VERIFICATION ACTIVITIES SINCE THE SECOND WIND WORKSHOP

DR DONALD E. HINSMAN

WMO Satellite Activities
World Meteorological Organization
P.O. Box 2300, CH-1211 Geneva, Switzerland

ABSTRACT

The Second International Wind Workshop was hosted by Japan Meteorological Agency (JMA) in December 1993. Since then, five meetings relevant to the cloud track wind community have occurred. In March 1994, the first session of the WMO CBS Working Group on Satellites (CBS WGSAT-I) was held in Geneva followed in April 1994 by the Co-ordination Group for Meteorological Satellites Twenty Second Session (CGMS-XXII) in Annapolis, Maryland. In April 1995, CGMS-XXIII met in Darmstadt, Germany. Finally, in April 1996, CBS WGAT-II was held in Geneva followed by CGMS-XXIV in Lauenen, Switzerland.

1. CBS WG SAT-I

The following is an excerpt from the report of the first session of the CBS Working Group on Satellites related to cloud track winds.

The Rapporteur on Cloud Track Winds presented the status of activities concerning cloud track winds. He reviewed the outcome of the successful winds workshop co-sponsored by EUMETSAT, JMA, WMO, and held by NOAA in September 1991 and the Second International Winds Workshop held in Tokyo in December 1993. Both CGMS and workshop participants were most appreciative of the active WMO involvement and co-sponsorship and strongly encouraged that such activities should continue.

The Rapporteur noted that CGMS had endorsed a recommendation to establish a CGMS Working Group on Satellite Winds. Proposed draft Terms of Reference for the Winds Working Group were circulated for comments among representatives of the operating agencies with the expectation that the draft would be submitted for approval at the twenty-second session of CGMS to be held in Annapolis, MD, USA 11-15 April 1994.

2. CGMS-XXII

The following is an excerpt from the report of the twenty second session of the Co-ordination Group for Meteorological Satellites related to cloud track winds.

EUMETSAT presented a proposal for the establishment of a CGMS Working Group on Satellite Winds. The working group would report to the plenary of CGMS. The Winds Working Group would have core representation from each CGMS Member and the Winds Working Group would continue to have workshops involving the user community. CGMS discussed these issues, agreed to minor

modifications to the Terms of Reference, and decided to establish a Winds Working Group under the recommended Terms of Reference, to be found in Appendix A. It was noted that the work plan and procedures of this Working Group would be discussed at its first meeting, to take place at or before the next CGMS Plenary Meeting.

JAPAN introduced the improvements of GMS high-level cloud motion winds since 1990. CGMS enthusiastically noted this improvement. Japan also presented the current state of water vapour wind extraction from GMS.

RUSSIA presented a brief report on the wind extraction system for GOMS. Three successive IR and one visible image will be used to generate winds.

3. CGMS-XXIII

The following is an excerpt from the report of the twenty third session of the Co-ordination Group for Meteorological Satellites related to cloud track winds including the first report from the newly formed Working Group on Satellite-Derived Winds.

The Working Group on Satellite-Derived Winds was chaired by Dr Johannes Schmetz of EUMETSAT. The working group noted the progress since the Second International Winds Workshop, held in Japan in December 1993. Working group participants also discussed plans for the next workshop, tentatively scheduled for 1996 in Europe. To facilitate further progress on winds intercomparison methods, the working group expressed the desire for scheduling the 1996 winds workshop in advance of the next CGMS Plenary. Specifically, the working group wished to change the current CGMS method of winds comparison described in the CGMS Consolidated Report. The working group recommended that the CGMS Plenary in turn arrange to hold CGMS-XXIV after the next International Winds Workshop.

3.1 Winds Verification Statistics

EUMETSAT provided an update on METEOSAT cloud motion winds (CMW) verifications based on comparisons against collocated radiosonde measurements. The paper addressed the performance of METEOSAT high, medium, and low level CMW and water vapour winds (WVW). The new WVW were of comparable quality to the high level CMW, and improvement at medium and low level was also apparent. The introduction of the new rectification scheme had a noticeable positive impact on CMW at all three levels. The transition from METEOSAT-4 to METEOSAT-5 in February 1994 had an initial negative effect on CMW quality due to a rotating lens problem on Meteosat-5, but was mitigated with software modifications in September 1994. The present speed biases at all three levels have been reduced to less than 1.0 m/s. Root Mean Square (RMS) vector differences versus radiosondes were also reduced. Efforts for further improvement continue.

Japan reported on the status of GMS CMW derivation. Monthly mean differences between CMW and radiosondes were calculated according to the standard CGMS method. The quality of low-level CMW has been good. Since 1991, RMS vector differences have been smaller than 5.0 m/s. Absolute values of speed differences have generally been below 0.5 m/s.

NOAA/NESDIS provided a summary of modifications to NESDIS winds processing and the resulting improvements to CMW quality. Operational GOES-7 CMW have been stabilized. GOES-8 CMW showed an improvement over those of GOES-7. GOES-8 winds were planned to become operational in the summer of 1995, when they would be transmitted to other NWP centres over the GTS. Wind vector production every three hours was envisaged in 1996. NOAA also informed the working group

of plans to modify the GOES-M satellite to add a CO_2 channel at 8 km resolution. The working group welcomed the reappearance of a CO_2 channel aboard the GOES satellites since the CO_2 slicing for height assignment has advantages over the water vapour methods.

NOAA/NESDIS provided the CGMS standard winds intercomparison report. It was recognized by the working group that the current CGMS guidelines for CMW statistics need revision. Detailed specifications should be provided by the International Winds Workshop for the next CGMS Plenary Meeting (XXIV). Thus the working group agreed upon the following:

> CGMS members should develop a new standardized reporting method on winds quality, in coordination with the International Winds Workshop, and propose a new method at CGMS-XXIV. Coordination via electronic bulletin board is requested from WMO.
>
> EUMETSA T should provide over this bulletin board an electronic copy of the winds statistics section of the CGMS Consolidated Report.
>
> The next International Winds Workshop should be held prior to the next CGMS Plenary Meeting.

As an interim step the Working Group agreed on the following recommendation:

> The working group members should provide the following information to one another and to the CGMS secretariat.
>
> (1) Monthly means of speed bias and RMS vector difference between radiosondes and satellite winds for low- (>700 hPa), medium- (700-400 hPa), and high- (< 400 hPa) levels together with the radiosonde mean wind speed. This procedure should be done for three latitude bands: North of 20 North, the tropical belt (20 North to 20 South), and South of 20 South.
>
> (2) Figures of the monthly CMW and WVW statistics through the last 12 months.
>
> (3) Information on recent significant changes in the wind retrieval algorithm.

Furhermore the working group participants agreed to revise Permanent Action 5 so that it reads:

> "CGMS members generating CMW check that the following monthly statistics are sent and received on a quarterly basis: number of co-locations, temporal and spatial co-location thresholds, and radiosonde inclusion/exclusion criteria."

3.2 Derivation of Wind Vectors

The European Space Agency (ESA) provided an update on the status of ESOC's water vapour wind extraction. These operational WVW showed comparable quality to CMW and provided better horizontal coverage. Additionally, the water vapour channel provided an easy alternative to image filtering of high level cloud scenes. Recent research at ESOC had developed an approach for assigning a quality mark to each of the derived vectors. This mark provided an indication of the representativeness of the WVW vector as a single level wind measurement. The dissemination of these quality marked together with the derived vector was highly desirable and would improve the utilisation of these data.

The working group noted that quality marks were needed by NWP centres, which can use all quality levels for improved synoptic analyses. The working group added that charts of WVW including lower quality vectors were very useful for synoptic analyses in tropical regions due to the very good spatial coverage; MDD dissemination of these was suggested. These charts were in particular useful in developing countries which may lack other detailed observations. The following action was proposed:

> CGMS winds operators to explore the establishment of standard guidelines for quality marking and report on their progress at CGMS-XXIV. CGMS winds operators to propose a special session on this topic at the next International Winds Workshop.

ESA reported on the development of low level CMW derivation using visible METEOSAT images. The technique was similar to the infrared low level cloud motion wind retrieval method, but was restricted to marine regions. The height assignment of the visible CMW relied on the cloud brightness temperature obtained in the METEOSAT IR channel. Validation of these winds showed that they were of operational quality. High spatial resolution visible imagery warranted shorter time intervals for monitoring winds; additional improvements were likely when this was possible.

Japan presented its CMW and WVW extraction methods planned for GMS-5. GMS-5 WVW were expected to become operational after adjustment of the pattern selection and the evaluation of data quality. WMO noted that, in all cases, users would like the CMW and WVW to be provided as distinguishable datasets.

The working group invited EUMETSAT to report, at CGMS-XXIV, on any differences between MPEF and MIEC wind processings.

The working group noted that a new milestone was within reach. Very soon JMA, ESA/EUMETSAT, and NOAA would be using similar height assignment techniques. Russia intended to use the experimental water vapour channel on GOMS to develop similar capabilities. The use of similar height assignments would be a major step forward for global winds modelling efforts.

4. CBS WG SAT-II

The following is an excerpt from the report of the second session of the CBS Working Group on Satellites related to cloud track winds.

Notable changes concerning the operational production of wind fields from geostationary satellites have occurred since the last CBS WG SAT: Two satellites of a new series of US geostationary satellites GOES-8 and GOES-9 have been launched successfully and winds were being derived operationally and made available to the user community. The Japanese GMS-5 satellite was successfully launched in 1994 and featured a WV channel in addition to IR window channel which enhanced the communality between the Japanese, US and European geostationary meteorological satellites.

Concerning the European METEOSAT satellites, an important event was the hand-over of all operational activities from ESA/ESOC to EUMETSAT by 1 December 1995.

At the twenty-third CGMS meeting held from 15 to 19 April 1995, the newly established Working Group on Satellite Tracked Winds met for the first time. Of particular interest was the recommendation of the working group to adopt a new standardized reporting method on the quality of satellite-tracked winds superseding a previous standard. The recommendation would be further discussed at the 24th CGMS meeting and at the Third International Wind Workshop.

The Third International Wind Workshop would be held in Ascona, Switzerland, 10-12 June 1996. The workshop would be jointly organised and co-sponsored by WMO, the Swiss Meteorological Institute, JMA, NOAA/NESDIS and EUMETSAT. The wind workshops bring together operational centres that produce satellite-tracked winds, the user community (numerical weather prediction, forecasters) and the research community. Based on the success of previous workshops it was expected that the Third International Wind Workshop would provide a new impetus to improve satellite tracked winds. Recommendations from the workshop would be published in the Workshop Proceedings and be made available to the members of the CBS Working Group on Satellites.

5. CGMS-XXIV

CGMS noted the progress of activities reported by its Working Group on Cloud Motion Winds. It was agreed that CGMS wind operators should inform each other of the algorithms used for the derivation of wind speed data and for the processing of vertical localisation of radiosondes. CGMS endorsed a list of fourteen items proposed for consideration by the third Meeting of the International Winds Workshop (See Appendix B). Furthermore, CGMS considered that there was a need to address the use of new wind measurement techniques expected to be used operationally in the short-term, such as the scaterrometer. CGMS agreed to identify and propose a forum suitable to address these issues.

6. LIST-SERVER

A list-server has been installed and is regularly updated at WMO for those involved with cloud track winds. A list-server allows anyone on a list to send an email message to everyone on a pre-defined list automatically without any intervention. The following reflects an update to the list called "cgmswind" based on changes agreed upon at CGMS-XXIV held in Lauenen. To use this list, you only need send an email message to:

cgmswind@www.wmo.ch

It will automatically be resent to the following list:

imk122@ucla.hdi.kfk.d400.de
jhalle@cmc.aes.doe.ca hinsm
an@www.wmo.ch kimura@w
ww.wmo.ch
J. LeMarshall@bom.gov.au rwlun
non@email.meto.gov.uk paul.me
nzel@ssec.wisc.edu purdom@ter
ra.cira.colostate.edu qwu@gih.gr
ace.cri.nz ccheasman@meto.gov
.uk schmetz@eumetsat.de szant
ai@lmdx07.polytechnique.fr
/g = SED/s = MSC/o = MSC/admd = ati/c
= jp/@sprint.com chrisv@ssec.wisc.edu
woick@eumetsat.de
uspensky@planeta.msk.su
vfratta@nesdis.noaa.gov
jxusmc@public.bta.net.cn
holmlund@EUMETSAT.DE
Gaertner@EUMETSAT.DE

Rattenborg@Eumetsat.de
graeme.kelly@ecmwf.int
bernard.strauss@ecmwf.int
jreyre@meto.gov.uk

Changes or modifications should be made to WMO, attention Dr. Donald Hinsman or hinsman@www.wmo.ch

APPENDIX A

TERMS OF REFERENCE OF THE
CGMS WORKING GROUP ON CLOUD MOTION WINDS

1. BACKGROUND

The Working Group on Cloud Motion Winds (WG-CMW) was established as a permanent working group at the 22nd meeting of the Coordination Group for Meteorological Satellites (CGMS) in Annapolis, Md, USA, 11-15 April 1994. The WG-CMW was established to pursue an objective of CGMS which is to encourage complementarity and compatibility in meteorological data products and to complement the work of other international satellite coordination mechanisms. A long time task of CGMS has been the routine exchange of validation statistics of routine inter-comparisons of Cloud Motion Vectors from the Geostationary satellites. CGMS has also encouraged an increase of scientific research in this field. This WG is established to place greater emphasis on the coordination of operational and research efforts in the derivation of Cloud Motion Winds.

2. PURPOSE

This Working Group on Cloud Motion Winds (WG-CMW) is established to continue and emphasize the CGMS accomplishments and objectives in the area of operational extraction of Cloud Motion Winds from satellite data. This emphasis includes the coordination of complementary and compatible operational procedures, the development of common verification and validation procedures, and the encouragement of a robust program of scientific research in this technology.

3. OBJECTIVES

A. To devise and implement regular procedures for the exchange of data on inter-comparisons of operational CMW.

B. To promote harmonization and, where feasible/practical, the standardization of operational procedures for deriving CMW.

C. To establish agreement for standards in the verification and validation of CMW derived from satellite data. This includes the:

- selection of data sources for validation
- standardization of statistical parameters to be used for verification and inter-comparison.
- standardization of verification criteria, i.e. standard windows in space and time for collocations and standard criteria for the acceptance (or consideration) of the validation data.

D. To promote increased scientific activity in this field, and to establish routine means of exchanging scientific results and progress.

E. To establish and encourage a regular dialogue and information exchange with the users of the data. This to include both scientific and operational exchanges in order to:

- agree on the designation of data quality as a part of the delivery of the data (e.g. quality flags),
- agree on modifications to data formats and codes, and
- discuss means of verifying the usefulness and quality of the data for numerical analysis and prediction.

4. MEMBERSHIP

The working group shall comprise representatives nominated by the satellite operators of the CGMS or by other members of the CGMS. CGMS or the WG-CMW may invite experts from the user community to participate in the activities of the group. CGMS should consider a balance of producers of the CMWs and scientists working in the field for membership in the working group.

5. WORKING ARRANGEMENTS

The working group will meet on an ad hoc basis, but at least once a year to review progress in the field. CGMS can request a meeting at any time. The chair of the working group is appointed by a plenary of CGMS, and serves at the pleasure of the plenary. The chair shall report activities of the committee at the scheduled plenary meetings of CGMS. The members of the WG-CMW are to forward their contributions to the working group chair in time for the annual report by the chair to the CGMS plenary.

The WG-CMW will organize workshops, co-sponsored by CGMS members. The workshops are to promote the exchange of scientific and operational information between the producers of CMW, the research community, and the user community. The workshops may be held every two years, or as required by the judgement of the working group chair.

APPENDIX B

Input to the 3rd Meeting of the International Workshop on Winds

The CGMS Working Group on Cloud Motion Winds recommends that the third meeting of the International Workshop on Winds considers:

1) Requesting wind operators to assess the appropriate use of wind forecast data in the production of winds;

2) Developing methods to assign *quality flags* to individual winds;

3) Requesting wind operators to improve coverage of the wind product whilst preserving an acceptable quality of the product;

4) Exploring applications of wind products in addition to those of NWP centres;

5) Investigating, and proposing, the generation of wind products with improved temporal and spatial resolution;

6) Proposing an appropriate reporting format for the comparison of Cloud Motion Winds with radiosonde data;

7) Investigating, and proposing, a common approach to the establishment and regular maintenance of a directory of accurate sources of radiosonde data;

8) Investigating whether a consensus can be developed between NWP centres concerning the pre-processing and quality control of winds that is recommended to take place at wind producing centres;

9) Compiling a report on the accuracies assigned to winds during the assimilation process at all NWP centres;

10) Encouraging NWP centres to investigate improved techniques for the assimilation of wind information and, in particular, clear air WV winds;

11) Encouraging climatological studies which utilise satellite winds and UTH;

12) Preparing recommendations concerning the re-processing of satellite winds for use in future re-analysis projects;

13) Producing a summary of the product development plans of all wind operators;

14) The scope of future International Workshops on Winds (whether to increase consideration of scatterometer data; whether to include consideration of passive microwave surface wind data, wind lidar data, etc).