV. Status of satellites and anomaly reports - USA WP 3.

V. Status of International Satellite Cloud Climatology Project (ISCCP) - WMO WP 3.

VI. Development of the Automated Shipboard Aerological Programme (ASAP) - WMO WP 4.

VII. Coordination of Meteorological Parameter Extraction - ESA WP 8 and Japan WP 15.

VIII. Quality and quantity of satellite winds - WMO WP 6.

IX. Addresses for the procurement of archived data.

X. Contact list for operational matters.

XI. Distribution list for documents.

XII. List of Working Papers for CGMS XVI.

XIII. List of Actions from CGMS XVI.

ANNEX I

LIST OF ACRONYMS AND ABBREVIATIONS

LIST OF ACRONYMS AND ABBREVIATIONS

ACC	ASAP Coordinating Committee
AFOS	Automation of Field Operations and Services (USA)
ASAP	Automated Shipboard Aerological Programme
ASDAR	Aircraft to Satellite Data Relay
ASPP	Advanced Satellite Products Project (USA)
AVHRR	Advanced Very High Resolution Radiometer
BUAN	Baseline Upper Air Network
CAC	Climate Analysis Centre (USA)
CGMS	Committee for coordination of Geostationary Meteorological Satellites
CMS	Centre de Meteorologie Spatiale (Lannion)
DAPS	DCS Automated Processing System (USA)
DCP	Data Collection Platform
DCPR	Data Collection Platform report
DCS	Data Collection System
ESA	European Space Agency
ECMWF	European Centre for Medium range Weather forecasts
ELV	Expendable Launch Vehicle
ESOC	European Space Operations Centre
FAX	Facsimile
FIRE	First ISCCP Regional Experiment
GARS	GOES Archive and Retrieval System (USA)
GMS	Geostationary Meteorological Satellite (Japan)
GOES	Geostationary Operational Environmental Satellite (USA)
GOMS	Geostationary Operational Met. Satellite (USSR)
GPCP	Global Precipitation Climatology Project
GTS	Global Telecommunications System
GVAR	GOES Variable (data format) (USA)
INSAT	Indian geostationary satellite
IR	Infrared
ISCCP	International Satellite Cloud Climatology project
ITU	International Telecommunications Union
JMA	Japanese Meteorological Agency
LR	Low Resolution
METEOSAT	European geostationary meteorological satellite
MOP	Meteosat Operational Programme
MSC	Meteorological Satellite Centre (Japan)
MSG	Meteosat Second Generation
NASDA	Japanese National Space Agency
NESDIS	National Environmental Satellite Data and Information Service (USA)
NGDC	National Geophysical Data Centre (USA)
NHC	National Hurricane Centre (USA)
NMC	National Meteorological Centre
NOAA	National Oceanographic and Atmospheric Administration
NSSFC	National Severe Storms Forecasting Centre (USA)
NWS	National weather service (USA)

OWSE	Operational WWW systems evaluation
PRC	Peoples Republic of China
SARSAT	Search And Rescue, Satellite supported facility
SCIC	Satellite Cloud Information Chart (Japan)
SDSD	Satellite Data Services Division (USA)
SDUS	Secondary data user station (Meteosat)
SEAS	Shipboard Environmental (data) Acquisition System
SFCG	Space Frequency Coordination Group
S-VISSR	Stretched VISSR (see below)
SST	Sea Surface Temperature
TTC	Telecommand and Telemetry Centre (Japan)
UTC	Universal Time Code
VAS	VISSR Atmospheric Sounder
VDUC	VAS Data Utilisation Centre
VHRR	Very high resolution radiometer
VISSR	Visible and Infra-red Spin Scan Radiometer
WCRP	World Climate Research Programme
WEFAX	Weather facsimile
WMO	World Meteorological Organization
WP	Working Paper
WV	Water Vapour
WWW	World Weather Watch
XBT	On board transmitter

ANNEX II

STATUS OF SATELLITES AND ANOMALY REPORTS - EUMETSAT WP 1.

CGMS-XVI EUM-WP 1 Rev 1.
Prepared by EUMETSAT
Agenda Item: B.1

(Updated 1 Nov 1987)

REPORT ON THE STATUS OF SATELLITE SYSTEMS

SUMMARY

A. METEOSAT - 1

Meteosat - 1 is no longer operated. The longitudinal position of this satellite on 15 October 1987 was 57 degrees East. The longitudinal drift at that time was 0.38 degrees West per day. The data collection mission can no longer be revitalized.

B. METEOSAT - 2

Meteosat - 2 continues to be the operational satellite supporting the imaging and dissemination missions. The relay of DCP messages is carried our via the GOES-IV satellite located at 43 degrees West.

i) Anomalies

During the period October 1986 to June 1987 13 minor and known anomalies occurred.

There is, however, no sign of degradation in the general functioning of the satellite equipment.

Two other anomalies have occurred, one involving a battery over-temperature detection and the other a black-body temperature sensor out of service. This latter anomaly does reflect a certain aging of the satellite equipment.

ii) Orbit control

One inclination, one longitude and one attitude station keeping manoeuvre were performed on respectively 11.12.86, 05.12.86 and 19.12.86.

One attitude and one longitude station keeping manoeuvre were performed on 24.02.1987 and 08.03.1987 respectively.

One orbit station keeping manoeuvre was performed on 24 April to maintain the longitudinal position of the spacecraft in the permitted limited 0 + 1 degree.

iii) On board power management

Electrical power, even at the winter solstice, has been sufficient to provide full dissemination capability on both channels. Battery discharging, does however occur during peak loads caused by radiometer retrace, black body calibration etc.

iv) Radiometer performance

The IR sensitivity of the radiometer steadily reduced during the first part of the period because of ice contamination and there was a need to increase the gain by one step.

Because of increasing contamination a radiometer decontamination operation was performed on 21, 22, 23 April to increase the sensitivity of the IR detectors.

A gain change of the Image amplifier chain was carried out on 12 May

IR	=	7	changed to 6
VIS	=	0	changed to 1
WV	=	6	changed to 7

C. GOES-4 STATUS

GOES 4 continues to be operated by NOAA/NESDIS at 43 degrees West in support of the Data Collection Mission. It is available 24h/day including during eclipses.

As far as the DCP mission is concerned, the status is good except for International 16 where permanent interference is experienced. Actions have been taken to identify the source of this interference. If this activity is unsuccessful, the I16 ASDAR channel may have to be declared "out of service" for the time being. A temporary allocation to another channel (I14) has been made for those users (e.g. ASAP) particularly suffering from the loss of data because of this problem.

STATUS OF ESA METEOSAT SATELLITE SYSTEMS

1. ORBITAL CHARACTERISTICS OF METEOSAT-1 AND METEOSAT-2

INTERNATIONAL DESIGNATION	7710801	8105701
CATALOGUE NUMBER	10489	12544
SATELLITE	METEOSAT-1	METEOSAT-2
LAUNCH DATE	23 NOVEMBER 1977	19 JUNE 1981
DAYS OPERATIONAL	723 IMAGING/2960 DCS	2258
DATE OPERATIONS BEGAN	10 DECEMBER 1977	10 AUGUST 1981
INCLINATION (DEGREE)	NOT KNOWN	0.953 (F)
AVERAGE ALTITUDE (KM)	35770	35787
HYDRAZINE REMAINING (KG)	ZERO	5.9 WITH 2 KG UNCERTAINTY (F)
LONGITUDINAL POSITION	57 DEG. E (F)	0.95 DEG. W (F)
LONGITUDINAL DRIFT	0.38 DEG. W/DAY (F)	0.001 DEG.E/DAY

2.

PAYLOAD STATUS		
OPERATIONAL	NOTHING (A)	IMAGING, DISSEMINATION, ELECTRON SPECTROMETER (B) (C)
MARGINAL	-	ELECTROSTATIC EVENTS MONITOR (D)
INOPERATIVE	IMAGING, DISSEMINATION, DCS	DCS (E)

(A) Failure of Bus Undervoltage circuit removed image and dissemination features. Data Collection can no longer be revitalised.

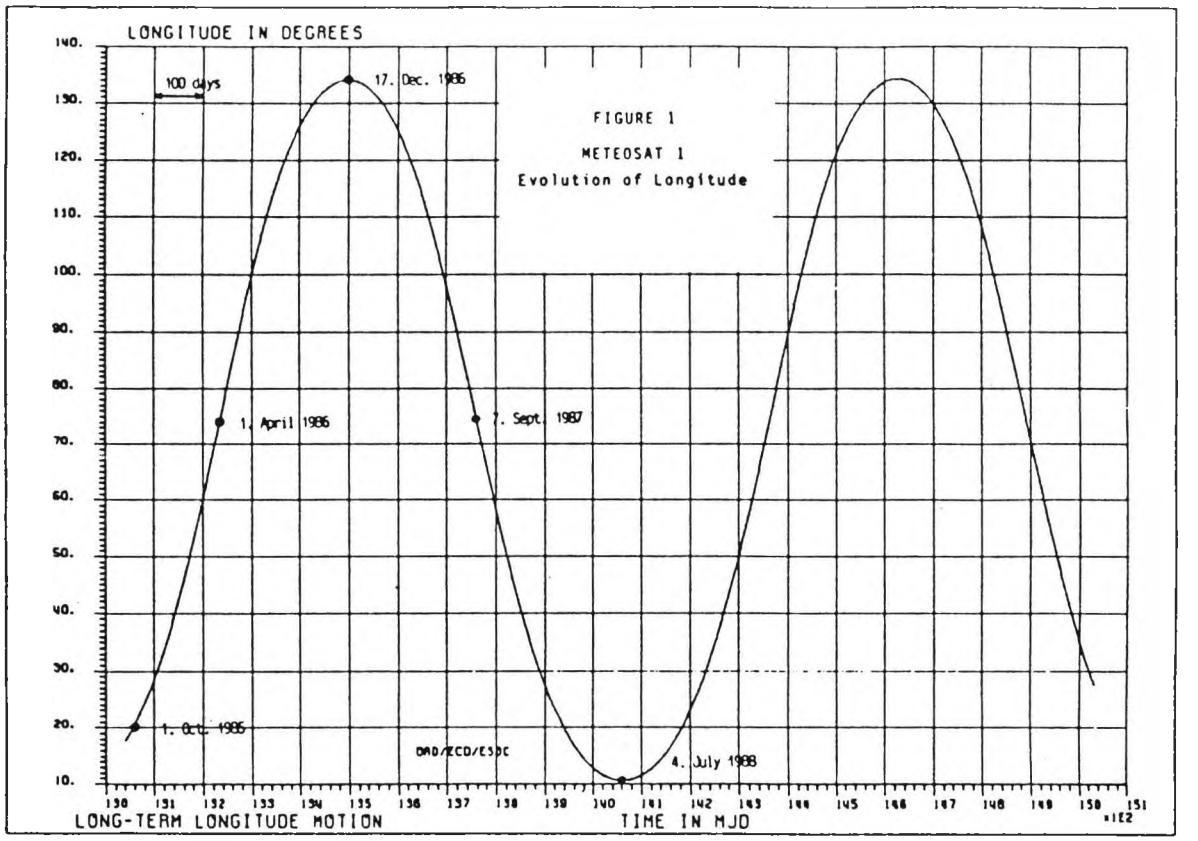
(B) Frequent scanning anomalies in March 1982 caused image taking to be reduced to 8/day. Full 48/day resumed in early May 1982. No problems since then.

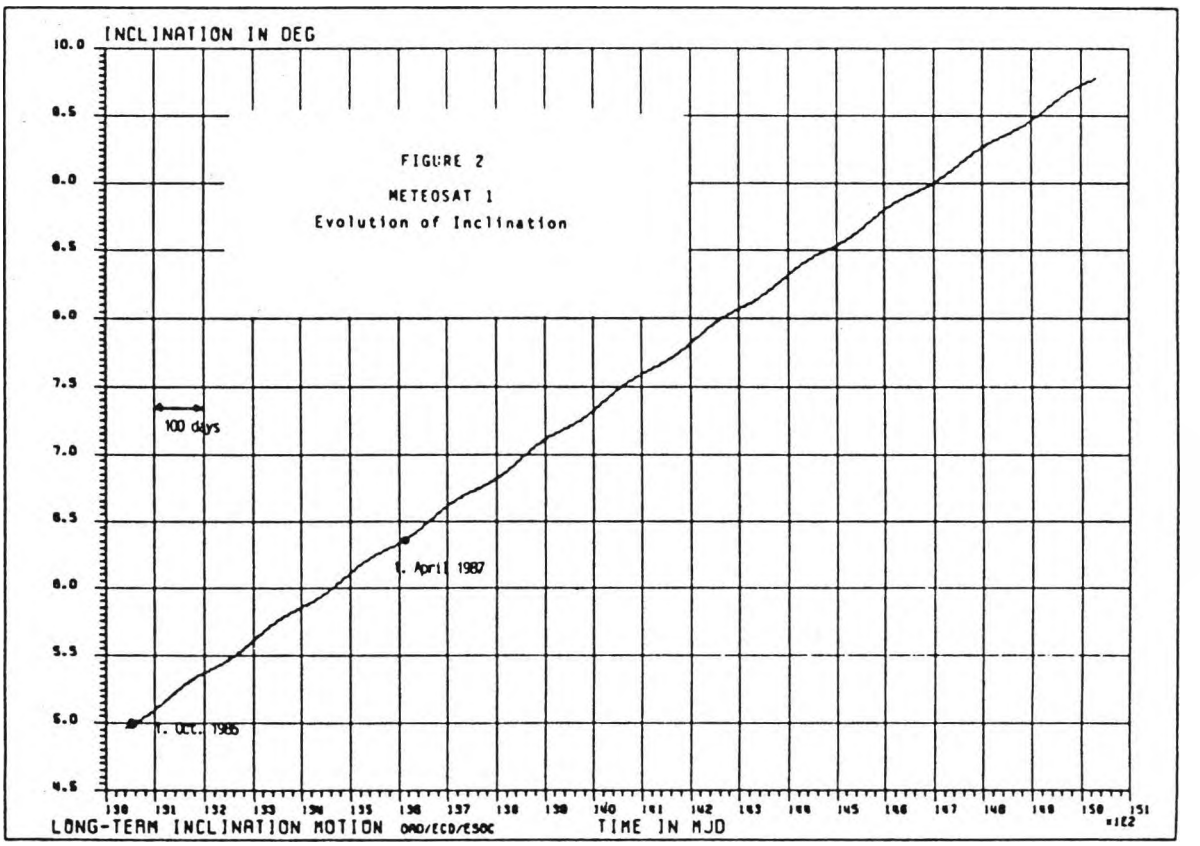
(C) 20 % reduction in sensitivity in IR channel due to ice contamination is compensated by increasing video amplification gain. No operational consequence. Can be recovered by decontamination (most recent performed in April 1987).

(D) Counts appear only once per format but major EE events cause Telemetry jumps therefore not possible to detect in this way.

(E) DCP reception has not been possible since launch.

(F) Orbit of Meteosat-1 is uncontrolled. These figures correspond to 15 October 1987 (see over for evolution of orbit parameters).


LONGITUDE IN DEGREES
100 days
17. Dec. 1986
FIGURE 1
METEOSAT 1
Evolution of Longitude
1. April 1986
7. Sept. 1987
1. Oct. 1985
4. July 1988
DAD/ECD/ESOC
LONG-TERM LONGITUDE MOTION
TIME IN MJD
*1E2


INCLINATION IN DEG
FIGURE 2
METEOSAT 1
Evolution of Inclination
100 days
1. April 1987
1. Oct. 1985
LONG-TERM INCLINATION MOTION
DAD/ECD/ESOC
TIME IN MJD
*1E2

3. METEOSAT SATELLITE SUBSYSTEM STATUS

Satellite	Power	Propellant	Imaging	Mission Communications	TLM	DCS	SEM
METEOSAT-1	Note 1	Zero	No	No	No	No	-
METEOSAT-2	Marginal Note 3	5.9kg, 2kg uncertainty	OK Note 4	OK	OK	Failed at launch	OK

Note 1: adequate for VHF/S band and DCS Reception.

Note 2: switched off but could be used for short campaigns, tests.

Note 3: permits full mission performance outside eclipse but battery discharges with peak pulse loads. New alternating discharge/charge procedure for the 2 batteries has allowed full winter 1986 and summer 1987 solstice operations.

Note 4: Redundant Synchroniser Image Channel in use since September 1984 after commanding original unit into non-nominal operating mode. Status of original unit is not known.

ANNEX III

STATUS OF SATELLITES AND ANOMALY REPORTS - JAPAN WP 3-1, 3-2

CGMS-XVI WP-3-1
Agenda Item: B-3
Prepared by Japan

REPORT ON STATUS OF SATELLITE SYSTEMS

Japan

Status of GMS-3 VISSR Observations

CGMS-XVI WP-3-1
Agenda Item: B-3
Prepared by Japan

Status of GMS-3 VISSR Observations

Operational three hourly VISSR observation for the full-disk were made on the normal operational schedule. Since the new computer system operation started on March 1, 1987, additional hourly observation for the northern hemisphere has been performed(shown Table 1).

Term	Normal Observation		Hourly Observation		Special Observation
	Number of Obs.	Percentage of Obs.	Northern Hemisphere	Southern Hemisphere	
'86 Jul.	428	98.6 %	117	0	0
Aug.	421	97.0 %	49	0	4
Sep.	417	99.3 %	26	0	0
Oct.	431	99.3 %	10	0	2
Nov.	410	97.6 %	12	0	14
Dec.	426	98.4 %	0	0	7
'87 Jan.	426	98.4 %	10	28	22
Feb.	376	84.1 %	7	32	8
Mar.	673	84.1 %	-	(4)	1
Apr.	811	99.1 %	-	-	0
May.	865	99.7 %	-	-	0
Jun.	832	99.0 %	-	-	0

Table 1

Note i) Special observations consist of Short-interval Limit Scan and the performance test of GMS system. This special observation include the AMEX which is described in the attachment of this WP-3.

ii) Since March, 1987, Hourly Observation for the Northern Hemisphere has been counted in Normal Observation.

Attachment 1
CGMS-XVI WP-3
Agenda Item: B-3
Prepared by Japan

THE AUSTRALIAN MONSOON EXPERIMENT (AMEX), Reference paragraph 28 of E-B-1, ATTACHMENT 2, Record of 7th session of Japan-Australia GMS Joint Committee, 29 JULY - 1 AUG. 1986.

ATTACHMENT 2 to
E-8-1
(para 28 refers)

THE AUSTRALIAN MONSOON EXPERIMENT (AMEX)

(Reference paragraph 28 of E-8-1)

Overview

The Bureau of Meteorology Research Centre (BMRC) is conducting a field experiment, titled AMEX, during late 1986 and early 1987. This experiment is designed around the collection of a high quality, high density tropical sonde and radar data set, which is intended to form the basis of Australian tropical research during the following 5 to 10 years. The experiment is of fundamental importance in the Bureau's research efforts to improve tropical forecasts.

2. The experimental design of AMEX has been based on the assumption that the current 3-hourly infrared and 3 per day visible GMS images will be available during the experiment's field phases. Accordingly the fulfilment of the AMEX objectives is absolutely dependent on the availability of imagery at this current time resolution continuously through the two field phases.

3. The development of Australian tropical meteorology has been severely hampered by lackof data for both research and forecasting operations. The AMEX experiment represents a once-in-a-lifetime opportunity to obtain a set of high density atmospheric data in this region. Much effort has gone into optimising the benefits that can be obtained from the data; and as an example of this, the actual timing of the experiment has been set to coincide with several other Australian and US atmospheric and oceanic experiments being held in the same region. The subsequent AMEX research will involve the blending of many different data types including sonde, radar, ship, aircraft and satellite measurements. It is intended to both develop new techniques plus adapt existing international techniques for this data blending. The different data sources will all be of different time resolution; thus this part of the AMEX research would greatly benefit from the availability of GMS images at 1-hour time resolution for six different 12-hour sequences during the main field phase in January-February 1987.

4. In particular, virtually all of the techniques developed in the US for the determination of rainfall or wind from satellite imagery are based on images of half-hourly or better resolution. The special periods of hourly satellite data during AMEX will be of major importance in the adaption of such techniques for use in the rest of the experiment.

Description of AMEX

5. The AMEX experiment is being conducted by the Bureau of Meteorology Research Centre in collaboration with Monash University and with the cooperation of several other Australian and international institutions. The experiment has two scientific objectives:

(a) to investigate the interactions between cumulonimous convection and the Australian summer monsoon circulation: and.

(b) to investigate a specific weather phenomenon, the North Australian Cloud Line

6. AMEX consists of two data gathering field phases preceded by a period of background research and followed by several years of data analysis and analytical and numerical modelling. The two field exercises involve enhanced radar and upper air observation networks across northern Australia and concentrated around the Gulf of Carpentaria. Data from these networks will be used in conjunction with satellite, aircraft and ship data and with the routine upper air observing network data over southern Australia, Papua New Guinea and Indonesia.

7. The first field phase (Phase I) is aimed at objective b) and will be conducted for 15 days from 20 October to 4 November 1986. The core of the experiment is Phase II. This phase is oriented mainly towards objective (a). Among other factors it will involve the installation of five new radiosonde stations, the upgrading of several existing sonde stations, the installation of a ground based radar, plus for the first time in Australia the digitisation and archival of multiscan radar data at several sites. This major field phase will occur for 34 days from 12 January to 15 February 1987. A detailed description of the objectives and scientific basis of AMEX is given in a BMRC internal report by McBride and Holland.

Why fulfillment of the AMEX objectives is critically dependent on the uninterrupted availability of the current 3-hourly GMS imagery for the duration of the field phases

8. The major field phase of AMEX is oriented towards the first aim of the experiment. This aim is to study and understand the relationships between changes in tropical cumulonimbus activity over northern Australia and changes in the larger scale surrounding monsoon circulation. The design of the experiment has been strongly influenced by experience gained from the international GATE experiment held in the north Atlantic ITCZ region during 1974.

9. Following the GATE design, variations in atmospheric structure will be measured by a cloud-cluster scale radiosonde network, installed specifically for the experiment around the Gulf of Carpentaria. This sonde network will operate at 6-hourly time resolution for the entire 34 days. Simultaneous variations in convective activity and rainfall will be monitored using digital data from satellite and radar. The two data sources will be combined, as the radar coverage extends over only a limited portion of the domain. Detailed information in the region of radar-satellite overlap will be used to extrapolate into the regions observed purely by satellite.

10. The continuous simultaneous monitoring of atmospheric structure by the sonde network will provide time series of many derived quantities such as conditional instability, potential vorticity, budget estimates of the vertical profile of convective heating, and so on. Through the simultaneous monitoring of convective activity (by radar and satellite) theoretical and empirical relationships can be formulated between the above derived quantities and characteristics of the convection, such as stage in the life-cycle of a cloud cluster, stage in a monsoon active-break transition, degree of organisation of the convection into mesoscale complexes, and so on. The satellite is the prime data source for measuring the convection, and none of this research can be done if these data are not available. It is thus essential for the success of the experiment that there be an uninterrupted time series of 3-hourly infrared plus 3 per day visible images.

How the usefulness of the AMEX data will be greatly enhanced by the addition of several 12-hour periods of hourly GMS imagery

11. There are several important benefits that can be gained from the use of hourly satellite data for special observing periods during AMEX.

- AMEX will provide the first ever set of sonde data on the same time and space resolution as the actual weather systems in the Australian tropics. Several of the AMEX systems will be studied intensively through diagnostic analysis followed by the derivation of conceptual, analytical and numerical models. These models will form the basis of Australian forecasters' and researchers' understanding of tropical weather. Verification of the models will depend on an accurate documentation of the evolution and organsiation of convection within the weather systems. This can be provided only by hourly satellite data.

- Throughout the duration of the experiment the satellite data will be used in combination with radar data to monitor the total latent heat release driving the larger-scale weather systems. The current techniques in the scientific literature (eg that of Oliver and Scofield) for determining rainfall from satellites are strongly dependent on high temporal resolution for the satellite data. To adapt such techniques to 3-hourly satellite imagery, it will be necessary to have a subset of data at higher temporal resolution.

- Simultaneous with Phase II of AMEX will be conducted two aircraft based atmospheric experiments : the Stratosphere Troposphere Exchange Program (NASA) and the Equatorial Mesoscale Experiment (NOAA/NSF/CSIRO). Both experiments will be operating within the AMEX sonde network and will be sharing data with AMEX. It would be extremely beneficial to have hourly satellite data during the operation of certain flights, so that the flight data could be directly related to particular cloud and mesoscale elements.

- The BMRC satellite and data group have a long term interest in the generation of satellite cloud winds, and inparticular in experimentation with their generation from hourly data. The AMEX sonde data will provide a rare opportunity to have a "ground-truth" tropical wind data set for the development of this technology.

CGMS-XVI WP-3-2
Agenda Item: B.3
Prepared by Japan

REPORT ON STATUS OF SATELLITE SYSTEMS

JAPAN

Status of Geostationary Meteorological Satellites

CGMS XVI WP-3-2
Agenda Item: B.3
Prepared by Japan

1. Present Status of the Geostationary Meteorological Satellites

A. GMS

GMS is being kept at 160° E longitude.

The VISSR scan mirror drive is no more operable. There is no major anomaly in the other equipments.

The remaining fuel is estimated to be less than 2.4 kg no North-South station keeping is being made. Orbital inclination is about 5.6 deg. at present.

B. GMS-2

GMS-2 is being kept at 120 ° E longitude.

The VISSR is operable only for infrequent uses. The output power of the S-band transmitter degraded to 13 dB below normal and is still degrading. The transmitter can be switched to the low-power mode, the output of which is now greater than the high-power mode.

The remaining fuel of about 2.7 kg, no North-South station keeping is being made. Orbital inclination is about 3.4 deg. at present.

C. GMS-3

GMS-3 is being kept at 140 ° E longitude.

Except VISSR encoder lamp voltage was raised from step 2 to step 3 on Nov.26 1986, GMS-3 is operating normally from CGMS-XV.

From March 1987, the frequency of VISSR observation are increased from 3 hours to hourly as the MSC data processing facilities were replaced.

GMS (160° E)	140° E (7/30/77 ~ 12/19/81) 160° E (9/10/84 ~) 160° E (1/24/82 ~ 12/23/83) 140° E (1/30/84 ~ 8/ 4/84)	∇ See Note No.	OPERATIONAL ——— DEGRADED OPE. ——— STANDBY MODE ---------- FAILURE MODE ———

	SPACECRAFT SUBSYSTEM	1977 JFMAMJJASOND	1978 JFMAMJJASOND	1979 JFMAMJJASOND	1980 JFMAMJJASOND	1981 JFMAMJJASOND
1	VISSR	∇2	∇3			∇7、8
2	SEM					
3	VDM					
4	S-BAND RX1					
5	S-BAND RX2					
6	S-BAND TX1					
7	S-BAND TX2					
8	UHF RX1					
9	UHF RX2					
10	UHF TX1					
11	UHF TX2					
12	VHF RX1					
13	VHF RX2					
14	VHF TX1					
15	VHF TX2					
16	COMMAND UNIT1					
17	COMMAND UNIT2					
18	RCS/CONTROL	∇1	∇4			
19	POWER					
20	TELEMETRY				∇5	∇6
21	THERMAL					

GMS (160° E)	140° E (7/30/77 ~ 12/19/81) 160° E (9/10/84 ~) 160° E (1/24/82 ~ 12/23/83) 140° E (1/30/84 ~ 8/ 4/84)	▽ See Note No.	OPERATIONAL ———	STANDBY MODE ·····	DEGRADED OPE. ~~~~	FAILURE MODE ~~~~

	SPACECRAFT SUBSYSTEM	1982 JFMAMJJASOND	1983 JFMAMJJASOND	1984 JFMAMJJASOND	1985 JFMAMJJASOND	1986 JFMAMJJASOND
1	VISSR			▽10 ▽11		
2	SEM			▽9		
3	VDM					
4	S-BAND RX1					
5	S-BAND RX2					
6	S-BAND TX1					
7	S-BAND TX2					
8	UHF RX1					
9	UHF RX2					
10	UHF TX1					
11	UHF TX2					
12	VHF RX1					
13	VHF RX2					
14	VHF TX1					
15	VHF TX2					
16	COMMAND UNIT1					
17	COMMAND UNIT2					
18	RCS/CONTROL				▽14	
19	POWER					
20	TELEMETRY		▽6 ------ ▽6	▽6 ▽6 ▽12、13 ▽	▽6▽6	
21	THERMAL			6		

GMS (160° E)	140° E (7/30/77 ~ 12/19/81) 160° E (9/10/84 ~) 160° E (1/24/82 ~ 12/23/83) 140° E (1/30/84 ~ 8/ 4/84)	▽ See Note No.	OPERATIONAL ———	DEGRADED OPE. ———	STANDBY MODE ·····	FAILURE MODE ~~~~~

	SPACECRAFT SUBSYSTEM	1987 JFMAMJJASOND	1988 JFMAMJJASOND	1989 JFMAMJJASOND	1990 JFMAMJJASOND	1991 JFMAMJJASOND
1	VISSR	———				
2	SEM	·····				
3	VDM	·····				
4	S-BAND RX1	·····				
5	S-BAND RX2	·····				
6	S-BAND TX1	·····				
7	S-BAND TX2	·····				
8	UHF RX1	·····				
9	UHF RX2	·····				
10	UHF TX1	·····				
11	UHF TX2	·····				
12	VHF RX1	———				
13	VHF RX2	———				
14	VHF TX1	·····				
15	VHF TX2	·····				
16	COMMAND UNIT1	———				
17	COMMAND UNIT2	———				
18	RCS/CONTROL	———				
19	POWER	———				
20	TELEMETRY	———				
21	THERMAL	———				

GMS

1. Spacecraft tilt (about 2°) was discovered. (Sep. / 77)
2. VIS ch. 4 HVPS was failed and switched to redundant unit.(11/4/77)
3. VIS ch. 6 HVPS was failed and switched to redundant unit.(3/8/78)
4. VISSR FOV sfited about 117° without command from ground. (9/9/78)
5. Remote MUX 5A was switched off without command from ground.(11/6/80)
6. Index Pulse was switched on without command from ground. (7/28/81, 4/19/83, 4/23/83, 5/8/83, 10/21/83, 1/10/84, 3/30/84, 4/4/84, 12/21/84, 1/1/85, 3/8/85)
7. First scan mirror hang-up was occurred.(PRI encoder side) (10/10/81)
8. Scan mirror hang-up (PRI encoder side) was occurred and switched to redundant encoder. (10/12/81)
9. SEM P4 and E1 channels were failed. (3/20/84)
10. Scan mirror hang-up (Redundant encoder) was occurred. (4/5/84)
11. VISSR observation was terminated. (6/29/84)
12. PCM telemetry was switched off without command from ground. (7/20/84)
13. PCM and real-time telemetry were switched off without command from ground. (7/21/84)
14. Antenna pointing was sfited 61° without command from ground. (8/30/85)

GMS-2 (120° E)	160° E (8/20/81 ~ 11/ 5/81) 120° E (8/23/85 ~) 140° E (12/11/81 ~ 1/21/84) 145° E (1/31/84 ~ 7/ 3/85)	∇ See Note No.	OPERATIONAL ——— STANDBY MODE ·····	DEGRADED OPE. ——— FAILURE MODE ———

	SPACECRAFT SUBSYSTEM	1981 JFMAMJJASOND	1982 JFMAMJJASOND	1983 JFMAMJJASOND	1984 JFMAMJJASOND	1985 JFMAMJJASOND
1	VISSR			10∇∇	∇∇13 ∇16 ∇17	
2	SEM			∇9 11	12	
3	VDM					
4	S-BAND RX1					
5	S-BAND RX2					
6	S-BAND TX1	∇4				
7	S-BAND TX2	∇2				
8	S-BAND TLM TX1					
9	S-BAND TLM TX2	∇1				
10	S-BAND DCPR TX1					
11	S-BAND DCPR TX2					
12	UHF DCPR RX1					
13	UHF DCPR RX2					
14	UHF DCPI TX1					
15	UHF DCPI TX2					
16	USB RX1				∇15	
17	USB RX2			∇7		
18	USB TLM TX1					
19	USB TLM TX2					
20	TELEMETRY	∇3	∇5 ∇6	∇8	∇14	
21	THERMAL					
22	COMMAND UNIT1					
23	COMMAND UNIT2					∇18
24	RCS/CONTROL					
25	POWER					

GMS-2 (120° E)	160° E (8/20/81 ~ 11/ 5/81) 120° E (8/23/85 ~) 140° E (12/11/81 ~ 1/21/84) 145° E (1/31/84 ~ 7/ 3/85)	▽ See Note No.	OPERATIONAL ———	STANDBY MODE ----------	DEGRADED OPE. ———	FAILURE MODE ———

	SPACECRAFT SUBSYSTEM	1986 JFMAMJJASOND	1987 JFMAMJJASOND	1988 JFMAMJJASOND	1989 JFMAMJJASOND	1990 JFMAMJJASOND
1	VISSR	----------	----------			
2	SEM	----------	----------			
3	VDM	----------	----------			
4	S-BAND RX1	———	———			
5	S-BAND RX2	———	———			
6	S-BAND TX1	----------	----------			
7	S-BAND TX2	———	———			
8	S-BAND TLM TX1	----------	----------			
9	S-BAND TLM TX2	———	———			
10	S-BAND DCPR TX1	----------	----------			
11	S-BAND DCPR TX2	----------	----------			
12	UHF DCPR RX1	----------	----------			
13	UHF DCPR RX2	----------	----------			
14	UHF DCPI TX1	----------	----------			
15	UHF DCPI TX2	----------	----------			
16	USB RX1	———	———			
17	USB RX2	———	———			
18	USB TLM TX1	———	———			
19	USB TLM TX2	----------	----------			
20	TELEMETRY	———	▽19 ——— ▽20			
21	THERMAL	———	———			
22	COMMAND UNIT1	----------	----------			
23	COMMAND UNIT2	———	———			
24	RCS/CONTROL	———	——— ▽21			
25	POWER	———	———			

GMS-2

1. S-band TLM TX2 was locked off (due to frequency jumping) and switched to S-band TLM TX1. (9/24/81)
2. S-band TX2 was failed and switched to TX1. (9/24/81)
3. RTU telemetry channel crosstalk was discovered. (9/26/81)
4. S-band TX1 output power decreased during to eclipse also long-term degradation. (1 watt as of Sep. 87) (10/10/81)
5. Command answer back from CTU1 was anomaly and switched to CTU2. (4/4/82)
6. Telemetry from CTU2 was locked off and switched to CTU1. (9/3/82)
7. USB RX2 was failed. (1/31/83)
8. PCM telemetry was interrupted and returned normal upon cycling CTU1. (4/21/83)
9. Data from A3,A4,P4 and P5 channels of SEM were anomaly due to increasing detector current. (5/22/83)
10. First scan mirror hang-up in retrace (Primary Encoder) was occurred. (11/3/83)
11. Scan drive was switched to redundant encoder side, but hang-up at retrace was discovered, soon reswitched back to primary encoder. (12/13/83)
12. Reswitched to redundant encoder. (1/6/84)
13. Operational S/C was changed from GMS-2 to GMS.(1/21/84)
14. 120 ~ 127 channels status from RTU2 were anomaly. (2/8/84)
15. USB RX1 received power was decreased. (3/20/84)
16. Terminated operation of GMS, restarted operation of GMS-2. VISSR observation was operated at an interval of six hours. (6/29/84)
17. Operational S/C was changed from GMS-2 to GMS-3. (9/27/84)
18. Antenna pointing was sfited 45° and VISSR preregurater 1 was switched off without command from ground. (9/11/85)
19. Part of PCM telemetry data became erroneous. The data returned normal upon power cycling. (2/4/87)
20. PCM telemetry from CTU1 became erroneous. The data returned normal upon power cycling. (8/15/87)
21. South Earth Sensor was switched North Earth Sensor and DBE was switched on without command from ground. (9/1/87)

GMS-3 (140° E)

140° E (8/16/84 ~)

▽ See Note No.

OPERATIONAL ——— DEGRADED OPE. ———

STANDBY MODE ····· FAILURE MODE ~~~~~

SPACECRAFT SUBSYSTEM		1984 JFMAMJJASOND	1985 JFMAMJJASOND	1986 JFMAMJJASOND	1987 JFMAMJJASOND	1988 JFMAMJJASOND
1	VISSR	▽1	4▽▽5▽ -- ▽▽7	9▽▽ ▽6 ▽15		
2	SEM		6 6 ▽8	10,11		
3	VDM					
4	S-BAND RX1					
5	S-BAND RX2					
6	S-BAND TX1					
7	S-BAND TX2					
8	S-BAND TLM TX1					
9	S-BAND TLM TX2					
10	S-BAND DCPR TX1					
11	S-BAND DCPR TX2					
12	UHF DCPR RX1					
13	UHF DCPR RX2					
14	UHF DCPI TX1					
15	UHF DCPI TX2					
16	USB RX1					
17	USB RX2					
18	USB TLM TX1					
19	USB TLM TX2					
20	TELEMETRY	▽2 ▽	3▽▽ ▽3	▽▽▽3 ▽14	▽16	
21	THERMAL	3	3	33		
22	COMMAND UNIT1			▽12		
23	COMMAND UNIT2					
24	RCS/CONTROL			▽13		
25	POWER					

GMS-3

1. The problem of VISSR cooler cover release was occurred. (8/16/84)
2. PCM telemetry from CTU1 was anomaly and recovered by command. (9/3/84)
3. CTU condition was initiated by SEU. (12/15/84, 12/29/84, 3/9/85, 4/6/85, 7/7/85, 1/26/86, 2/9/86, 3/20/86)
4. IR channel was switched from ch 2 to ch 1 without command from ground. (3/1/85)
5. Scan mirror hang-up (redundant encoder) was occurred, increased encoder lamp voltage one step. (4/1/85)
6. VISSR VIS ch gain step changed without command from ground. (6/14/85, 7/11/85, 8/1/85, 8/16/85, 8/30/85, 9/24/85, 10/7/85, 10/11/85, 8/17/86, 8/25/86, 8/27/86, 8/29/86)
7. VISSR mirror step scan changed on and status of VISSR units were changed without command from ground.(9/27/85)
8. Data from P4 and E1 channels were anomaly due to detector degradation. (Nov. /85)
9. Scan mirror hang-up (redundant encoder) was occurred. (4/29/86)
10. Scan mirror encoder was switched to primary encoder. (5/10/86)
11. Scan mirror hang-up in expanded frame mode due to lubricant build-up. (5/13/86)
12. Command answer back from Command Demodulator Decoder 1 was anomaly and switched to CDD2. (8/6/86)
13. Pointing of antenna was shifted. (8/6/86)
14. PCM telemetry data became erroneous both CTU and RTU were switched to redundant side. (11/26/86)
15. VISSR scan line number became erroneous. Encoder lamp voltage was raised from step 2 to step 3. (11/26/86)
16. Relating to the PCM anomaly of Nov. 26, 1986, both CTU and RTU were switched back to primary side. Both units were found to work normally. (2/6/87)

ANNEX IV

STATUS OF SATELLITES AND ANOMALY REPORTS - USA WP 3

CGMS XVI - USA - WP 03

Agenda Item B.4

Report on Satellite Status

Report on Goes Satellite Status for CGMS XVI

The GOES-7 spacecraft located at 74.3°W continues to support East MODE AAA VAS, DCS, WEFAX and SEM Operations. All subsystems are functioning nominally with the exceptions noted on the detailed attachment.

The GOES-6 spacecraft located at 134.5°W continues to support West MODE AAA VISSR, DCS, WEFAX and SEM Operations. The VAS is operating in step 4 of the third bulb, past history indicates this is a relatively unstable environment and selection of our last bulb could be inminent. All other subsystems are functioning nominally with the exception noted on the detailed attachment.

The GOES-5 spacecraft located at 107.3°W supports the CENTRAL WEFAX and provides back-up DCS support.

The GOES-4 spacecraft located at 43.0°W supports DCPR for ESA.

The GOES-2 spacecraft located at 112.8°W and the GOES-3 spacecraft located at 130.8°W are both in standby mode.

A detailed status report for all NOAA spacecraft is attached.

S/C STATUS: Operational as EAST spacecraft providing MODE AAA VAS, DCS, WEFAX and SEM.

PART I - Subsystem Status -

POWER: Operational with a load of 10.4 amps.

TELEMETRY AND COMMAND: Operational with Central TLM Unit 1 ON and Remote TLM Unit 1 and 3 ON.

DESPIN: Operational with Side 2 selected.
DCE-1 has intermittent anomaly causing loss of antenna pointing control.

RCS: Operational

Latch valves: open

Maneuvers this month:

DATE	TYPE	FUEL REQD
9	ATT	0.041bs.

Fuel remaining (lbs.): 132.6

COMMUNICATIONS: Operational.

S-Band: Side 1 selected and on.
UHF: Side 1 selected and on.
DCPR: Transmitter 1 on.
STDN: Transmitter 1 and 2 off.
CDA: Transmitter 1 on.

VDM: Operational with unit 1 selected.

VAS: Operational.

	MONTH		ACCUM.		
	STA 1	STA 2	STA 1	STA 2	
PRI Scan Drive Usage (Hrs):	0	0	22	22	(LAMP)
RED Scan Drive Usage (Hrs):	0	744	3	3509	(LED)

Scan Drive Selected: Redundant/LED 2

Max torque, top of frame = 10.5 in. oz. at line 101
Max torque bottom of frame = 11.1 in. oz. at line 1506

SEM: Operational. Calibration performed weekly.
HEPAD failed during NASA checkout.

THERMAL: Operational.

PART II - Station and Orbital Environment -

The S/C is located at 74.3°W
Orbital inclination is 0.15°
Spin rate is 100.0 RPM.

PART III - Anomalies

VAS PMT-5 channel gain increase. See GAR#110 included in this report.

PART IV - Plans

Start battery reconditioning 10 August

PART V - Comments

1. Tests were conducted July 17 and 31 to characterize the PMT-5 anomaly. On July 31 PMT 4, 5, 6 were cycled through all four gain settings and the calibration ramp was observed at Wallops and ingested at the Univ. of Wisconsin for analysis. The test was then repeated after switching to VDM-2. No difference was observed between the two VDM's. Preliminary analysis indicates a failure in the PMT-5 gain circutry. PMT-4 channel remains patched to PMT-5 channel at the VIP.

2. Continuous VAS Mode AAA operations commenced 4 May using the T&C GMACS unit at Wallops to generate PDL's and command the spacecraft.

GOES-7 (GOES-H) (Continued)
STATUS AS OF JULY 31, 1987

1. AFT Bearing temperature telemetry failed. GAR #103
   Axial thruster 2 temperature telemetry erratic. GAR #104
   Radial thruster 3 and 4 temperature telemetry reversed. GAR #105

2. DCE-1 intermittently unstable causing loss of antenna painting. GAR #109
   Spin Axis misalignmant 0.4° GAR #106

3. HEPAD failed. GAR #107

4. Coherant noise in VAS IR bands 1, 2 and 9. GAR #108

5. PMT-5 channel gain increase 70% 7/16/87. GAR#110

TURNOVER: 3/25/87
OPERATIONAL: 3/25/87 75 DEG E.

OPERATIONAL	*****
STANDBY MODE	SSSSS
DEGRADED OPERATION	DDDDDD
FAILED	FFFFFF
(NUMBERS).....SEE NOTES	

SPACECRAFT SUBSYSTEMS	1987 JFMAMJJASOND	1988 JFMAMJJASOND	1989 JFMAMJJASOND	1990 JFMAMJJASOND	1991 JFMAMJJASOND	1992 JFMAMJJASOND	1993 JFMAMJJASOND	1994 JFMAMJJASOND
VISSR/VAS	(4) (5) *****							
SEM	(3) *****							
VDM	*****							
DCPR TRANSMITTER 1	*****							
DCPR TRANSMITTER 2	*SSSS							
S-BAND RECEIVER 1	*****							
S-BAND RECEIVER 2	*SSSS							
S-BAND TRANSMITTER 1	*****							
S-BAND TRANSMITTER 2	*SSSS							
UHF RECEIVER 1	*****							
UHF RECEIVER 2	*SSSS							
UHF TRANSMITTER 1	*****							
UHF TRANSMITTER 2	*SSSS							
CDA TLM TRANSMITTER 1	*****							
CDA TLM TRANSMITTER 2	*SSSS							
STDN TRANSMITTER 1	*SSSS							
STDN TRANSMITTER 2	*SSSS							
COMMAND/RANGING UNIT 1	*****							
COMMAND/RANGING UNIT 2	*****							
RCS	*****							
THERMAL	(1) *****							
POWER	*****							
TELEMETRY	*****							
DESPIN	(2) *****							

S/C STATUS: Operational as WEST spacecraft providing MODE AAA VISSR, DCS, WEFAX. and SEM.

PART I - Subsystem Status -

POWER: Operational with a load of 8.8 amps.

TELEMETRY AND COMMAND: Operational with Central TLM Unit 1 ON and Remote TLM Unit 1 and 3 ON.

DESPIN: Operational with Side 1 selected.

RCS: Operational

Latch valves: open

Maneuvers this month:

DATE	TYPE	FUEL REQD
30	ATT/N-S/SPIN	3.6 lbs

Fuel remaining (lbs.): 15.4

COMMUNICATIONS: Operational.

S-Band: Side 1 selected and on.
UHF: Side 1 selected and on.
DCPR: Transmitter 1 on.
STDN: Transmitter 1 and 2 off.
CDA: Transmitter 2 on. Transmitter 1 failed.

VDM: Operational with unit 1 selected.

VAS: Operational.

	MONTH		ACCUM.	
	LAMP 1	LAMP 2	LAMP 1	LAMP 2
PRI Scan Drive Usage (Hrs):	0	Failed	15	9,023
RED Scan Drive Usage (Hrs):	744	Failed	8,489	19,381

Scan Drive Selected: Redundant/Lamp 1/Step 4 (4.90V)
Lamp voltage Step 2 Selected 8/17/86
Lamp voltage Step 3 Selected 3/16/87
Lamp voltage Step 4 Selected 7/10/87

Max torque, top of frame = 26.0 in. oz. at line -15
Max torque bottom of frame = 25.1 in. oz. at line 1873

SEM: Operational. Calibration performed weekly.
EPS E1 channel degraded starting early 1985; failed Fall, 1986.

THERMAL: Operational.

PART II - Station and Orbital Environment -

The S/C is located at 134.5°W
Orbital inclination is 0.10°
Spin rate is 100.0 RPM.

PART III - Anomalies

NONE

PART IV - Plans

1. Resume VAS operations under GMACS control late Aug, 1987.

2. Start battery reconditioning 10 August.

PART V - Comments

1. Torque buildup has been controlled by periodically offsetting the start and end of VISSR and VAS frames. Operating exclusively in the VISSR Mode since 19 February has increased the buildup rate necessitating more frequent ACS file rotation. Buildup and control in the North expanded frame has been particularly troublesome. Lubricant hang-ups have occasionally occurred since 2 May at lines (-)47 and (-)22. Image scan modes which delayed increasing the lamp voltage caused use of new ACS files which did not contain expanded frame torque control. This contributed to the present high torque areas. A lubricant hang-up also occurred at line 1410 on 9 July, again due to exclusive use of 1400 line scans.

2. A dwell on line count telemetry during a complete VISSR scan is performed weekly to detect erroneous line numbers. Erroneous line continued to increase during early July but the retrace in normal step scan rate mode developed in June allowed 1400 line imaging to continue. However, this mode prevented effective torque control, especially in the North expanded frame and after this became a concern it was decided to increase the lamp voltage to step 4 (4.90 volts) on 10 July. Since then, erroneous lines have randomally varied from 4 to 26 each scan indicating fluctuations in lamp intensity. Rapid retrace hang-ups have not occurred.

TURNOVER:	5/2/					
OPERATIONAL:	6/01/83	135 DEG W				
GOES-PRIME	8/31/83	98 DEG W	GOES-PRIME	7/09/86	98 DEG W	
GOES-PRIME	10/30/84	108 DEG W	GOES-PRIME	12/11/86	108 DEG W	
GOES-PRIME	7/09/85	98 DEG W	GOES-WEST	4/28/87	135 DEG W	
GOES-PRIME	11/20/85	108 DEG W				

STANDBY MODE SSSSSS

DEGRADED OPERATION DDDDDD

FAILED FFFFFF

(NUMBERS).....SEE NOTES

```
SPACECRAFT SUBSYSTEMS   I          I          I          I          I          I          I          I
                        I   1983   I   1984   I   1985   I   1986   I   1987   I   1988   I   1989   I   1990
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
                        I----------I----------I----------I----------I----------I----------I----------I----------
                        I (2,7,4)(5)   (13)(14)  (16-21)   (22)(27-28,31-32,34-35)  I          I          I
VISSR/VAS               I ********I**********I**********I**********I*******  I          I          I
                        I      (6)         I          (23-24)     I          I          I          I
SEM                     I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
VCM                     I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
DCPR TRANSMITTER 1      I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
DCPR TRANSMITTER 2      I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I          I          I          I          I          I          I          I
S-BAND RECEIVER 1       I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
S-BAND RECEIVER 2       I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I          I          I          I          I          I          I          I
S-BAND TRANSMITTER 1    I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
S-BAND TRANSMITTER 2    I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I          I          I          I          I          I          I          I
UHF RECEIVER 1          I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
UHF RECEIVER 2          I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I          I          I          I          I          I          I          I
UHF TRANSMITTER 1       I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
UHF TRANSMITTER 2       I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I (3) (3) I (8)      I          I          I          I          I          I
CDA TLM TRANSMITTER 1   I ********I**FFFFFFFFFFIFFFFFFFFFFFFIFFFFFFFFFFFFIFFFFFFF  I          I          I
                        I          I          I          I          I          I          I          I
CDA TLM TRANSMITTER 2   I *SSSSSSSISS**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
STDN TRANSMITTER 1      I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I          I          I          I          I          I          I          I
STDN TRANSMITTER 2      I *SSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS  I          I          I
                        I (1)      I          I          I          I          I          I          I
COMMAND/DECODING UNIT 1 I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
COMMAND/DECODING UNIT 2 I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
RCS                     I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
THERMAL                 I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
POWER                   I ********I**********I**********I**********I*******  I          I          I
                        I          I (9-10,12)I (15)  (20) I(25-26,29-30)  (33)  I          I          I
TELEMETRY               I ********I**********I**********I**********I*******  I          I          I
                        I          I          I          I          I          I          I          I
DESPIN                  I ********I**********I**********I**********I*******  I          I          I
```

GOES-6 (GOES-F) (Continued)
STATUS AS OF JULY 31, 1987

1. DECODER/DEMOD-1 command register would not clear 6/10/83. GAR # 68
2. Erroneous line numbers in VAS telemetry during checkout. GAR # 70
3. CDA TLM XMTR-1 power output decrease. GAR # 71 and # 75
4. VAS PMT 8 degraded output required +3 db gain step. GAR # 72
5. VAS FILTER WHEEL HTR temperature servo control failed. GAR # 77
6. X-RAY position telemetry responds erratically at N & S Limits. GAR # 78
7. Increased VAS Redundant Encoder Lamp 2 to voltage step 2; 7/7/83.
8. CDA TLM XMTR - 1 failed 3/5/84. Switch to Redundant XMTR. GAR # 81
9. First GOES-6 CTU SEU anomaly. Cycled CTU power to correct. GAR # 84
10. CTU SEU anomaly - PCM reset and Real-Time to initialized state.
11. Thruster R1 and R2 underperformance during station change maneuvers. GAR#87
12. CTU SEU anomaly -word 3, bit 3 flipped
13. VAS SCAN MIRROR hang-up in VAS mode (processor on) 9/21/84. GAR # 88
14. Increased VAS Redundant Encoder Lamp 2 to voltage step 3 12/17/84.
15. CTU SEU anomaly - word 3, bit 3 flipped
16. VAS SCAN MIRROR hang-up in VAS mode 4/17/85.
17. Increased VAS Redundant Encoder Lamp 2 to voltage step 4 5/31/85
18. VAS Rendundant Encoder Lamp 2 failed 8/6/85. GAR # 93
    Switched to Primary Encoder, Lamp 2, voltage step 2.
19. An'EVENT' simultaneously shifted VAS pointing 45 degrees East and switched operational modes of three units (X-RAY, X-Ray Positioner, VDM) GAR # 94
20. CTU SEU anomaly - 9/10/85 - Switched into Dwell Mode.
    CTU SEU anomaly - 9/25/85 - Infinite Loop.
21. STDN TLM XMTR, when ON, causes VISSR North-South image shift. GAR # 95
22. Increased VAS Primary Encoder Lamp 2 to voltage step 3 1/14/86.
23. Uncommanded X-RAY switch to CAL MODE and POS. ELECT switch to ON. GAR #98
24. SEM EPS E1 channel failed due to radiation damage to detector.
25. CTU SEU anomaly - 6/25/86 - word 62, bit 4 stuck at 'one'.
26. CTU SEU anomaly - 8/10/86 - switch into dwell mode
27. VAS primary Encoder Lamp 2 failed 8/17/86. GAR #100. Switched to Redundant Encoder, Lamp 1, voltage step 2.
28. An 'Event' simultaneously shifted VAS pointing 45° degrees West and switched operational modes of X-Ray and X-Ray positioner. Sept. 27, 1986
29. CTU SEU anomaly - 10/08/86 - erroneous analog words.
30. CTU SEU anomaly - 12/06/86 - word 3, bit 3 flipped.
31. SCAN mirror hang-up during retrace at line (-)70 - 01/02/87.
32. Increased VAS redundant encoder Lamp 1 to Voltage Step 3:3/15/87.
33. CTU SEU anomaly - 4/29/87 - Word 62 bit 4 Stuck at 1.
    CTU SEU anomaly - 5/14/87 - Word 62 bit 4 Stuck at 1.
34. Lubricant hang-up at line -47. Torque TLM indicated 36 in. oz. pseudo-incremental stepping cleared the hang-up 5/2/87.
35. Increased VAS redundant encoder lamp 1 to voltage Step 4 - 7/10/87.

S/C STATUS: Semi-operational as CENTRAL spacecraft providing WEFAX and back-up DCS.

PART I - Subsystem Status -

POWER: Operational with a load of 6.8 amps.

TELEMETRY AND COMMAND: Operational with Central TLM Unit 2 ON and Remote TLM Unit 2 and 4 ON.
VAS sunshade side temperature intermittent.

DESPIN: Operational with Side 1 selected.

RCS: Operational

Latch valves: open

Maneuvers this month:

DATE	TYPE	FUEL REQD
	NONE	

Fuel remaining (lbs.): 11.6

COMMUNICATIONS: Operational.

S-Band: Side 1 ON
UHF: Side 1 ON
DCPR: XMTR 1 ON
STDN: OFF
CDA: Transmitter 2 ON

VDM: Operational and OFF.

VAS: Inoperative and OFF. Last tested 07/16/85.
PRI scan drive Encoder Lamp failed 07/22/84.
(9,672 hours operational)
Red scan drive Encoder Lamp failed 07/30/84.
(17,880 hours operational)
Primary power failed 16 June 83.

SEM: Semi-operational.
HEPAD failed 11/05/82, turned OFF 02/24/84.
MAG Hp offset generator reset to 0 by transient 08/06/84. Partial recovery.
EPS E1 channel failed; EPS P4 channel degraded.

THERMAL: Operational.

PART II - Station and Orbital Environment -

The S/C is located at 107.3°W.
Orbital inclination is 0.78°.
Spin rate is 100.0 RPM.

PART III- Anomalies:

NONE

PART IV - Plans

NONE

PART V - Comments

Battery Reconditioning in preparation for the Fall eclipse season commenced 27 July.

OPERATIONAL:	8/05/81	75 DEG W.
GOES-EAST	7/30/84	75 DEG W
STANDBY	3/25/87	1 DEG DAY W DRIFT
GOES-CENTRAL	5/14/87	107 DEG W

STANDBY MODE SSSSSS

DEGRADED OPERATION DDDDDD

FAILED FFFFFF

(NUMBERS).....SEE NOTES

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SPACECRAFT SUBSYSTEMS   I          I          I          I          I          I          I          I
                        I    1931  I    1982  I    1983  I    1984  I    1985  I    1986  I    1987  I    1988
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
                        I----------I----------I----------I----------I----------I----------I----------I----------
                        I     (23) I           I  (10,14) (13,16-17,19-20)    I          I          I
VISSR/VAS               I   *******I***********I***********I*******FFFFFIFFFFFFFFFFFFIFFFFFFFFFFFFIFFFFFFF     I
                        I          I      (11)I           I(15)  (21)  I          I (29)  (32)I          I
SEM                     I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
VDM                     I   *******I***********I***********I*******SSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I     (12) I           I           I           I           I
DCPR TRANSMITTER 1      I   *******I***********I***********I***********I***********I***********I***S***     I
                        I          I           I           I           I           I           I           I
DCPR TRANSMITTER 2      I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I           I           I           I
S-BAND RECEIVER 1       I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
S-BAND RECEIVER 2       I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I           I           I           I
S-BAND TRANSMITTER 1    I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
S-BAND TRANSMITTER 2    I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I           I           I           I
UHF RECEIVER 1          I   *******I***********I***********I***********I***********I***********I***S***     I
                        I          I           I           I           I           I           I           I
UHF RECEIVER 2          I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I           I           I           I
UHF TRANSMITTER 1       I   *******I***********I***********I***********I***********I***********I***S***     I
                        I          I           I           I           I           I           I           I
UHF TRANSMITTER 2       I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I           I           I           I
CDA TLM TRANSMITTER 1   I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I     (28)  I           I           I
CDA TLM TRANSMITTER 2   I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
STDN TRANSMITTER 1      I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSS     I
                        I          I           I           I           I           I           I           I
STDN TRANSMITTER 2      I   SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSIS*SSSSS     I
                        I          I           I           I           I           I           I           I
COMMAND/RANGING UNIT 1  I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
COMMAND/RANGING UNIT 2  I   *******I***********I***********I***********I***********I***********I*******     I
                        I     (4)  I           I           I           I           I           I           I
RCS                     I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I     (6)   I           I           I           I           I           I
THERMAL                 I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
POWER                   I   *******I***********I***********I***********I***********I***********I*******     I
                        I  (1)     I  (5)(7)   (8)(9)     I  (18)(22) I (23-27)   I     (30-31)I(33-34)     I
TELEMETRY               I   *******I***********I***********I***********I***********I***********I*******     I
                        I          I           I           I           I           I           I           I
DESPIN                  I   *******I***********I***********I***********I***********I***********I*******     I
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GOES-5 (GOES-E) (Continued)
STATUS AS OF JULY 31, 1987

1. CTU-2 failed, switched to CTU-1 6/15/81. CTU-2 good 4/27/82
2. PMT 4 and 5 degraded 20% in responsivity during eclipse season.
3. Phantom PMT gain step changes started 8/28/81.
4. RCS tank pressure telemetry failed 11/10/81. Recovered 1/9/84.
5. CTU-1 anomaly 4/27/82, switched to CTU-2.
6. VAS sunshade side temperature intermittent 7/23/82.
7. CTU-2 PCM anomaly 7/29/82. OK after ON/OFF cycle.
8. CTU anomaly occurred 1/1/83. OK after ON/OFF cycle.
9. 27 analog telemetry words increased several counts then corrected itself 3/23/83.
10. VAS PRI PWR failed 6/16/83.
11. HEPAD failed 11/5/82.
12. Beginning of daily one hour DCPR downlink interference.
13. Scan mirror hung up in retrace (one time) GAR #79.
14. Increased lamp voltage one step (4.66V) 6/29/83.
15. HEPAD turned OFF 2/24/84.
16. Scan mirror hung up at line 1650 during Rapid Scan 3/20/84 GAR#82.
17. Increased lamp voltage one step (4.72V) 4/6/84.
18. CTU anomaly 4/26/84. OK after Reply BUS A select command.
19. Primary Encoder Lamp failed 7/22/84. GAR #85
20. Redundant Encoder Lamp failed 7/30/84. GAR #86
21. SEM MAG-transient reset Hp offset generator to 0, 8/6/84. GAR #89
22. CTU SEU word 3, bit 8 flip 7/9/84. Unused bit-discovered by ERL.
23. CTU SEU - Several analog words erroneous 3/23/85. REPLY BUS A command to correct.
24. CTU-SEU infinite loop 4/12/85. Corrected by cycling CTU-2 power OFF-ON.
25. CTU-SEU sub-com inhibit 6/6/85. PCM NORMAL command corrected.
26. CTU-SEU infinite loop 9/10/85. Cycled CTU power.
27. CTU-SEU switch to Reply Bus B 10/14/85. Reselected Reply Bus A.
28. CDA TLM XMTR 2 output power decreased from 1.86 to 1.74 watts 12/29/85. GAR #96.
29. SEM EPS E1 and P4 channels noisy after post eclipse power up.
30. CTU-SEU word 2 bit shifts. REPLY BUS 'B' CMD. GAR #99 7/11/86
31. CTU-SEU word 2 bit shifts. REPLY BUS 'A' CMD. 9/14/86
32. EPS-E-1 channel unusable due to level shift (Nov. 86).
33. CTU-SEU SCID word 3 bit 2 flipped from 0 to 1. PCM NORMAL CMD. 2/19/87
34. CTU-SEU 5/27/87 - Infinite loop.

GOES-4

S/C STATUS: Semi-operational supporting DCPR for ESA.

PART I - Subsystem Status -

POWER: Operational with a load of approximately 6.2 amps.
Battery 1 charge current telemetry has failed.

TELEMETRY AND COMMAND: Operational with Central TLM Unit 2 on and Remote TLM Unit 2 and 3 on.
CTU 1 has failure which sets bit rate at 125 BPS
RTU 4 has failed.

DESPIN: Operational with Side 1 selected.

RCS: Operational.

Latch valves: Open

Maneuvers this month:

DATE	TYPE	FUEL REQD
	NONE	

Fuel remaining (lbs.): 3.1

COMMUNICATIONS:

S-Band: ON. Side 1 transmitter has failed; Side 2 is degraded.
UHF: Receiver 2 is ON. Receiver 1 and Transmitter 1 are unreliable.
DCPR: XMTR 2 ON. Transmitter 1 has frequency fluctuations.
STDN: XMTR 2 ON.
CDA: XMTR 1 ON.

VDM: Operational and OFF

VAS: Inoperative and OFF. Last tested 02/04/85.
A single-point power supply distribution failure disabled both scan drive units on 11/26/82.
Primary scan drive had accumulated 19,498 hours of continuous operation at time of failure. Redundant scan drive had never been operated on-orbit and exhibited same failure symptoms as primary scan drive when selected after primary failure.

SEM: Semi-Operational and OFF. HEPAD and magnetometer Hp fine sensor failed.

THERMAL: Operational.

PART II - Station and Orbital Environment -

The S/C is located at 43.0°W
Orbital inclination is 3.7°.
Spin rate is 100.8 RPM.

PART III- Anomalies:

NONE

PART IV - Plans

NONE

PART V - Comments

NONE

TURNOVER:	10/15/80	
OPERATIONAL:	3/05/81	135 DEG W.
STANDBY	4/28/83	139 DEG W
NASA OPS	4/15/85	4 DEG DAY W DRIFT
ESA DCS OPS	10/01/85	44 DEG W

STANDBY MODE SSSSSS

DEGRADED OPERATION DDDDDD

FAILED FFFFFF

(NUMBERS).....SEE NOTES

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SPACECRAFT SUBSYSTEMS   I         I         I         I         I         I         I         I         I
                        I   1980  I   1981  I   1982  I   1983  I   1984  I   1985  I   1986  I   1987
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
                        I---------I---------I---------I---------I---------I---------I---------I---------I---------
                        I       (1) I (5)   (5) I  (10)  (13)   I         I         I         I         I
VISSR/VAS               I       ****I***********I**********FIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFF
                        I         (3)         I      (11)  I         I         I         I         I
SEM                     I       SSSSISS*********I***********I**SSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSS
                        I       (1) I         I           I         I         I         I         I
VDM                     I       ****I***********I***********I*SSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSS
                        I           I         I           I         I         I   (18-19) I(20)    I
DCPR TRANSMITTER 1      I       SSSSISC*********I***********I*****SS*****I***********I***SSS******I*FFFFFFFFFFFIFFFFFFF
                        I           I         I           I         I         I         I         I
DCPR TRANSMITTER 2      I       SSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSIS**********I******
                        I           I         I           I         I         I         I         I
S-BAND RECEIVER 1       I       **SSISSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSISSSSSSS
                        I           I         I           I         I         I         I         I
S-BAND RECEIVER 2       I       SS**I***********I***********I***********I***********I***SSSSSSSSSISSS*****SS**I******
                        I       (1) I         I           I         I         I         I         I
S-BAND TRANSMITTER 1    I       **FFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFF
                        I        (2)I         (7)I           I         I         (15)(15)  I         I
S-BAND TRANSMITTER 2    I       SS**I***********I***********I***********I***********IDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDD
                        I           I   (4)     I           I         I         I         I         I
UHF RECEIVER 1          I       SSSSISS**DDDDDDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDD
                        I           I         I           I         I         I         I         I
UHF RECEIVER 2          I       SSSSISSS********I***********I*****SS*****I***********I***SSS******I***********I******
                        I           I       (5) I       (12) I         I         I         I         I
UHF TRANSMITTER 1       I       SSSSISS*********I*******DDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDDDDDDIDDDDDDD
                        I           I         I       (12) I         I         I         I         I
UHF TRANSMITTER 2       I       SSSSISSSSSSSSSSSISSSSSSSSS****I****SSSSSSSISSS********I*SSSSSSSSSSISSSSSSSSSSSISSSSSSS
                        I           I         I           I         I   (14)    I         I         I
CDA TLM TRANSMITTER 1   I       ****I***********I***********I***********I***********I***SSS******I***********I******
                        I           I         I           I         I         I         I         I
CDA TLM TRANSMITTER 2   I       SSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS
                        I           I         I           I         I         I         I         I
STDN TRANSMITTER 1      I       SSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSS
                        I           I         I           I         I         I         I         I
STDN TRANSMITTER 2      I       SSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSS**SSSSSSSISS**********I***********I******
                        I           I         I           I         I         I         I         I
COMMAND/RANGING UNIT 1  I       ****I***********I***********I***********I***********I***********I***********I******
                        I           I         I           I         I         I         I         I
COMMAND/RANGING UNIT 2  I       ****I***********I***********I***********I***********I***********I***********I******
                        I           I         I           I         I         I  (16)   I         I
RCS                     I       ****I***********I***********I***********I***********I***********I***********I******
                        I           I         I           I         I         I         I         I
THERMAL                 I       ****I***********I***********I***********I***********I***********I***********I******
                        I           I         I           I         I         I         I         I
POWER                   I       ****I***********I***********I***********I***********I**********I***********I******
                        I           I   (6)     I  (9)      I         I         I   (17)    I         I  (21)
TELEMETRY               I       ****I***********I***********I***********I***********I***********I***********I******
                        I           I         I           I         I         I         I         I
DEEPIN                  I       ****I***********I***********I***********I***********I***********I***********I******
```

GOES-4 (GOES-D) (Continued)

STATUS AS OF JULY 31, 1987

COMMENTS

1. Satellite supported VAS experiment 10/15/80 - 3/4/81.
2. S-Band Transmitter - 1 failed, switched to S-Band, Side 2, 11/19/80.
3. HEPAD solid state detector failed 12/15/80.
4. UHF-1 Receiver went into oscillation on 4/16/81. Returned to operation 4/24/81 and failed again on 5/17/81 and 5/21/81. Receiver #2 used between failures.
5. Phantom command due to possible floating grounds on s/c started 3/29 thru 4/26.
6. CTU-1 failed, switched to CTU-2, 6/15/81.
7. S-Band transmitter output power slowly decreasing 11/81. Stablilized at 16 watts 3/11/81, dropping again 3/23/82.
8. UHF transmitter 1 output power dropped to 0 watts on 9/3/81, then recovered. Reoccurred 3/15, 3/23 and 3/31/82.
9. CTU reset and initialized itself 4/6/82.
10. VAS/VISSR scan mirror not allowed to go beyond line 1920 due to excessive lubricant buildup at south expanded frame limit. Effective 6/8/82.
11. Hp fine sensor failed 4/23/82.
12. UHF Transmitter 2 selected 9/9/82. UHF Transmitter 1 and Receiver 1 are unreliable.
13. Scan drive failed 11/26/82
14. CDA TLM XMTR 1 output power decreased 0.3 watts 1/9/84.
15. S-Band functional test 4/10/85. RCVR 1 and 2 operational, XMTR 1 failed, XMTR 2 degraded.
16. Four E-W maneuvers performed by NASA 4/15 - 4/17/85 to obtain 4°/day Westward drift to new station at 10°W. Arrived 6/14/85.
17. RTU-4 failed 6/1/85 switched to RTU-3. GAR #91.
18. Interfering signal in DCPR passband prevents ESA DCS support. GAR #92.
19. Spacecraft repositioned to 43° W 8/31/85. Interfering signal not present.
20. DCPR XMTR 1 unusable 2/26/86. GAR #97. Selected DCPR XMTR 2.
21. CTU SEU - 5/5/87 - SCID word 3, bit 2 flipped from '0' to '1'.

S/C STATUS: Standby

PART I - Subsystem Status -

POWER: Fully operational. Load current is approximately 3.6 amps.

TELEMETRY AND COMMAND: Fully operational. TLM unit 1 selected. VHF Transmitter 1 selected and ON.

ADAC: Operational. Side 2 selected. ADAC 1 had previously failed, now returned to operation.

APS: Fully operational.

Latch valves: Open

Maneuvers this month:

DATE	TYPE	FUEL REQD (lbs.)
	NONE	

Fuel remaining, (lbs.): 9.7

COMMUNICATIONS: Fully operational.

S-Band: Side 1 ON
UHF: OFF

VDM: Fully operational and off.

VISSR: Inoperative and off. Last tested 02/04/85.

SEM: Operational and off.

THERMAL: APS heaters are cycled. Temperatures are within acceptable limits.

PART II - Station and Orbital Environment

The S/C is located at 130.8°W.
Orbital inclination is 4.3°.
Spin rate is 100.00 RPM.

PART III - Anomalies

NONE

PART IV - Spacecraft Plans -

NONE

PART V - Comments

NONE

OPERATIONAL:	7/13/79	135 DEG W.	
STANDBY	3/05/81	135 DEG W	
STANDBY	2/15/82	90 DEG W	
GOES-WEST	2/05/85	135 DEG W	
STANDBY	4/28/87	129 DEG W	

STANDBY MODE SSSSSS

DEGRADED OPERATION DDDDDD

FAILED FFFFFF

(NUMBERS).....SEE NOTES

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SPACECRAFT SUBSYSTEMS   I          I          I          I          I          I          I          I
                        I    1986  I    1987  I    1988  I    1989  I    1990  I    1991  I    1992  I    1993
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
                        I------------I------------I------------I------------I------------I------------I------------I
                        I            I            I            I            I            I            I            I
VISSR                   IFFFFFFFFFFFIFFFFFFF      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
SEM                     ISSSSSSSSSSSISSSSSSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
S-BAND RECEIVER 1       I************I*******      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
S-BAND RECEIVER 2       ISSSSSSSSSSSISSSSSSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
S-BAND TRANSMITTER 1    I************I*******      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
S-BAND TRANSMITTER 2    ISSSSSSSSSSSISSSSSSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
UHF RECEIVER 1          I************I****SSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
UHF RECEIVER 2          ISSSSSSSSSSSISSSSSSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
UHF TRANSMITTER 1       I************I****SSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
UHF TRANSMITTER 2       ISSSSSSSSSSSISSSSSSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
VHF TRANSMITTER 1       I************I*******      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
VHF TRANSMITTER 2       ISSSSSSSSSSSISSSSSSS      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
APS                     I************I*******      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
DYNAMICS                I************I*******      I            I            I            I            I            I
                        (16)   (17)  I(18)        I            I            I            I            I            I
POWER                   I************I*******      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
TELEMETRY               I************I*******      I            I            I            I            I            I
                        I            I            I            I            I            I            I            I
DESPIN                  I************I*******      I            I            I            I            I            I
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TURNOVER:	7/05/78	
OPERATIONAL:	7/13/78	135 DEG W
STANDBY	3/05/81	135 DEG W
STANDBY	2/15/82	90 DEG W
GOES-WEST	2/05/85	135 DEG W
STANDBY	4/28/87	129 DEG W

OPERATIONAL	******
STANDBY MODE	SSSSSS
DEGRADED OPERATION	DDDDDD
FAILED	FFFFFF
(NUMBERS).....SEE NOTES	

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SPACECRAFT SUBSYSTEMS   I          I          I          I          I          I          I          I
                        I    1977  I    1979  I    1980  I    1981  I    1982  I    1983  I    1984  I    1985
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
                        I----------I----------I----------I----------I----------I----------I----------I----------
                        I        (3)I    (4)(5)  I(9) (10-12,8)   (13)      I        (14)I          I          I
VISSR                   I     *******I***********I********DDDDIDDDDFFFFFFFFIFFFFFFFFFFFFIFFFFFFFFFFFFIFFFFFFFFFFFFIFFFFFFFFFFFF
                        I    (2)     I    (6)    I          I          I          I          I          I
SEM                     I     *******I***********I***********I**SSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
S-BAND RECEIVER 1       I     *******I***********I***********I********SSSSISS**********I***********I***********I***********
                        I          I          I          I          I          I          I          I
S-BAND RECEIVER 2       I     SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
S-BAND TRANSMITTER 1    I     *******I***********I***********I********SSSSISS**********I***********I***********I***********
                        I          I          I          I          I          I          I          I
S-BAND TRANSMITTER 2    I     SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
UHF RECEIVER 1          I     *******I***********I***********I**SSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSIS**********
                        I          I          I          I          I          I          I          I
UHF RECEIVER 2          I     SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
UHF TRANSMITTER 1       I     *******I***********I***********I**SSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSIS**********
                        I          I          I          I          I          I          I          I
UHF TRANSMITTER 2       I     SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
VHF TRANSMITTER 1       I     SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
VHF TRANSMITTER 2       I     SSSSSSSISSSSSSSSSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSS
                        I          I          I          I          I          I          I          I
APS                     I     *******I***********I***********I***********I***********I***********I***********I***********
                        I      (1) I      (7)  I          I          I          I          I          I
DYNAMICS                I     *******I***********I***********I***********I***********I***********I***********I***********
                        I          I          I          I          I          I          I          I (15)
POWER                   I     *******I***********I***********I***********I***********I***********I***********I***********
                        I          I          I          I          I          I          I          I
TELEMETRY               I     *******I***********I***********I***********I***********I***********I***********I***********
                        I          I          I          I          I          I          I          I
DESPIN                  I     *******I***********I***********I***********I***********I***********I***********I***********
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STATUS AS OF JULY 31, 1987

COMMENTS

1. ADAC anomaly switched to ADAC #2 9/2/78.
2. SEM - Channel P4 of the energetic particles sensor noisy since launch.
3. Lubricant buildup discovered 11/28/78.
4. Start of VISSR mirror intermittent stepping fault 6/10/79.
5. Redundant encoder failed 9/14/79. Switched to primary encoder rolldown of expanded frame no longer possible. Undetermined TORQUE anomaly.
6. X-Ray position readout and stepper intermittent.
7. ADAC #1 tested on 8/14/79 and is now operable.
8. PMT 4 failed on 10/22/80.
9. Post-eclispe lubricant hang-ups in north and south frame limits on 2/27/80.
10. Full disk pictures no longer possible due to lubricant buildup at end of frame.
11. VISSR hang-ups due to threshold loss experienced in eclipse season. Classified degraded 9/80.
12. Hang-ups cleared temporarily after eclipse, however, additional hang-up caused curtailment of picture taking to 1650 lines with a roll down to 1700 lines on 11/20/80.
13. 5/6/81 VISSR tested: Classified failed.
14. 11/29/82 VISSR tested: Classified failed.
15. 3/18/85 - Both batteries undervoltage during eclipse caused by VHF transmitter in high power mode.
16. 2/27/86 - Both batteries undervoltage trip during 57 minute eclipse.
17. 8/27/86 - Both batteries undervoltage trip during 46 minute eclipse.
18. 2/21/87 - Both batteries undervoltage trip during 44 minute eclipse.

JULY

GOES-2

S/C STATUS: Standby

PART I - Subsystem Status -

POWER: Fully operational with a load of approximately 3.9 amps.

TELEMETRY AND COMMAND: Fully operational. TLM unit 1 selected. VHF transmitter 1 selected and ON.

ADAC: Fully operational with side 1 selected.

APS: Fully operational.

Latch valves: open

Maneuvers this month:

DATE	TYPE	FUEL REQD
	NONE	

Fuel remaining, lbs: 15.4

COMMUNICATIONS: Fully operational.

S-Band Side 2 selected and on.
UHF: OFF

VDM: Operational and off.

VISSR: Inoperative and off. Last tested 02/04/85.

SEM: Operational and OFF.

THERMAL: APS heaters are cycled and all temperatures are within acceptable limits.

PART II - Station and Orbital Environment -

The S/C is located at 112.8°W.
Orbital inclination is 5.4°.
Spin rate is 99.9 RPM.

PART III - Anomalies

NONE

PART IV - Plans - NONE

PART V - Comments

NONE

TURNOVER:	7/29/77	
OPERATIONAL:	8/15/77	75 DEG W
STANDBY	1/26/79	105 DEG W
GOES-CENTRAL	1/29/81	107 DEG W
GOES-CENTRAL	9/21/84	113 DEG W
STANDBY	5/27/87	113 DEG W

OPERATIONAL	******
STANDBY MODE	SSSSSS
DEGRADED OPERATION	DDDDDD
FAILED	FFFFFF
(NUMBERS).....SEE NOTES	

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SPACECRAFT SUBSYSTEMS   I           I           I           I           I           I           I           I
                        I    1985   I    1986   I    1987   I    1988   I    1989   I    1990   I    1991   I    1992
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
                        I-----------I-----------I-----------I-----------I-----------I-----------I-----------I-----------
                        I           I           I           I           I           I           I           I           I
VISSR                   IFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFF    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
SEM                     ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
S-BAND RECEIVER 1       ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
S-BAND RECEIVER 2       I***********I***********I*******    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
S-BAND TRANSMITTER 1    ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
S-BAND TRANSMITTER 2    I***********I***********I*******    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
UHF RECEIVER 1          ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
UHF RECEIVER 2          ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
UHF TRANSMITTER 1       ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
UHF TRANSMITTER 2       ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
VHF TRANSMITTER 1       I***********I***********I*******    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
VHF TRANSMITTER 2       ISSSSSSSSSSSISSSSSSSSSSSISSSSSSS    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
APS                     I***********I***********I*******    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
DYNAMICS                I***********I***********I*******    I           I           I           I           I           I
                        I           I(13)   (14) I(15)      I           I           I           I           I           I
POWER                   I***********I***********I*******    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
TELEMETRY               I***********I***********I*******    I           I           I           I           I           I
                        I           I           I           I           I           I           I           I           I
DEEPIN                  I***********I***********I*******    I           I           I           I           I           I
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                                GOES-CENTRAL1  1/29/81   107 DEG W                 DEGRADED OPERATION  DDDDDD
                                GOES-CENTRAL1  9/21/84   113 DEG W
                                STANDBY        5/27/87   113 DEG W                 FAILED              FFFFFF

                                                                                  (NUMBERS).........SEE NOTES
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SPACECRAFT SUBSYSTEMS   I            I            I            I            I            I            I            I
                        I    1977    I    1978    I    1979    I    1980    I    1981    I    1982    I    1983    I    1984
                        IJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASONDIJFMAMJJASOND
-----------------------I------------I------------I------------I------------I------------I------------I------------I------------
                        I      (3,4) I(4) (6)(4)(8,9,4)    (10)I            I            I         (12)I            I
VISSR                   I      SS*****I************I*FFFFFFFFFFFIFFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFIFFFFFFFFFFFI
                        I(1,7)       I            I            I            I            I            I            I
SEM                     I      *******I************I************I************I************I************I*****SSSSSSSISSSSSSSSSSS
                        I            I            I            I            I       (11) I            I            I
S-BAND RECEIVER 1       I      SSSSSS*I************I************I************I*********SSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I            I            I            I            I            I            I            I
S-BAND RECEIVER 2       I      ******SISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSS***I************I************I************
                        I            I            I            I            I       (11) I            I            I
S-BAND TRANSMITTER 1    I      SSSSSS*I************I************I************I*********SSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I            I            I            I            I            I            I            I
S-BAND TRANSMITTER 2    I      ******SISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSS***I************I************I************
                        I  (2)       I            I            I            I            I            I            I
UHF RECEIVER 1          I      SSSSSS*I************I*SSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I  (2)       I            I            I            I            I            I            I
UHF RECEIVER 2          I      SS****SISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I            I            I            I            I            I            I            I
UHF TRANSMITTER 1       I      SSSSSS*I***********SI*S*****SSSSSISSSSS***SSSSISSSSS****SSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I            I            I            I            I            I            I            I
UHF TRANSMITTER 2       I      SS****SISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I            I            I            I            I            I            I            I
VHF TRANSMITTER 1       I      ***SSSSISSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSS*******I************
                        I            I            I            I            I            I            I            I
VHF TRANSMITTER 2       I      SSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSSSISSSSSSSSSSS
                        I            I            I            I            I            I            I            I
APS                     I      *******I************I************I************I************I************I************I************
                        I            I            I            I            I            I            I            I
DYNAMICS                I      *******I************I************I************I************I************I************I************
                        I         (5) I            I            I            I            I            I            I  (13)
POWER                   I      *******I************I************I************I************I************I************I************
                        I            I            I            I            I            I            I            I
TELEMETRY               I      *******I************I************I************I************I************I************I************
                        I            I            I            I            I            I            I            I
DESPIN                  I      *******I************I************I************I************I************I************I************
```

STATUS AS OF JULY 31, 1987

COMMENTS

1. X-Ray data noisy during post launch checkout.
2. DCPR dropouts since launch with VHF ON in high power.
3. PMT 5 failed 8/3/77.
4. Pre-amps PMT 2,3,4,7 during eclipse degrades 20%.
5. Battery #2 discharge current monitor failed 10/21/77.
6. PMT 1 failed 6/16/78.
7. SEM - Channel P4 of the energetic particles sensor noisy since launch.
8. VISSR hang-up due to redundant encoder failure 12/18/78.
9. Primary encoder failed 1/26/79, VISSR no longer usable.
10. VISSR tested 11/2/79, still failed & PMT 4 was discovered to have failed.
11. S-Band switched from Side 1 to Side 2 on 10/22/81 after 5-8 KHz frequency shift noted.
12. VISSR tested 11/29/82, still failed.
13. 2/22/86 - Both batteries undervoltage trip during eclipse durations exceeding 53 minutes.
14. 8/22/86 - Both batteries undervoltage trip during eclipse durations exceeding 40 minutes.
15. 2/19/87 - both batteries undervoltage trip during eclipse durations exceeding 49 minutes.

GOES ANOMALY REPORT (GAR) STATUS

JULY 1987

	OPEN	CLOSED	TOTAL
GOES-4	2	44	46
GOES-5	2	34	36
GOES-6	5	15	20
GOES-7	8	0	8
TOTALS	17	93	110

Opened this month: ONE

Closed this month: NONE

GOES ANOMALY REPORT (GAR)

SECTION I (TO BE COMPLETED BY ORIGINATOR)

GAR NO. 110 S/C-ID GOES-7 STATUS ☒ EAST ☐ CENTRAL ☐ WEST ☐ STANDBY

DATE PREPARED July 20, 1987

ANOMALY-DATE July 16, 1987 JULIAN DAY 197 GMT 0320-0400

SUSPECT SUBSYSTEM VAS OPERATIONAL IMPACT VIS Resolution loss

ANOMALY DESCRIPTION Sometime between the 0300z image and 0400z image, PMT-5 channel showed an apparent gain increase of approximately 70% causing this channel to be in saturation most of the time. During these two images, PMT-6 channel had a 10% decrease in gain. Channel 6 has since returned to normal. Channel 5 has been patched out at the VIP with channel 4 being shared with channel 5.

ORIG RLF GSEG R. Forness SOCC MANAGER

SECTION 2. (TO BE COMPLETED BY NASA)

ANOMALY-DATE

STATUS PRIORITY

RESPONSIBLE PERSON DUE DATE

ACTION/STATUS

DATE CLOSED NASA DED

GOES ANOMALY REPORT (GAR) SUMMARY

GAR S/C DATE	SUB-SYSTEM	ANOMALY DESCRIPTION	STATUS
#86 GOES-5 7/30/84	VAS	REDUNDANT Encoder Lamp Failed	Closed - normal life was achieved for this generation lamp.
#87 GOES-6 8/4/84	RCS	Thrusters R1 & R2 low performance	Closed- procedures changed to prohibit long pulsed maneus. with low tank pres
#88 GOES-6 9/21/84	VAS	Scan mirror hang-up under processor control	Closed - caused by lamp degradation and lower threshold with processor ON
#89 GOES-5 8/6/84	SEM	Transient reset of MAG Hp channel offset generator	Closed - electronic discharge in sensor structure or interconnecting cable. Corrections on G & H.
#90 GOES-6 11/16/84	T & C	Fluctuations in CDA MTR current and Array current associated with S/C manuevers	Closed - caused by normal spin related fluctuations and telemetry sample timing
#91 GOES-4 6/4/85	T & C	Erroneous Analog and bilevel PCM Telemetry words. RTU-4 failed	Open
#92 GOES-4 6/25/85	COMM	Interfering signal in DCPR Pass Band impacting ESA DCS Support	Closed-S/C was repositioned to 44°W where interfering signal was not present.
#93 GOES-6 8/6/85	VAS	Redundant Scan Drive Encoder Lamp 2 Failed (open)	Closed - normal life was achieved for this generation lamp.
#94 GOES-6 8/25/85	VAS VDM SEM	Transient 'Event' shifted VAS Earth view window and changed mode of VDM and SEM units	Open
# 95 GOES-6 10/25/85	VAS COMM	VISSR image shifts Associated with STDN TLM XMTR and RNG XPONDER being powered ON.	Open
# 96 GOES-5 12/29/85	COMM	CDA TLM XMTR 2 Output power decrease	Open
# 97 GOES-4 2/26/86	COMM	DCPR XMTR 1 frequency shift jitter - unusable for DCS support.	Open
# 98 GOES-6 3/17/86	SEM	X-RAY switched uncommanded from DATA to CAL and POSITION ELECT. from OFF to ON.	Open
#99 GOES-5 7/10/86	T&C	Unusual SEU. Word 2 bit shifted gave erroneous CMD load verification	Open

GOES ANOMALY REPORT (GAR) SUMMARY

GAR S/C DATE	SUB-SYSTEM	ANOMALY DESCRIPTION	STATUS
#100 GOES-6 8/17/86	VAS	Primary scan drive Encoder Lamp 2 failed (Open	Open
#101 GOES-6 9/27/86	VAS SEM	Transnent Event Shifted VAS Earth View window and changed mode of SEM units	Open
#102 GOES-5 1/6/87	SEM-EPS	E-1 channel failed	Closed - caused by radiation damage to D3 detector.
#103 GOES-7	TLM	AFT Bearing temperature TLM failed	Open
#104 GOES-7	TLM	TLM AX thruster 2 temperature erratic	Open
#105 GOES-7	TLM	RAD thruster 3 & 4 TLM temperature reversed	Open
#106 GOES-7	DESPIN	Spin Axis misaligned 0.4°	Open
#107 GOES-7	SEM	HEPAD failed	Open
#108 GOES-7	VAS	Coherant noise in IR bands 1, 2 and 9	Open
#109 GOES-7	DESPIN	DCE-1 intermittent instability	Open
#110 GOES-7	VAS	PMT-5 gain circuity malfunction	Open

ANNEX V

STATUS OF THE INTERNATIONAL SATELLITE CLOUD CLIMATOLOGY PROJECT (ISCCP) - WMO WP 3

STATUS OF THE INTERNATIONAL SATELLITE CLOUD CLIMATOLOGY PROJECT (ISCCP)

(As of June 1987)

Summary and Purpose of Document

The ISCCP was established in July 1983 by the World Climate Research Programme as a project to develop a global climatology of clouds from satellite data over a 5-year period. The purpose of this Working Paper is to summarize the status of the project after four years of operations.

ACTION PROPOSED

The CGMS is invited to take note of the status of the project.

STATUS OF THE INTERNATIONAL SATELLITE CLOUD CLIMATOLOGY PROJECT

(As of June 1987)

1. Introduction

The International Satellite Cloud Climatology Project (ISCCP) was established as the first project of the World Climate Research Programme (WCRP), to develop a global climatology of clouds over a 5-year period. The ISCCP is focussing on the study of the distribution and variation of cloud radiative properties. The scientific objectives of the project are:

(i) To produce a global, reduced resolution, infrared and visible, calibrated and normalized radiance data set containing basic information on the radiative properties of the atmosphere from which cloud parameters can be derived.

(ii) To stimulate and co-ordinate basic research on techniques for inferring the physical properties of clouds from the condensed radiance data set and to apply the resulting algorithms to derive and validate a global cloud climatology for improving the parameterization of clouds in climate models.

(iii) To promote research using ISCCP data and contributing to an improved understanding of the earth's radiation budget (top of the atmosphere and surface) and of the hydrological cycle.

The ISCCP was designed to take advantage of the global coverage to be provided by the planned international array of geostationary and polar orbiting meteorological satellites. The overall strategy for the preparation of global radiance and cloud data sets called for the establishment of the following activities:

(i) Sector Processing Centres (SPCs) - to collect the raw radiance data from the satellite data streams and to reduce the amount of data to a manageable size, involving an averaging and sampling procedure which effectively reduces the spatial resolution to about 10 kilometres (B1-data).

(ii) Satellite Calibration Centre (SCC) - to collect samples of high resolution data sets from each SPC over areas of overlap (in time and space) between the NOAA polar orbiting satellite and each of the geostationary satellites, and to compute coefficients to normalize the radiance measurements of individual geostationary satellites to the polar orbiting satellite values, since the latter underflies all of the other satellites.

(iii) Global Processing Centre (GPC) - to collect the data sets from each SPC and the normalization coefficients from the SCC and to assemble the data into a global radiance data set, which has been normalized and also reduced in spatial resolution to about 30 kilometres (B3-data). In addition, the GPC is responsible for the preparation of global cloud data sets, using an operational algorithm developed by a series of Cloud Algorithm Workshops.

2. Status of the Project, as of 30 June 1987

The ISCCP completed the fourth year of its data collection phase on 30 June 1987. Radiances from all operating meteorological satellites, with the exception of INSAT, were being routinely collected by the cognizant Sector Processing Centres (SPC) and delivered to the Global Processing Centre (GPC) in accordance with project requirements. During this period, all data processing and exchange procedures, previously approved by the International Working Group on Data Management (WGDM), had been implemented by the ISCCP Data Centres. It should be noted that at the Informal Planning Meeting on the First Implementation Plan for the WCRP (Geneva, May 1986), Dr. R.P. Sarker confirmed India's plans to establish an SPC for INSAT and commence routine delivery of INSAT B1 and AC imagery, as soon as details could be worked out. Although an IMD representative participated in the fifth session of the ISCCP WGDM in June 1986 for co-ordination of data exchange, no INSAT data have been made available to the project.

All SPCs are currently operational with the exception of the SPC for INSAT. With the launch of GOES-7 in February 1987, the Atmospheric Environment Service in Ontario, Canada assumed full SPC responsibilities for the collection and processing of data for this satellite.

The Satellite Calibration Centre (SCC) at Lannion, France has continued to perfect a methodology for providing periodic satellite-to-satellite radiance normalization. Routine archiving of B3 level (reduced resolution) radiances, which began in November 1984, is no longer limited by the availability of normalization data. Although there are a number of data quality issues concerning the navigation and calibration that are slowing the delivery of B3 data to the archives, none of the problems is serious and procedures for resolving them have been developed. A revised catalogue of data products was issued in May 1987.

An ISCCP operational cloud algorithm was adopted on the basis of a three-year pilot study. Software development is nearly completed and the first cloud fields for July 1983 have been produced. These represent a complete analysis and merging of normalized radiances measured by Meteosat-2, GOES-5, GOES-6, GMS-2 and NOAA-7. Refinements and corrections for the cloud algorithm were planned to be completed in August 1987 and full-scale cloud production was expected to begin then. The goal of the GPC was to complete production of cloud fields for the first year of the ISCCP (July 1983-June 1984) by July 1988.

With respect to the lifetime of the project (currently July 1983-June 1988), the Joint Scientific Committee for WCRP agreed to support the continuation of the ISCCP for an additional two years, with the understanding that a preliminary assessment would be made in 1988 to determine the usefulness of ISCCP data in climate modelling studies. The findings of this review would help to assess the value of a further extension of the project.

3. ISCCP Research

In support of the ISCCP research component, a number of programmes have been organized for regional validation and utilization of ISCCP data for improving the parameterization of clouds in climate models.

3.1 First ISCCP Regional Experiment (FIRE)

The central objectives of the USA FIRE are to quantitatively evaluate present models which use satellite measurements to characterize large-scale cloud systems and their radiative effects, and to obtain the data and understanding necessary to improve such models. To achieve these objectives, the cloud-radiation parameterization schemes used by the ISCCP will be evaluated both by intensive case studies and by statistical comparisons, with two types of cloud systems, cirrus and marine boundary layer stratus, to be studied in depth.

A cirrus Intensive Field Observation (IFO) was conducted over central Wisconsin from 13 October to 2 November 1986. Radiative and physical properties of cirrus cloud systems were measured from a variety of satellite (8), aircraft (3) and surface platforms. Observations were taken of pre-warm frontal systems, jet streams and convective storm blowoffs. For the first time, cirrus clouds have been measured directly from aircraft and indirectly with lidars and other remote sensing instrumentation, simultaneously with satellite observations.

During June-July 1987, a marine stratocumulus IFO was scheduled to be performed off the southwest coast of California. This IFO will involve co-ordinated satellite, aircraft, ship and surface measurements.

3.2 Other Regional Experiments

The Japanese research programme, Western North Pacific Cloud-Radiation Experiment, is directed towards a deeper understanding of the climatology of clouds, the radiative properties of clouds, and cloud-radiation coupling processes in the western North Pacific region. This programme has been approved by the Japanese government and field experiments are expected to begin in 1988.

Participants from the European Space Agency, Federal Republic of Germany, France, Sweden and the United Kingdom are organizing an International Cirrus Experiment (ICE), to perform studies of cirrus life cycles and physical properties to derive parameterization schemes for use in general circulation models. A preparatory campaign is scheduled for 20 September-9 October 1987 and the main campaign planned for spring 1989 over the North Sea.

ANNEX VI

DEVELOPMENT OF THE AUTOMATED SHIPBOARD AEROLOGICAL PROGRAMME (ASAP) - WMO WP 4

DEVELOPMENT OF THE AUTOMATED SHIPBOARD AEROLOGICAL PROGRAMME (ASAP)

Summary and Purpose of Document

The operational ASAP has 11 systems in operation with at least an additional 4 expected in 1988-1989. The ASAP Co-ordinating Committee (ACC) continues to act as the interface between CGMS and the ASAP operators. Several issues are raised which the CGMS is asked to consider.

ACTION PROPOSED

The CGMS is invited:

(a) As a matter of urgency, to take whatever additional action is possible to resolve the problem of noise on the ASAP IDCS channel. If a channel change is required, CGMS is requested to take this decision as soon as possible and to co-ordinate changes through the ACC;

(b) To keep the ACC informed of the status of the IDCS and of any problems; and

(c) To advise the ACC concerning any possibility of changing the baud rate for transmission to the satellite.

(SECGEN2950)

DISCUSSION

1. The Automated Shipboard Aerological Programme (ASAP) is an operational part of the Global Observing System of the World Weather Watch. The implementation has proceeded at a steady rate since CGMS-XV and will continue during the coming year.

2. The present and projected schedule for implementation is:

Country	No. in service	Future
Canada/USA	3	2/1988
USA	-	1/1988 (if funds are available)
Federal Republic of Germany	1	3/1988-1989
United Kingdom	1 (Sept. 1987)	1/1988
France	4	None planned
Finland	1	None planned
Denmark	1 (Sept. 1987)	Possibly 1 in 1988
Spain	-	Possibly 1 in 1988-1989
Total	11	6-9

The Canadian/USA ships ply the North Pacific. The remainder are on the North Atlantic.

3. Co-ordination of the ASAP is carried out through the ASAP Co-ordinating Committee (ACC). At its second session (ACC-II), September 1986, the ACC agreed to co-ordi ıte the channel and time-slot assignments within the guidelines established by CGMS. After minor problems at the beginning, this procedure has been successful. ASAP operators first contact the ACC (Mr. D. Phillips, Atmospheric Environment Service, Vancouver, Canada) to receive an assignment from the block allocated by CGMS. The assignment is then confirmed by CGMS in the normal fashion. This procedure allows the ACC to make assignments which minimize potential problems for ASAP operators and saves time and effort on the part of CGMS. It also gives CGMS a single point of contact for the entire ASAP programme.

4. With respect to co-ordination with CGMS, the ACC wishes to raise the following points:

(a) The noise on the ASAP IDCS channel is an urgent problem. Substantial data loss has occurred at times, particularly on the North Atlantic. With eight ships currently in operation on the North Atlantic and four additional expected in 1988, the impact is substantial both on the ASAP operation and on the Operational WWW Systems Evaluation - North Atlantic (OWSE-NA). ASAP is an especially important part of the OWSE-NA and data losses are highly detrimental. CGMS is urged to take whatever additional steps may be necessary to solve the problem. If channels are to be changed, the ACC urges that:

(i) The decision be taken as quickly as possible; and

(ii) The action be thoroughly co-ordinated through ACC;

(b) The ACC would like to ask that there be even closer ties to CGMS. It would be especially useful if status reports and information on IDCS problems could be sent to Mr. D. Phillips;

(c) At one point, there had been discussion within CGMS on increasing the baud rate for transmission from the current 100 to 300 or 1200 baud. It would be useful to know the status of this proposal. If there is any serious possibility of changing the baud rate, ACC needs to examine the changes which would have to be made in ASAP operations.

ANNEX VII

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION ESA WP 8 AND JAPAN WP 15

European Space Agency
European Space Operations Centre
Meteosat Exploitation Project
Darmstadt - FRG
August 1987

CGMS XVI - ESA - WP 08
AGENDA ITEM H

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

Cloud Motion Winds

At high levels in the troposphere there has always existed a negative bias between the wind speed of cloud motion winds and collocated radiosonde winds, i.e. cloud track winds generally underestimate the speed of upper level winds.

Whilst this bias is in part due to physical reasons, it was felt that there was still room for improvement in the automatic cloud tracking scheme. The scheme, which has been in use at ESOC, performs the cross-correlation for cloud matching using all available IR pixels in a segment (32 x 32 IR pixels) and stops when it has found a significant peak in the correlation surface. The use of the full radiometric information implies that the peak in the correlation surface can be the result of the superposition of the displacement of different layers. Since high level clouds generally move with the highest speed, a slowing down of high level cloud motion winds is to be expected.

An extension to the scheme has now been introduced for high level winds. Using the correlation peak found by the old scheme as a starting point, a further search for a peak is made using only those radiances (windowed radiances) classified by the bispectral histogram analysis as belonging to high cloud. The scheme, whilst not solving the overall problem of a negative speed bias for high level cloud motion winds, has shown a reduction in the bias of 0.5 m/s (10-15 %) when compared with collocated radiosonde winds.

Currently a study is ongoing to assess the value of extending the new scheme to the calculation of low and medium level winds. In addition, height assignment of winds is currently made independently of the vector calculation. The new scheme provides the potential for using the same set of windowed radiances for both the height and vector calculations.

Further areas of study include the development of a manual wind procedure for deriving winds in areas where the automatic scheme has failed to produce a wind. The manual procedure will also be used to investigate the derivation of winds from visible and water vapour channel data. Finally, in the Autumn of 1987, a study will be instigated to look at ways of image enhancement (modification) prior to wind vector calculation.

The attached paper provides information on some recent improvement of cloud track winds.

M E T E O S A T - 2 METEOROLOGICAL PRODUCTS

METEOSAT-RADIOSONDE WIND COMPARISON DATA

Y E A R 1986-1987

LEVEL - H I G H

	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
VECTOR DIFFERENCE	8.29	8.15	9.31	9.20	10.05	9.71	9.41	9.22	9.34	9.14	9.16	8.98
RMS	9.87	9.63	11.06	10.90	11.75	11.54	11.12	10.81	11.04	10.88	10.74	10.60
SPEED DIFFERENCE	-3.09	-2.77	-3.38	-3.99	-4.13	-3.94	-4.17	-3.71	-3.84	-3.67	-3.84	-3.84
RMS	8.06	7.42	8.58	8.50	9.05	9.36	8.81	8.52	8.71	8.70	8.67	8.83
DIR. DIFFERENCE	-1.03	-2.98	-2.36	-0.93	-1.50	-1.68	-2.31	-1.46	-1.86	-3.34	-4.31	-1.33
RMS	21.63	23.58	28.46	27.36	25.35	22.21	23.83	24.46	24.25	18.68	18.31	21.17
MEAN SAT. SPEED	20.16	19.74	18.37	17.73	21.20	23.41	20.03	21.09	21.51	21.64	21.21	18.17
MEAN R/S SPEED	23.25	22.51	21.75	21.72	25.33	27.35	24.20	24.80	25.35	25.31	25.05	22.01
NO. OF COMPARISONS	906	1231	1246	1104	1116	1252	1368	1341	1607	2016	1396	826

M E T E O S A T - 2 METEOROLOGICAL PRODUCTS

METEOSAT-RADIOSONDE WIND COMPARISON DATA

Y E A R 1986-1987

LEVEL - M E D I UM

	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
VECTOR DIFFERENCE	5.53	5.60	5.75	5.92	6.48	7.46	5.97	6.67	6.30	6.00	5.63	5.83
RMS	6.75	6.57	6.85	7.33	8.15	9.12	7.35	8.32	7.86	7.55	7.05	6.96
SPEED DIFFERENCE	-1.31	-0.04	-0.90	-0.68	-1.51	-1.89	-0.89	-0.92	-2.17	-1.93	-0.75	-0.90
RMS	5.17	4.91	4.87	5.72	6.15	7.31	5.75	6.74	6.29	6.37	6.02	5.53
DIR. DIFFERENCE	0.10	-2.20	4.77	1.69	-0.77	-0.31	-0.93	0.26	-1.88	-1.84	-2.10	2.50
RMS	21.86	26.37	28.17	23.94	24.21	25.97	23.56	25.31	23.90	21.85	17.85	21.19
MEAN SAT. SPEED	12.74	12.43	12.25	13.03	13.40	15.18	13.18	14.13	13.08	11.83	13.69	12.95
MEAN R/S SPEED	14.05	12.47	13.15	13.70	14.91	17.07	14.07	15.05	15.25	13.76	14.44	13.86
NO. OF COMPARISONS	339	338	361	401	467	545	565	568	511	585	486	259

M E T E O S A T - 2 METEOROLOGICAL PRODUCTS

METEOSAT-RADIOSONDE WIND COMPARISON DATA

Y E A R 1986-1987

LEVEL - L O W

	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
VECTOR DIFFERENCE	4.63	5.05	5.01	5.17	4.60	5.50	5.21	4.42	4.46	4.09	3.81	4.45
RMS	5.60	5.94	6.07	6.44	5.52	6.53	6.34	5.27	5.31	4.78	4.59	5.16
SPEED DIFFERENCE	0.45	1.02	0.30	0.08	-0.16	-0.23	-0.10	-0.16	-0.01	-0.25	0.45	1.37
RMS	3.54	4.22	4.49	4.66	3.79	5.24	4.37	4.00	3.72	3.64	3.48	3.96
DIR. DIFFERENCE	-1.90	2.03	5.61	0.40	-0.09	2.36	-1.27	3.34	1.32	0.60	-0.80	0.29
RMS	33.90	28.52	29.50	27.01	31.45	25.68	33.27	23.94	26.42	21.88	20.39	23.43
MEAN SAT. SPEED	9.32	10.50	9.49	10.21	9.95	10.97	10.33	9.71	10.26	9.52	9.72	10.05
MEAN R/S SPEED	8.88	9.48	9.19	10.13	10.11	11.20	10.43	9.87	10.27	9.78	9.27	8.69
NO. OF COMPARISONS	259	268	351	367	455	380	410	418	451	446	395	347

RECENT IMPROVEMENTS OF CLOUD TRACK WINDS

J. Schmetz, M. Nuret, O. Turpeinen and B. Mason

European Space Operations Centre, Meteosat Exploitation Project

Abstract

Subsequent infrared (IR) images from the geostationary satellite METEOSAT are used to operationally estimate wind vectors by tracking the displacement of clouds. Recent improvements to the cloud-tracking scheme have been made in the area of internal quality control at the production level of the cloud motion vectors and to automatic quality control which uses the ECMWF forecast. A tracking-technique using windowed radiance values is described which considerably reduces the negative speed bias of high level cloud-track winds.

I. Introduction

Cloud track winds are derived routinely in near real-time at the European Space Operations Centre and are disseminated three times (6, 12, 24 GMT) daily for routine use in numerical forecast models. The cloud motion vectors are determined from carefully aligned subsequent infrared (IR: 10.5 - 12.5 µm) images with a crosscorrelation technique over segments of 32 x 32 IR pixels which corresponds to an area of 160 x 160 km at sub-satellite point. Only those segments are processed which were classified as containing cloud tracers by two-dimensional histogram analysis. Correlation surfaces are calculated for two subsequent pairs of images (i.e. 3 images at half hourly intervals) which allows for a symmetry check of the two corresponding wind vectors.

The height assignment is based on the IR radiance of the cloud pattern and it includes a correction for atmospheric absorption and emission. The black body temperature equivalent to the radiance is converted into a pressure level using vertical temperature profiles of the forecasts from the ECMWF. The satellite's channel in the 6.3 µm water vapour band is employed to correct height assignment of semi-transparent cirrus cloud. The data are subject to an automatic and manual quality control before dissemination via the Global Telecommunication System (GTS).

The cloud track winds are used in the data assimilation process of numerical forecast models. Since the quality of the first guess has steadily improved over the last years (Delsol, 1984) a good quality of a specific observation becomes more and more important as bad observations can be more damaging. Overall cloud track winds have a positive impact on the analysis (e.g. Kallberg et al. 1982, Bengtsson, 1985) although it is a pertinent feature of the satellite high level cloud track winds to underestimate the true wind speed as measured by radiosonde (e.g. Pierrard, 1985).

The present ESOC cloud track scheme has been described by Bowen et al. (1979) and even though many detail improvements have been made since then the basic features of the scheme remained unchanged.

We have identified the following areas as promising significant improvements to our cloud track winds:

1. At present the full radiometric information of an IR image segment is used in the pattern matching software algorithm to find a cloud displacement which is indicative of a wind. The "windowing" of radiances (i.e. the stratification of the IR image segment data into radiance classes corresponding to the tracked cloud) has the potential to improve cloud vector estimation since clouds are tracked in a limited altitude range only. This alleviates the problem of determining apparent motions due to the superposition of the high and low cloud moving with different velocities.

2. Improvements in the internal quality check of cloud track winds at the production level. There the symmetry check of the two corresponding vectors from the correlation of an image with the previous and the following one has been improved.

3. An automatic quality control which should remove outliers before the wind vectors are manually quality controlled.

II. Automatic Quality Control

There are a considerable number of spurious cloud motion vectors produced by the correlation scheme. The most frequent error is caused by the difficulty of allocating appropriate heights to semi-transparent cirrus clouds. In addition, many clouds are correctly tracked but the cloud motion is not representative of the air flow at cloud top level. For instance, orographic clouds forming in mountain lee waves remain stationary, although there may be a substantial air flow through the cloud. Similarly, Cb-tops are often found in the high troposphere but their motion is usually more representative of lower tropospheric air flow. Since the manual quality control of spurious vectors is both demanding and time consuming, an automatic system has been developed to objectively screen the cloud motion vectors prior to manual quality control.

Each cloud motion vector is compared with a wind forecast, received

from ECMWF, interpolated horizontally to the segment position and vertically to the pressure level of the vector. Nine vertical standard levels are used. (85, 70, 50, 40, 30, 25, 20, 15 and 10 kPa) with a resolution of 3 degrees. The control is performed by calculating the vector difference between the cloud motion vector and interpolated forecast. If the difference is more than a certain percentage of the forecast wind, the cloud motion vector is flagged. A new automatic scheme was introduced in April 1986 which uses the 12 and 24 hr forecast of the ECMWF.

The new scheme is very attractive due to its simplicity. In that scheme the cloud track wind is simply compared with the ECMWF wind forecasts. If the vector difference is greater than a prefixed threshold, the cloud track wind is flagged. Thus no modification of the ECMWF forecast occurs.

During a special wind campaign the new scheme and its thresholds were tested. Three different thresholds were considered: a vector deviation of 60, 55 and 50% of the ECMWF forecast was allowed, respectively. The following can be concluded:

a) Essentially the deletions by the new scheme were similar to those performed by the previous one. Therefore it is justified to introduce the new scheme, which constitutes a major simplifaction of the software.

b) The choice of the threshold of 55% seems to be the compromise, since with the tighter threshold of 50% almost half of the produced winds would have been deleted.

The impact of the new automatic quality control scheme is presented in Table 1. It covers a part of the wind campaign. It can be concluded, that a slightly higher proportion of winds are deleted, especially in higher levels.

Table 1. Deletions (%) made by the old and the new schemes. A sample of more than 7000 winds was considered.

	OLD SCHEME	NEW SCHEME
ALL WINDS	28	34
LOW-LEVEL	28	29
MEDIUM-LEVEL	37	43
HIGH-LEVEL	26	35

III. Speed Calculation and Symmetry Check

The ESOC cloud track scheme creates two corresponding cloud motion vectors by cross-correlating an image at the time h with the previous image at the time h - 30 min and the following image at the time h + 30 min. The two vectors are used to calculate an average speed over one hour. The old scheme calculated the wind speed from:

$$|\mathbf{V}| = 0.5 * |\mathbf{V}_{h-} + \mathbf{V}_{h+}| \qquad (1)$$

In the new operational scheme (since September 1986) we use:

$$|\mathbf{V}| = 0.5 * (|\mathbf{V}_{h-}| + |\mathbf{V}_{h+}|) \qquad (2)$$

Obviously Equ. 2 leads to a higher wind speed however, the mean increase found is in the order of 0.2 m/s and thus an order of magnitude less than the observed bias for high level winds.

The wind direction is calculated from the vector sum of the two corresponding vectors.

Before accepting a cloud displacement as an estimate of a wind the two corresponding vectors undergo a check concerning their symmetry in speed and direction. In the old scheme this check was based on an empirical function which became tighter with wind speed. However, it also had the negative property to filter out very slow and extremely high wind speeds since the exact thresholds were functions of the speed and directional difference of the two vectors.

A new directional symmetry check has been implemented which simply breaks down the cloud motion vectors into three speed classes to which different thresholds for the directional difference are applied (see Table 2).

Table 2: Thresholds for directional difference between the two corresponding cloud motions - i.e. the directional symmetry check

SPEED CLASS (m/s)	REJECT WINDS IF DIRECTIONAL DIFFERENCE IS LARGER THAN
5 - 10	60°
10 - 30	40°
> 30	20°

For speed symmetry the two corresponding vectors must fulfil:

$$\big||\mathbf{V}_{h-}| - |\mathbf{V}_{h+}|\big| < 0.5 * |\mathbf{V}| \qquad (3)$$

Winds slower than 5 m/s are rejected.

The new directional symmetry check has led to the acceptance or production of more slow cloud winds.

The cut-off at 5 m/s and the peculiar behaviour of the old symmetry check are the reasons that the cloud wind distribution has less

winds in the weak range than radiosonde (e.g. Pailleux et al., 1983). The above can also be considered as an explanation that low level cloud winds (which are relatively slow) are not biased low as compared to radiosonde.

IV. High Level Cloud Tracking

IV.1 The Speed Bias of High Level Cloud-Track Winds

Fig. 1 shows the cumulative frequency of winds as a function of wind speed. The data are from a 13 months (January 1984- January 1985) data set of collocated radiosonde (RAS) and satellite (SAT) measurements. The data sample contains 9684 pairs of high level (400 hPa) and 2360 pairs of low level (700 hPa) wind vectors. The solid curves pertain to the RAS and the dashed curves to SAT measurements.

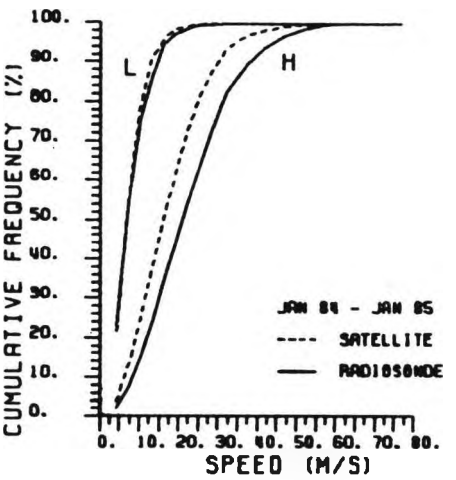

Fig. 1: Cumulative frequency of cloud-track (---) and radiosonde (—) winds as a function of wind speed for low level (L) and high level (H).

A good agreement between SAT and RAS is to be observed for low level winds, although this is partially due to the SAT wind distribution being biased high for slow winds (see above).

The high level SAT winds approach the 100 % value at a lower speed than the RAS. The latter corresponds to a mean bias of 3.3 m/s between RAS and SAT wind speed. Concerning the direction of the winds there is no systematic difference, the mean difference being of the order of 3°. The RMS error of the direction differences decreases slightly with height.

A wind measurement with a radiosonde can be considered as being a random sampling of the air flow so that a sufficiently large number

of measurements represents the true wind. Cloudtrack winds give an unbiased estimate only if clouds are conservative tracers randomly distributed within and floating with the airflow. However, this postulation in not fulfilled.

For instance, in jet areas the major part of cloud is found below the level of maximum wind speed and there are seldom any clouds above that level (e.g. England and Ulbricht, 1980). The jet core itself is also mostly cloud free. The vertical and horizontal wind shear can be as large as 10 m/s per 1 km and 5 m/s per 100 km, respectively. Thus, it is not unreasonable to expect from the present cloudtrack scheme significant underestimations of the wind speed, if one considers that there are (random) errors, in the height assignment.

Besides the above explanation, which inevitably implies a bias, we believe that some part of the bias is a pertinent feature of the present ESOC cloud-tracking scheme. The scheme performs a cross-correlation using all IR pixles of a segment, and it stops when it has found a significant peak in the correlation surface. The use of the full radiometric information implies that the peak can be the result of the superposition of the displacement of different layers. As high level cloud winds generally move with highest speed a slowdown of these wind vectors is to be expected.

IV.2 Windowing of Radiances

In order to quantify the effect mentioned above the following experiment has been conducted: For all high level cloud track winds which were found by the original scheme an additional tracking with the cross-correlation scheme was pursued using windowed radiances, i.e. only the coldest radiance values (i.e. the lowest counts) were taken, which were classified by the bispectral histogram analysis as being high level cloud. The "cold end" of the window is set to a very low value (35cts) to ensure that all cold-cloud pixels are used for the windowing. This is important as a sufficiently large number of pixels is usually required to avoid the correlation surface being too noisy. Pixel values outside the window are set to a constant. Fig. 2 illustrates the windowing: A histogram of IR counts is plotted for 9 segments (i.e. 9 x 1024 pixels) in the area across the Morrocan coast near Agadir. The 9 segments are the search area for the target window (one segment of 1024 pixels) which is moved within the search area to find a pattern match which is indicative of a cloud displacement. In order to illustrate difficulties we have chosen a complex case as an example, the search area contains sea and land surface as well as sheets of low level and high level cloud.

Fig 3a, b and 4a, b show the correlation surfaces which were calculated using all pixel values and the windowed values only. Fig. 3 pertains to the correlation of the centre image at the time 1100 GMT with the previous slot and Fig. 4 to the correlation with the following slot.

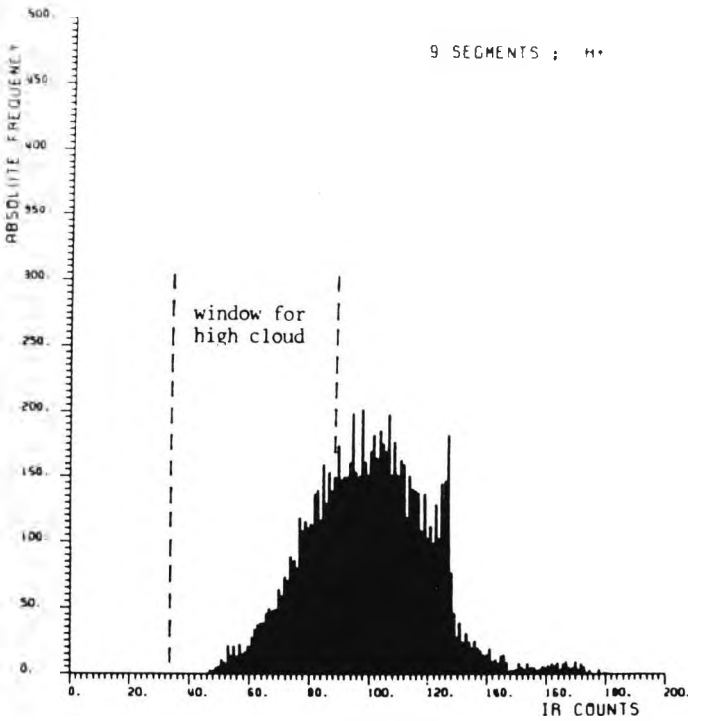

Fig. 2: Histogram of IR counts over an area of 9 segments (1 segment = 32 x 32 pixels) across the coast of Morocco near Agadir (centre segment at 31.8°N, 8.6°W) for slot 23 (1130 GMT) on 12 March 1986. The 9 segments are the search window in which the centre target segment is moved to find a cloud displacement.

A wind vector is calculated from the correlation surface by locating the most significant peak in the surface. Those vectors are indicated by black arrows. The important result is that the windowing yields larger speed values since there is no contribution from lower level radiances. In this case the wind vector determined by the old and presently used tracking scheme yields a speed of $|\mathbf{V}|$ = 17 m/s and a direction 270° as compared to $|\mathbf{V}|$ = 21 m/s and 260° for the windowing.

Figs. 3b and 4b also point out the problems associated with the windowing: generally speaking the correlation surfaces have a much more noisy structure leading almost invariably to multi-peak surfaces. In the present test version of the windowing scheme the problem is circumvented by starting the peak search for the windowed correlation surface at that peak which has been found by non-windowing scheme for the high level cloud displacement. That is to say, the windowing is added to the old scheme. A more elaborate processing of the windowed image before doing the tracking seems to be a prerequisite for a pure windowing technique since the patchiness of the correlation surface is due to the patchy structure of the real cloud.

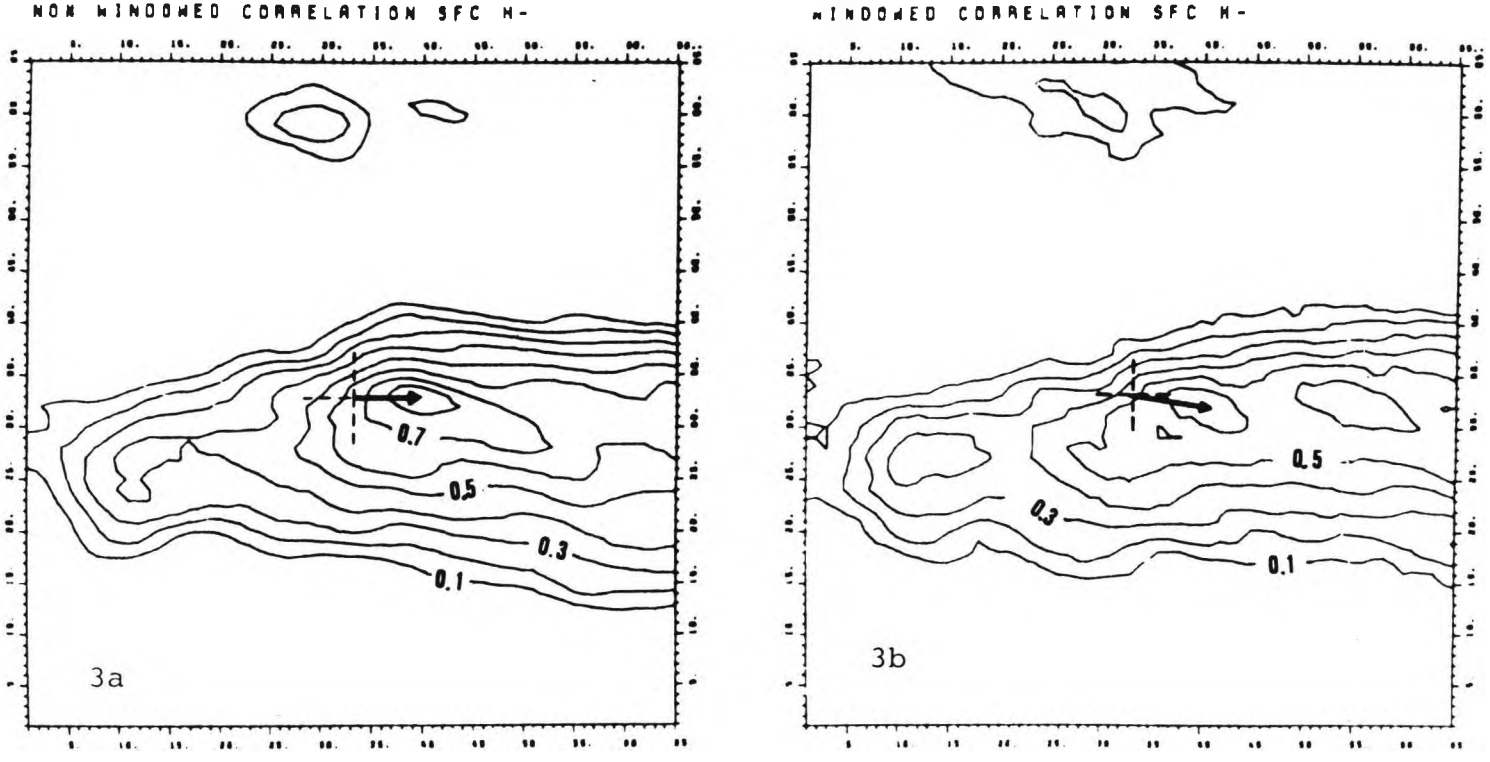

Fig. 3a,b: Correlation surface for the cross-correlation of a target segment at 1100 GMT on 12 March 1986 with the previous image (1030 GMT). Since the search window consists of 9 segments and 1 segment has 32 x 32 pixels there are 65 x 65 correlation values. The wind speed is proportional to the distance of the peak value from the centre of the correlation surface. Fig. 3a shows the surface for the non-windowed correlation and 3b the windowed one. Peak values are 0.75 and 0.51, respectively, and only positive values are indicated. The loacation of the target segment is at 31.8^{o} N, 8.6^{o}W. (Note: the cloud displacement corresponds to a westerly flow of 270° and 260°)

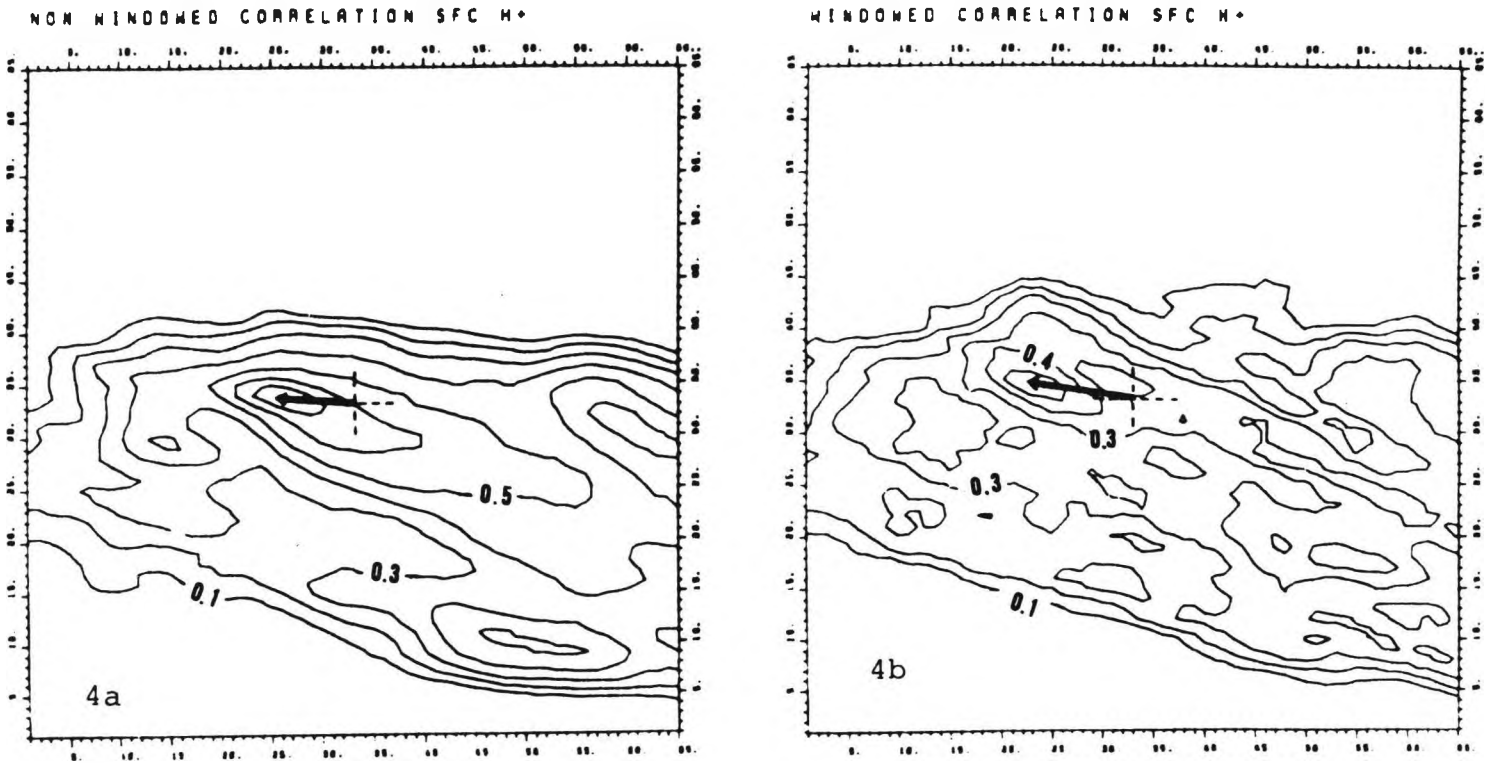

Fig. 4a,b: As Fig. 3a,b except that the correlation is made with the following image at slot 23 (1130 GMT). Peak values in the correlation surfaces are 0.83 for the non-windowed and 0.64 for the windowed correlation.

Table 3 is an account of the windowing as applied to high level cloud for a total image. 506 high level winds were re-evaluated by the windowing technique but 58 winds were rejected because the directional difference between windowed and non-windowed result was more than 30°. It is argued that in those cases the windowed correlation surface was too noisy to yield reasonable results. For the remaining 448 cases an average speed increase of 0.6 m/s has been found. For the 49 winds with speeds larger than 30 m/s (based on the windowing) the increase is 4.4 m/s and for winds greater than 40 m/s it is as large as 12.5 m/s.

Table 4 is a summary of the performance of the windowing scheme for 13 March 1986 slot 22. 625 high level winds have been reevaluated and 582 pass the check on the directional difference being less than 30°. The results closely resemble those of Table 3.

SPEED CLASS (m/s)	NUMBER OF WINDS	$\lvert V_{nw} \rvert$ (m/s)	$\lvert V_w \rvert$ (m/s)	$\lvert V_w \rvert - \lvert V_{nw} \rvert$ (m/s)
> 5	448	15.8	16.4	0.6
> 10	330	18.7	19.7	1.0
> 20	122	26.8	29.4	2.6
> 30	49	34.2	38.6	4.4
> 40	13	40.8	53.3	12.5
> 50	9	48.8	58.1	9.3

Table 3: Comparison of the average wind speed $\lvert V_{nw} \rvert$ and $\lvert V_w \rvert$ as estimated with the non-windowing (presently used) and the windowing cloud track scheme for 11 GMT on 12 March 1986. Only those results were taken where the wind direction from both schemes agreed within 30°.

V. Conclusion

The high level cloud tracking using windowed radiances yields a considerable increase in wind speed. The difference between the windowed and non-windowed results increases with wind speed. An implementation of the windowing technique into the operational system in the near future will help to alleviate the problem of high

level cloud track winds being biased low. However, it will not necessarily lead to an overall satisfaction since the height assignment of semi-transparent cloud is another problem area which in spite of the correction using the water vapour channel (e.g. Bowen and Saunders, 1984; Cayla and Tomassini, 1978; Szejwach, 1982) does not always lead to results of sufficient quality. To discuss this in detail is beyond the scope of the present paper. Some limitations were presented by Schmetz and Turpeinen (1986).

Modifications to the operational cloud tracking system have been made in the area of automatic quality control and at the production level for the symmetry check of the two corresponding cloud motion vectors. Those changes have led to a slight but noticeable improvement of the quality of cloud track winds.

SPEED CLASS (m/s)	NUMBER OF WINDS	$\lvert V_{nw} \rvert$ (m/s)	$\lvert V_{w} \rvert$ (m/s)	$\lvert V_{w} \rvert - \lvert V_{nw} \rvert$ (m/s)
> 5	582	14.6	15.9	1.3
> 10	392	18.0	19.4	1.4
> 20	156	25.4	28.3	2.9
> 30	48	31.1	38.8	7.7
> 40	22	34.4	44.7	10.3
> 50	2	36.5	56.5	20.0

Table 4: As table 3 except for 1100 GMT on 13 March 1986.

VI. References

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CGMS-XVI WP-15
Agenda Item: H-1
Prepared by Japan

COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

Winds

Status Report of GMS Wind Derivation

CGMS-XVI WP-15
Agenda Item: H-1
Prepared by Japan

Status Report of GMS Wind Derivation

1. Number of the cloud motion winds

In March 1987, the computer system at MSC was replaced by new one. Since then cloud motion wind calculation has been carried out 4 times per day ; at 00 GMT and 12 GMT in whole coverage, and at 06 GMT and 18 GMT in the northern hemisphere. The processing time of the cloud motion wind calculation in the new computer system is shorter by 30 minutes than before. The calculated winds has been transmitted to world-wide users through GTS within 2 hours and 50 minutes after the VISSR observation.

The total number of the winds per month are shown in Fig. 1. Since the introduction of new system, the total number of the low level winds has nearly increased by 10000 to 30000 in every month. It is because the numbers of the winds in the new system are made up the calculated winds at 06 GMT and 18 GMT in the northern hemisphere in addition to the winds at 00 GMT and 12 GMT.

The total number of the high level winds has increased by 12000 to 26000, because of not only mentioned above but also introduced the new method ; the automatical procedure and the man-machine interactive procedure are routinely used together .

The changes in the method for the cloud motion wind calculation in March 1987 was briefly described in CGMS-XV Japan WP-17.

2. Comparison of the cloud motion winds with radiosonde winds

The results of the International Comparison of the GMS winds (Type 2 Reports) are shown in Fig. 2.

The monthly mean of vector difference between GMS winds and radiosonde winds are shown in Fig. 3.1 and Fig. 3.2. The vector difference of these figures are calculated in the same way as the International Comparison of Satellite Winds, and the comparison is made 4 times a day in the new system.

The mean of the vector difference and the Root Mean Square (RMS) after introducing the new system are almost the same as those in previous year, except in March 1987. At the beginning of March 1987, a few unreliable data were transmitted without rejection because of the unexpected software troubles in quality control system and so on, and those troubles were quickly removed.

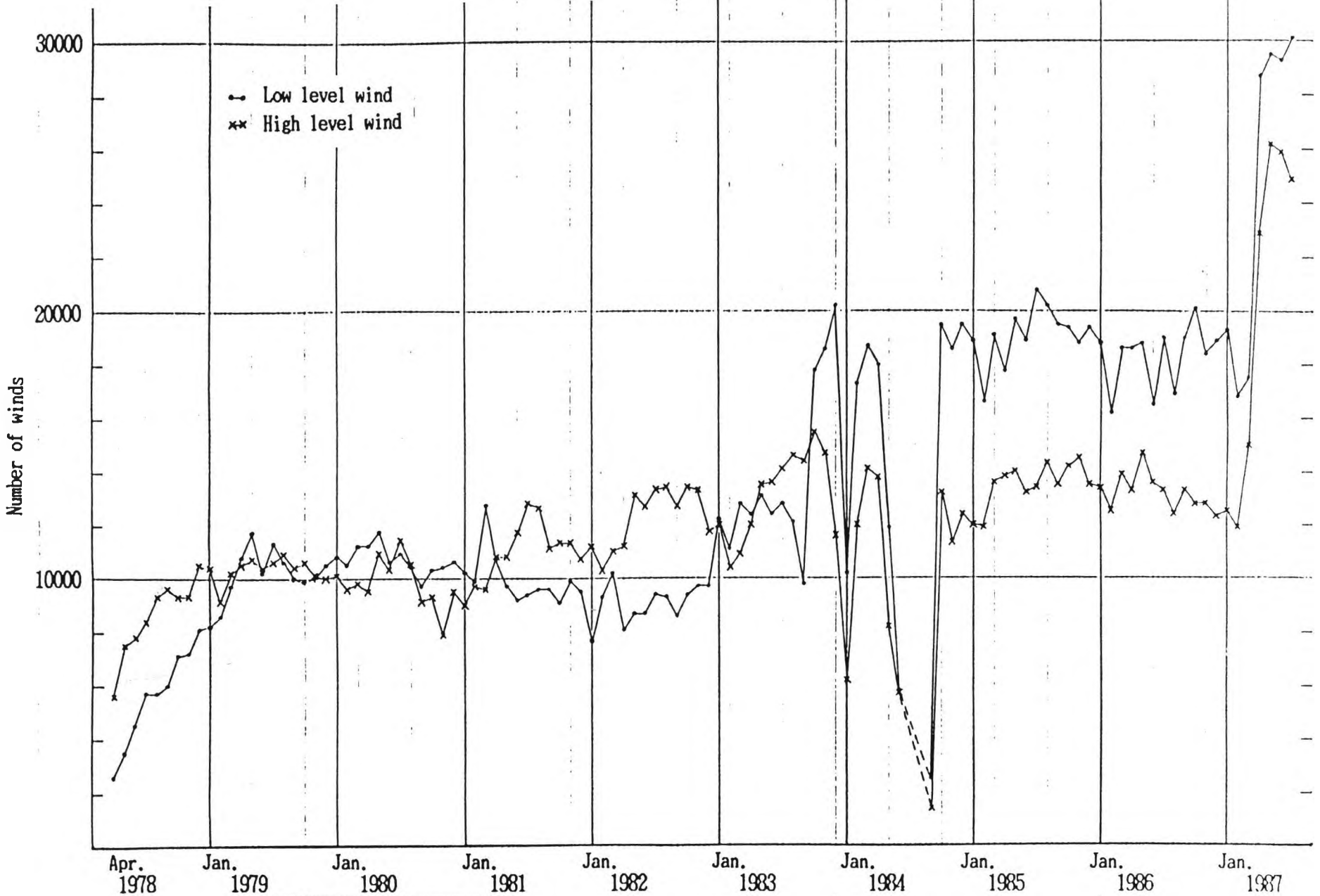


Fig.1 Total number of the transmitted GMS winds in every month.

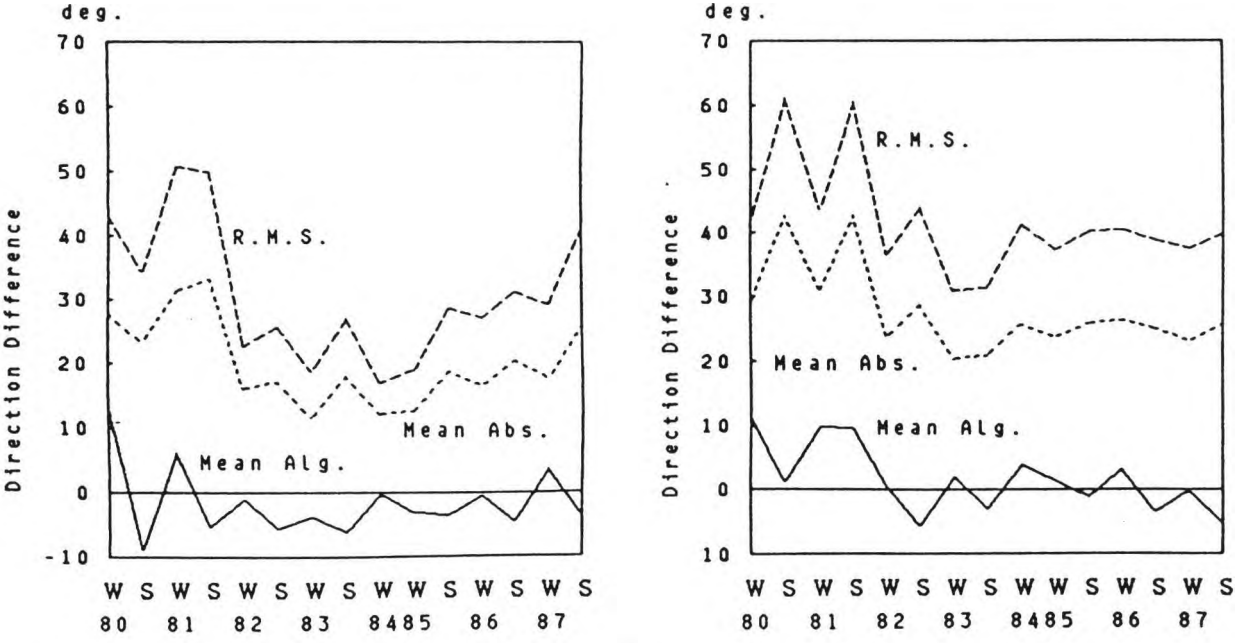
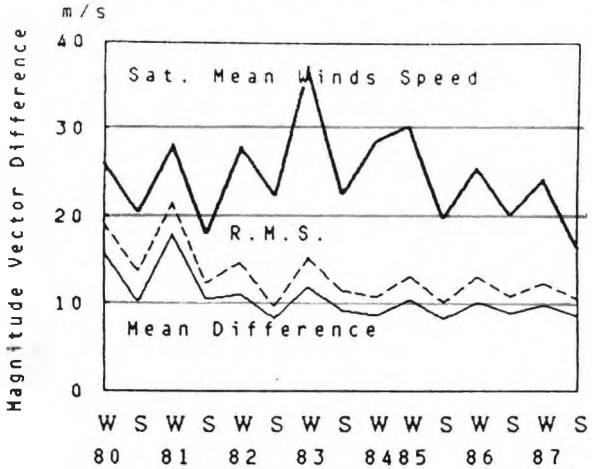
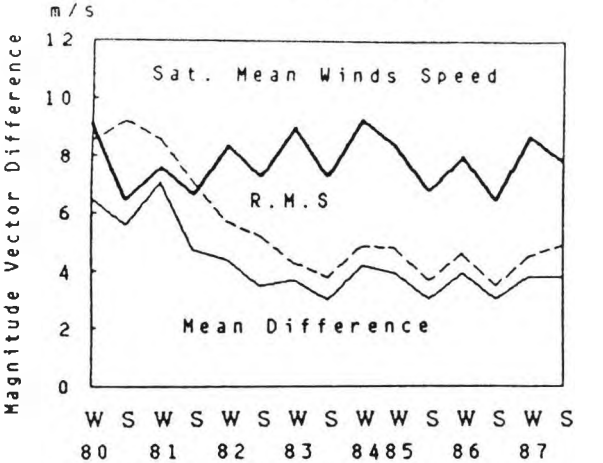


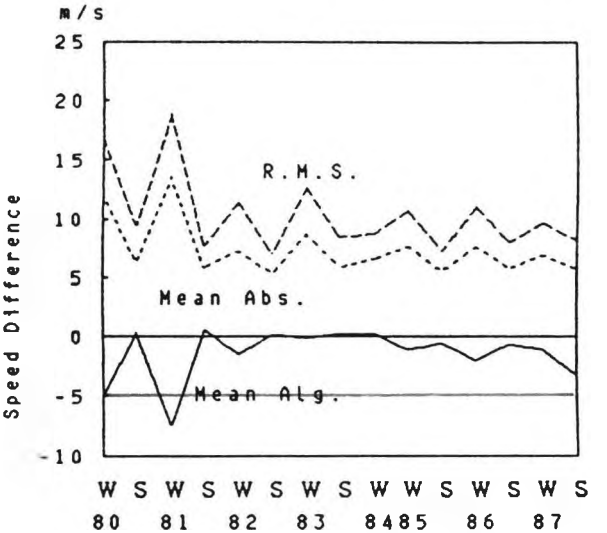
Fig. 2 Results of International Comparison of Satellite Winds from winter 1980 through summer 1987.

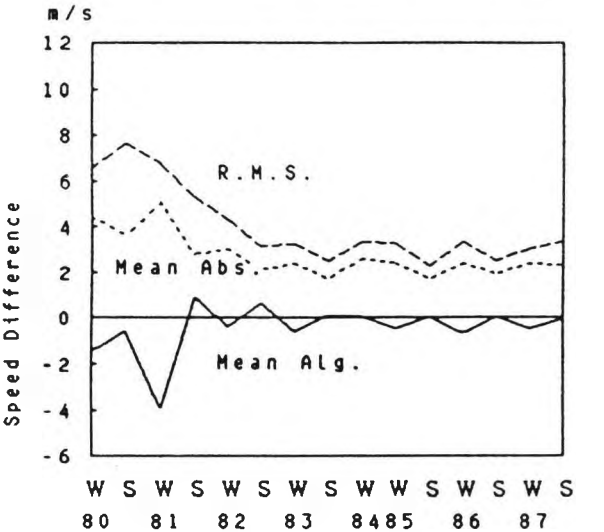
TYPE-2 COMPARISON (GMS-RAWIN)

[HIGH LEVEL] [LOW LEVEL]









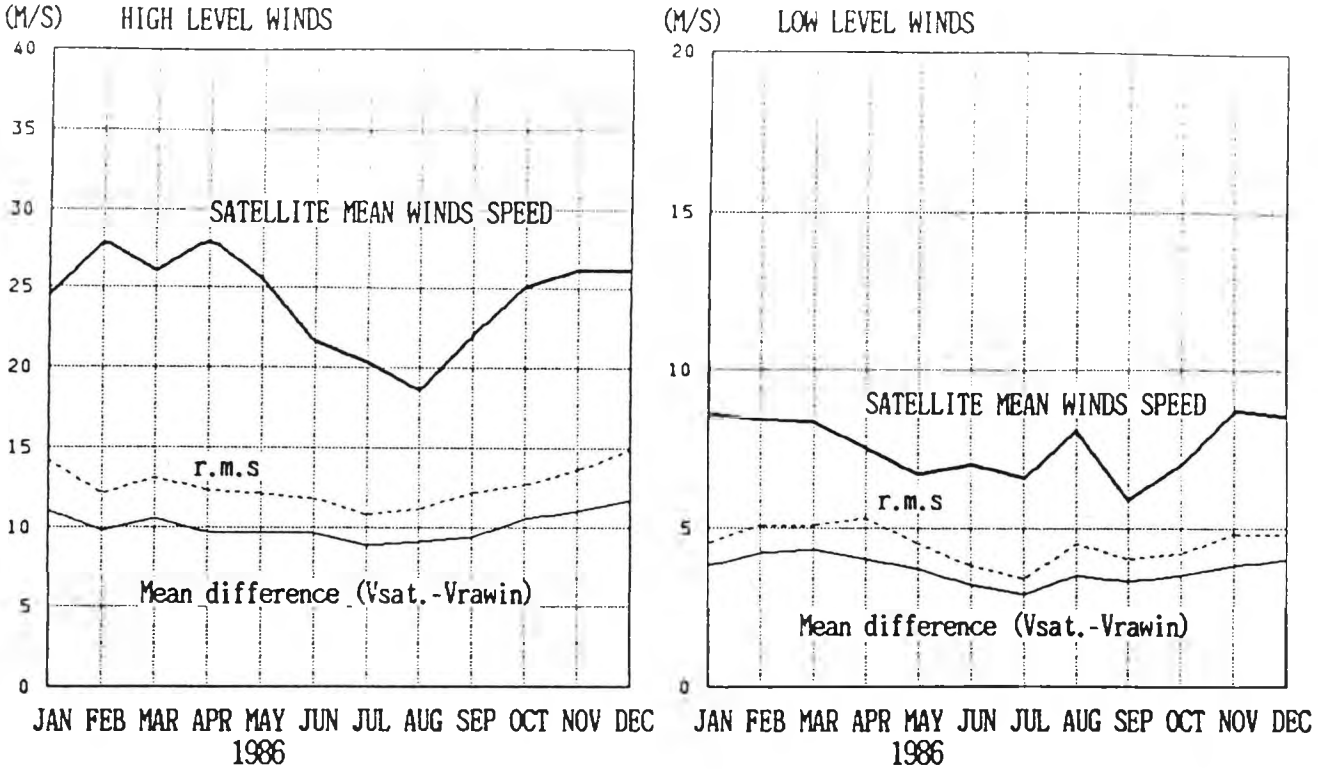


Fig.3.1 Results of Comparison of Satellite Wind with Rawinsonde Wind in 1986.

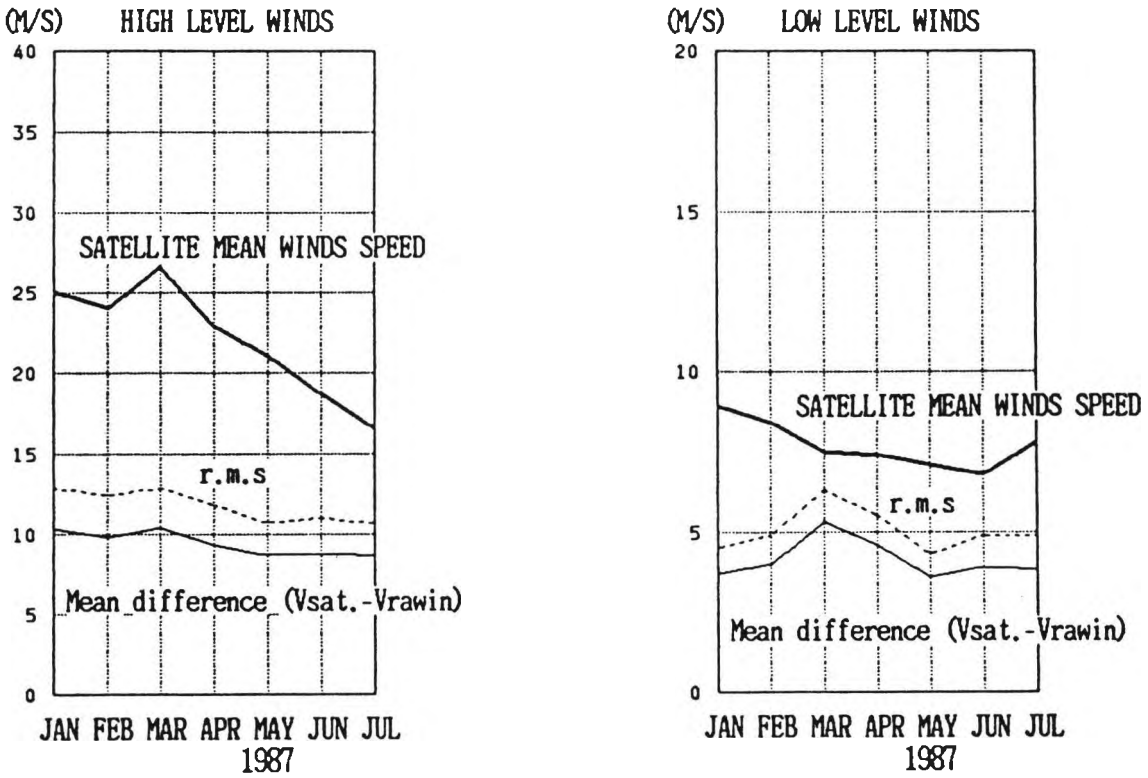


Fig.3.2 Results of Comparison of Satellite Wind with Rawinsonde Wind in 1987.

ANNEX VIII

QUALITY AND QUANTITY OF SATELLITE WINDS - WMO WP 6

QUALITY AND QUANTITY OF SATELLITE WINDS

Summary and Purpose of Document

The importance of satellite winds from geostationary satellites has been amply demonstrated. In the tropics, satellite winds are crucial for the reconstruction of wind field components needed to initialize numerical weather predictions. Improved quality and coverage is a requirement, both for weather forecasting and climate research. The purpose of this document is to review the current limitations of satellite winds and to suggest ways for improving their quality and quantity.

ACTION PROPOSED

The CGMS is invited to consider the inclusion, in its regular agenda item on satellite winds, a review of progress made on improving the quality and quantity of operational satellite winds, in terms of global, regional and national requirements.

1. Background

Since the inception of the Global Atmospheric Research Programme (GARP) in 1967, our ability to predict weather from a few days ahead to a week or more has improved considerably, thanks to the development of a global observing system, more accurate computer models, larger and faster computers, and a greater understanding of atmospheric dynamics and physical processes. Continued progressive improvements in the accuracy and resolution of satellite-based instruments, greater experience in the derivation of basic atmospheric variables and the assimilation of such data into numerical models, and better quality control of the entire satellite and ground-based data base, provide avenues for significant further advances over the coming decade.

Following GARP, the World Climate Research Programme (WCRP) is tackling the problem of understanding the whole climate system, comprised of the atmosphere, ocean, land and ice, and the interactions between the components. WCRP aims to determine the causes for climate change and to predict the influence of man's activities on climate. Three streams of activity have been identified within the WCRP. The first is directed towards extended-range weather forecasting over time scales of weeks to months and understanding the thermodynamics of the atmosphere/earth surface system; the second is concerned with interannual time scales and the interaction between the tropical ocean and global atmosphere (TOGA programme); and the third is centered on the World Ocean Circulation Experiment (WOCE), whose purpose is to observe and attain some understanding of the circulation of the oceans on a global scale.

The TOGA and WOCE programmes are under way and we can expect, by the mid-1990's, significant progress in our knowledge of the oceans and their interaction with the atmosphere. One of the largest remaining problems, then, will be the transports of water and energy within the atmosphere itself. Precipitation, evaporation and water transport are currently very poorly measured on the global scale and are not well described in atmospheric general circulation models. The Global Energy and Water Cycle Experiment (GEWEX) has been proposed to tackle this problem. In order to determine the global transports of water and energy, an accurate three-dimensional reconstruction of the atmospheric wind field is essential.

2. Data Requirements

As the realism of weather prediction models keeps improving, we are presently approaching a limit in predictive skill which cannot be overcome without an improvement in the quality of observations of basic atmospheric parameters. There is an increasing body of evidence, from operational weather forecasting and numerical experiments, that differences between predictions made with different models and data assimilation systems result mainly from differences in the initial analyses rather than differences in the atmospheric models. Figure 1 is a demonstrative example showing, in the case of the 850 hPa wind field, that global analyses performed with different data assimilation systems by two operational forecasting centres (ECMWF and U.K. Meteorological Office) may differ by as much as 10-15 m/s over the currently data-void central Indian Ocean (i.e., a wind vector difference of about the same magnitude as the local winds themselves). In spite of all the progress achieved during and after GARP, global analysis schemes do not produce a unique solution where a large-scale gap exists in the distribution of observations. Four-dimensional assimilation systems cannot replace direct wind measurements in the tropics.

In view of the need to sample the large day-to-day changes of the atmosphere, the basic data needed to establish accurate monthly statistics for WCRP are not substantially different from that required for daily global atmospheric circulation analyses used in operational numerical weather prediction. Therefore, observations of the density and quality required for the First GARP Global Experiment (FGGE) should adequately determine the day-to-day variations of the general atmospheric circulation for the purposes of WCRP. The requirements for winds are:

- Horizontal and Vertical Resolution	500 km/100-200 hPa (one high-level and one low-level wind vector for each 250 x 250 km^2 box in the tropics between 20°N - 20°S)
- Time Resolution	Daily
- Accuracy	1 - 3 m/s

It should be noted that these requirements were not actually met during the FGGE, even during the intensive periods of observation. However, there has been evidence that the skill of operational medium-range weather forecasts improves when the performance of the observational network rises toward meeting the above specifications.

WCRP recognizes that the only practical way to construct a good climatology of atmospheric circulation over an extended period of time (i.e., 10 years or longer) is to rely on the operational WWW system for providing the basic observations and analyses. The utility of cloud motion winds (CMWs) observed from geostationary satellites has been amply demonstrated. Because the geostrophic adjustment is weak in the tropics and winds cannot be properly inferred from the mass fields and in situ wind observations are very limited, satellite winds in the tropics are crucial for the reconstruction of both the rotational and divergent components of the wind field needed to initialize numerical weather predictions. The lack of sufficient wind data in the tropics could generate quite large errors in the analysed wind field, leading to a poor description of the atmosphere in these areas and a rapid decrease of prediction accuracy even in areas far removed from these data-sparse regions. Thus, improved coverage and quality of CMWs is a requirement of weather forecasting as well as climate research.

3. Current Limitations of Satellite Winds

Current limitations of the coverage and quality of satellite CMWs can be summarized under the following headings:

(i) Limitations of spatial coverage

- No CMWs available for region poleward of 50 degrees latitude.
- No CMWs over cloud-free regions.
- Generally poor wind coverage over areas with multiple cloud layers.

(ii) Limitations of vertical resolution

- Only two levels, at best, resolved in the vertical.

(iii) Ambiguity of height assignment

- Inaccurate height assignments, particularly with thin cirrus clouds, when the emissivity is less than unity.

(iv) Limitation of tracking high-speed cirrus clouds

- Biasing of actual high wind speeds in jet stream regions toward lower values.

Satellite operators are working to alleviate some of these problems but it is clear that a more concerted effort is needed in the research and development area to upgrade the quality and quantity of satellite winds.

4. Suggestions for Improving the Quality and Quantity of Satellite Winds

There is clear evidence from experimental wind extraction exercises that significant improvements in accuracy and coverage could be made using currently-available data. Two points need to be stressed. The first is that the primary objective is to improve the quality and coverage of operationally-available wind vectors. One way to achieve this goal is to recognize that timeliness of data delivery is not as crucial for the WCRP as it is for numerical weather prediction (i.e., wind derivation operations could be allowed to continue beyond the shortest operational cutoff times of a few hours after observation time set by short-range weather forecasting needs). The additional winds obtained should nevertheless be distributed over the GTS, so they can be utilized in operational data assimilation with a delayed cutoff time (e.g., ECMWF medium-range weather forecasting).

The second point is that results of research have shown that there are a number of ways to improve the quality and quantity of satellite winds. These can be classified as follows:

(I) Improvements in horizontal coverage

- Use of water vapour channel data to provide for a more complete wind coverage over the full image area, for the atmospheric layer 100-450 hPa.

- Use of man-machine interactive tracking techniques in multi-layer cloud situations to derive more low-level winds.

- Use of full-resolution visible channel data to improve the yield and accuracy of low-level wind vectors.

- Continue wind derivation for main synoptic times, even after data insertion cutoff times for current operational short-range forecasting models.

- Wind derivation at or near additional synoptic times.

(ii) Improvements in vertical coverage

- Use of gray scale enhancements of different temperature levels in the infrared channel data to identify cloud motions at more than one level in the vertical under multi-layer cloud situations.

- Use of water vapour channel data to provide middle-upper level winds.

(iii) Improvements in accuracy of jet stream winds

- Use of more frequent images ($\leq$15 minutes) to track high-speed cirrus clouds associated with jet streams.

(iv) Improvements in height assignment

- Use of water vapour channel radiances in the case of thin cirrus clouds to determine height assignments, since the signal in the water vapour channel is less influenced by semi-transparency than in the infrared channel.

- Use of split-window infrared radiances (11 and 12μm) to obtain more accurate height assignments for thin cirrus clouds.

- Use of multispectral infrared techniques (e.g., from VAS data) to measure cloud heights.

- Use of stereo observations from two neighboring satellites (where possible) to obtain more accurate height assignments.

- Increased use of surface-based data and thermodynamic calculations to estimate cloud-base heights in lower troposphere.

5. Conclusion and Recommendation

Satellite agencies are already working on improving the quality and quantity of satellite winds. At the European Space Agency, a number of experiments have been carried out to improve the quality of operational satellite CMWs (use of bispectral histogram analysis to discriminate high-level clouds; use of water vapour channel radiances to obtain a more accurate height assignment for thin cirrus clouds; use of an automatic quality control scheme to remove suspect winds). In addition, winds have also been produced for 0600 UT to increase the number of available winds. In Japan, a new computer system was installed in March 1987 at the Meteorological Satellite Centre and an increase in the number of CMWs is expected, owing to an increase in processing power and the introduction of man-machine interactive procedures for deriving high-level winds. In the USA, research has demonstrated that detailed wind fields can be obtained from water vapour channel images using man-machine interactive procedures.

In the future, satellite agencies are urged to commit the resources (people, money, computers) needed for continuing research and development to improve the quality and coverage of satellite winds. Considering the rapid advancements which are being made in computer technology and innovative data processing, it certainly seems likely that present-day, man-machine interactive techniques (expert systems) could be automated in the not-too-distant future if dedicated persons, with the required abilities and perseverance, could be committed to this task. The payoffs could be substantial for both operational and research purposes.

It is recommended that CGMS include, in its regular agenda item on satellite winds, a review of progress made on improving the quality and quantity of operational satellite winds, in terms of global, regional and national requirements.

ANNEX IX

ADDRESSES FOR THE PROCUREMENT OF ARCHIVED DATA

ADDRESSES FOR PROCURING ARCHIVE DATA

ESA **(specific requests for Meteosat imagery and data tapes)**

METEOSAT EXPLOITATION PROJECT - Data Service,
ESOC,
Robert Bosch Str. 5,
6100 Darmstadt
Federal Republic of Germany

EUMETSAT **(general requests for Meteosat archived material)**

The Director
EUMETSAT
Am Elfengrund 45
6100 Darmstadt-Eberstadt
Federal Republic of Germany

INDIA

India Meteorological Department
Attention: Director (Satellite Service)
Lodi Road
New Delhi
110003 India

JAPAN

Japan Meteorological Association,
Department of Data Service
1-3-4, Otemachi
Chiyoda-ku
Tokyo
Japan

USA

Satellite Data Services Division (E/CC6)
Room 100, World Weather Building
NOAA/NESDIS
Washington DC 20233
U.S.A.

ANNEX X

CONTACT LIST FOR OPERATIONAL ENGINEERING MATTERS

CONTACT LIST FOR OPERATIONAL ENGINEERING MATTERS

ESA

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EUMETSAT

Dr. G. Szejwach	EUMETSAT Am Elfengrund 45 6100 Darmstadt-Eberstadt Federal Republic of Germany Telex: 4197335 Telephone: 6151 - 539216

INDIA

Mr. U. V. Gopala Rao	Directorate of Satellite Meteorology India Meteorological Department Lodi Road New Delhi 110003, India Telex: 312612 Telephone: (Delhi) 626021

JAPAN

Mr. T. Kitamura	Satellite Operational Technology Lab. Nat'l Space Development Agency of Japan 2-1-1 Sengen, Sakura-Mora, Niihari-gun Ibaraki-ken, Japan 305 NASCOM: GTSC Telex: 3652420 Telephone: 0298-51-2271, Ext. 287
Mr. Tadaaki Hamada	Systems Engineering Division Data Processing Department Meteorological Satellite Center 3-235 Nakakiyoto, Kiyose Tokyo, Japan 204 Telex: 2228080 (JMA telex) Telephone: 0424-93-1111

USA

Mr. G. Davis	Manager, Satellite Operations Control Center NOAA/NESDIS, (E/SO1) Room 0226, Mail Stop B Washington DC 20233, USA NASCOM: GTOS Telex: RCA 248376 Telephone: (301) 763 1610

USSR

Mr. V. Kharitonov	USSR State Committee for Hydrometeorology and Control of Natural Environment Pavlika Morozova Str. 12, D-376 Moscow, USSR Cable: Moscow, Goscomgidromet Telex: 411117 RUMS SU Telephone: 252.08.08

ANNEX XI

DISTRIBUTION LIST FOR DOCUMENTS

DISTRIBUTION LIST FOR DOCUMENTS

ESA

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Mr. J. Aasted	Head of Meteosat Satellite Division European Space Agency 18, Avenue Edouard Belin 31055 Toulouse Cedex France
Mr. J. de Waard	Head of Meteosat Exploitation Project, ESOC Robert-Bosch-StraÃe 5 6100 Darmstadt Federal Republic of Germany

EUMETSAT

Mr. J. Morgan	Director EUMETSAT Am Elfengrund 45 6100 Darmstadt 13 Federal Republic of Germany
Mr. G. Bridge	CGMS Secretariat EUMETSAT Am Elfengrund 45 6100 Darmstadt 13 Rederal Republic of Germany

INDIA

Mr. U.V. Gopala Rao	Director Satellite Meteorology India Meteorological Department Lodi Road New Delhi 110003 India

JAPAN

Mr. Y. Ishizawa	Director of Earth Observation Satellite Group National Space Development Agency of Japan World Trade Center Building 2-4-1, Hamatsucho, Minato-ku Tokyo 105, Japan
Mr. Nobuhiko Murayama	Director Meteorological Satellite Center 3-235, Nakakiyoto, Kiyose-shi Tokyo 204, Japan

PRC

Mr. Xu Jian Ming	Director Satellite Meteorology Center State Meteorological Administration 46 Beishiquiaolu Beijing People's Republic of China
Mr. Xu Jian Pring	Senior Engineer Satellite Meteorology Center State Meteorological Administration 46 Beishiquiaolu Beijing People's Republic of China

USA

Mr. T. N. Pyke	Assistant Administrator for Satellites and Data NOAA/NESDIS Washington DC 20233 USA
Mr. E. L. Heacock	Director Satellite Operations NOAA/NESDIS Room 0226, FB4 Washington DC 20233 USA
Mr. C. P. Staton	Satellite Services Division NOAA/NESDIS (E/SP21) Room 806, Mail Stop I, WWB Washington DC 20233 USA (Telex: 7400359 JADS UC)

Mr. R. Masters	Special Projects Office NOAA/NESDIS (E/PO3) Room 3308, Mail Stop D Washington, DC 20233 (Telex: 258815 RMAS UR)

USSR

Mr. V. Kharitonov	USSR State Committee for Hydrometeorology and Control of Natural Environment Pavlika Morozova Str. 12, D-376 Moscow USSR
Mr. V. Backoumov	USSR State Committe for Hydrometeorology and Control of Natural Environment Pavlika Morozova Str. 12, D-376 Moscow USSR
Mr. A.V. Karpov	USSR State Committe for Hydrometeorology and Control of Natural Environment Pavlika Morozova Str. 12, D-376 Moscow USSR

WMO

Mr. J. Bruce	World Meteorological Organisation Case Postale No. 5 CH-1211, Geneva 20 Switzerland
Mr. T. Potter	World Meteorological Organisation Case Postale No. 5 CH-1211, Geneva 20 Switzerland
Mr. J. Leese	World Meteorological Organisation Case Postale No. 5 CH-1211, Geneva 20 Switzerland

ANNEX XII

LIST OF WORKING PAPERS FOR CGMS XVI

LIST OF WORKING PAPERS SUBMITTED TO CGMS XVI

AGENDA ITEM	SOURCE/ REF	TITLE
A	PRELIMINARIES	
A3	Japan WP-1	Review of actions items from CGMS XV
A3	USA WP-1	Review of actions items from CGMS XV
A4	ESA WP-10	Review of Consolidated Report
A4	Japan WP-2	Review of Consolidated Report
A4	USA WP-2	Review of Consolidated Report
A4	WMO WP-9	Review of Consolidated Report
B	REPORT ON THE STATUS OF SATELLITE SYSTEMS	
B1	EUMETSAT WP-1	Meteosat-2
B3	Japan WP-3-1	Status of GMS VISSR observation
	Att 1	The Australian monsoon experiment (AMEX), record of the 7th session of the Japan-Australia GMS Joint Committee 29 July1 August 1986
B3	Japan WP-3-2	Status of Geostationary Meteorological Satellite
B4	USA WP-3	Report on Satellite Status
C	REPORT ON FUTURE SATELLITE SYSTEMS	
C1	EUMETSAT WP-2	Status the Meteosat Operation Programme, Space Segment
C1	EUMETSAT WP-3	Requirements for Meteosat Second Generation
C3	Japan WP-4	Future Satellite System in Japan
C5	USA WP-04	GOES I-M Data Formats
C7	EUMETSAT WP-4	Common Backup Satellites
C7	Japan WP-5	Common Backup Satellites
C7	USA WP-05	Common Backup Satellites
D	GEOSTATIONARY SATELLITES AS PART OF WMO PROGRAMMES	
D	WMO WP-1	Summary of Satellite-Related Items

		in Tenth WMO Congress
D1	EUMETSAT WP-5	World Weather Watch Programmes
D1	WMO WP-2	WMO Plan for Operational WWW Systems Evaluation Africa (OWSE-AF)
D2	ESA WP-6	Comments on the status of ISCCP
D2	EUMETSAT WP-6	EUMETSAT Involvement in Other Programmes
D2	USA WP-06	Other Programmes
D2	WMO WP-3	Status of the International Satellite Cloud Climatology Project (ISCCP)
E	COORDINATION OF DATA COLLECTION	
E	USA WP-09	SEAS
E1	ESA WP-1	Status and problems of the IDCS
E1	USA WP-07	Status of IDCS
E1	WMO WP-7	Some Aspects of Alleviating Interference in the DCS Frequency Band (CGMS-XV Action Item 5)
E2	Japan WP-7	Ships
E2	USA WP-08	Ships
E2	WMO WP-4	Development of the Automated Shipboard Aerological Programme (ASAP)
E2	WMO WP-8	Baseline Upper-Air Network (BUAN)
E3	Japan WP-8	ASDAR
E3	USA WP-10	ASDAR
E3	WMO WP-5	Progress Report on Implementation of the ASDAR Programme
E4	Japan WP-9	Review of IDCS Users' Guide
E4	USA WP-11	Status of IDCS Users' Guide
E4	WMO WP-9	Review of IDCS Users' Guide
F	COORDINATION OF DATA DESSEMINATION	
F1.1	ESA WP-2	Meteosat high and low resolution (WEFAX) status report
F1.1	Japan WP-10	HR-FAX
F1.1	USA WP-12	Mode AAA
F1.2	Japan WP-11	LR-FAX
F1.2	USA WP-13	WEFAX Common Header
F1.2	USA WP-14	WEFAX Schedules
F1.2	USA WP-15	WEFAX Enhancement Wedge
F1.3	Japan WP-12	DCP Data
F1.4	EUMETSAT WP-7	Some further considerations on digital WEFAX
F2	Japan WP-13	Dissemination via GTS

F3	Japan WP-14	Other Dissemination
F3	USA WP-16	NOAAPORT Phase I
F3	USA WP-17	NOAAPORT Phase II

G COORDINATION OF SATELLITE DATA CALIBRATION

G	ESA WP-4	Calibration of Meteosat-2
G	USA WP-18	GOES I-M

H COORDINATION OF METEOROLOGICAL PARAMETER EXTRACTION

H1	ESA WP-8	Cloud Motion Winds
H1	Japan WP-15	Satellite-Wind
H1	USA WP-19	Winds
H1	WMO WO-6	Quality and Quantity of Satellite Winds
H1	ESA WP-3	Status Report on Meteosat Operational Products
H2	USA WP-20	Sea-Surface Temperature
H3	ESA WP-5	Atmospheric Corrections
H3	ESA WP-7	Upper Tropospheric Humidity
H3	Japan WP-16	Other Parameters
H3	USA WP-21	Precipitation & Cloud Cover
H3	USA WP-22	VAS Products

I COORDINATION OF ARCHIVING AND RETRIEVALS

I	ESA WP-9	Possible use of a system based on digital optical disks for Meteosat Archiving
I	Japan WP-17	Coordination of ARchiving and Retrievals of Japan
I	USA WP-23	GOES

J TELECOMMUNCATIONS

No papers were submitted under this heading

K MISCELLANEOUS

K	Japan WP-18	Summary of New DCP Computer System at MSC
K	Japan WP-19	Renewal Plan of the Ground Telecommunication Facilities
K	Japan WP-20	Corrrection of Information on Transmission of the Stretched VISSR Data of the GMS
K	USA WP-24	Search & Rescue

ANNEX XIII

LIST OF ACTIONS FROM CGMS XVI

LIST OF ACTIONS

ACTION: 16.1 The Secretariat to update and distribute the eighth edition of the CGMS Consolidated Report to all members.

ACTION: 16.2 USA is to inform all CGMS members of the type of vehicle to be used to launch GOES-I.

ACTION: 16.3 USA to mail information package on GIMTACS to all CGMS members within 30 days.

ACTION: 16.4 (Commonality of satellites). CGMS Secretariat to incorporate this proposal when preparing the agenda for the next CGMS session.

ACTION: 16.5 USA to provide CGMS members with the revised launch schedule (GOES I - M) as soon as it becomes available.

ACTION: 16.6 (Interference on the IDCS). CGMS members to discuss this topic and express concern over the resulting problems with appropriate organizations or agencies of their country and to report on this matter at the next meeting of CGMS.

ACTION: 16.7 JMA to distribute the technical information about GMS ship radar DCP and data transmission scheme to the CGMS members.

ACTION: 16.8 EUMETSAT, Japan and USA to inform the WMO not later than 1 November 1987 if they are not able to provide the 06 UTC and 18 UTC time slot allocations for ASAP ships during the BUAN evaluation period beginning 1 January 1988. No reply will be interpreted as an agreement to provide the time slots.

ACTION: 16.9 EUMETSAT to inform the CGMS on the level of interference on IDCS channels once P2 becomes the primary transponder for the DCS.

ACTION: 16.10 WMO to inform USA on the preferred ASDAR support by GOES-E.

ACTION: 16.11 The Secretariat to complete and distribute Issue 6 of IDCS Users Guide to all CGMS members.

ACTION: 16.12 The USA to distribute to all CGMS members a detailed schedule of imaging/sounding used in the normal, hurricane support and tornado support modes of dissemination.

ACTION: 16.13 The USA to investigate and present a proposal to CGMS members outlining the implementation of a digitally encoded header and an enhancement wedge for WEFAX imagery.

ACTION: 16.14 CGMS members to continue to develop proposals for digital WEFAX and a change-over scenario for consideration at CGMS XVII.

ACTION: 16.15 WMO to prepare a draft proposal for a study of the analysis and processing of data from a three-axis stabilized spacecraft and to circulate this proposal to CGMS members by the end of December 1987.

ACTION: 16.16 CGMS members are requested to include graphical presentations on the history of the quality and quantity of satellite winds for working papers prepared for CGMS-XVI. CGMS members are also requested to highlight any improvements made since the last CGMS session in their satellite winds products.

ACTION: 16.17 USA to provide time series of satellite to satellite wind comparisons for CGMS XVII.

ACTION: 16.18 USA to provide CGMS members with information on the products derived from the VAS Data Utilisation Centre.

ACTION: 16.19 JMA to provide CGMS members with the specification of the digital cassette tape storage system.

ACTION: 16.20 CGMS members to send all reports of spacecraft anomalies (retroactively where possible) to the NGDC.

ACTION: 16.21 EUMETSAT to coordinate with all CGMS members the date of CGMS XVII and confirm.