

FUTURE MONITORING POLICY FOR IPS

(Submitted by WMO)

Summary and purpose of document

To inform CGMS Members of WMO policy for monitoring satellite data.

ACTION PROPOSED

CGMS Members to note WMO policy for monitoring satellite data and indicate any willingness, as appropriate, to participate in a WMO planning meeting.

- Appendices:**
- A. Extracts of the Manual on the Global Data Processing System adopted by Recommendation 8 of CBS-IX "Amendments to the Manual on the GDPS"
 - B. Annex IX CBS 1990 Extraordinary session "Recommendations on Quality Control Procedures and Monitoring Data Quality"
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FUTURE MONITORING POLICY FOR IPS AT CGMS-XXIX

BACKGROUND

1. Monitoring of the quality of observational data

Policy and procedure issues within WMO were first adopted by Recommendation 8 at the Ninth Session of the Commission for Basic Systems (CBS-IX) in 1988. The Recommendation is entitled "Amendments to the Manual on the GDPS - monitoring of the quality of observations". The substance of the Recommendation as approved by the WMO Executive Council is Attachment II.7 to the Manual - Plan for monitoring the operation of the World Weather Watch paragraph 20 to 22 and Table E (Appendix A).

The President of CBS in November 1988, in accordance with the above recommendation appointed three centres as lead centres for monitoring: upper-air data quality - RSMC ECMWF, surface marine data quality - RSMC Bracknell, and satellite and aircraft data quality - WMC (NMC) Washington. The CBS Extraordinary session held in London 1990 recorded these decisions in the general summary of the work of the session paragraph 6.4.14. CBS 1990 in paragraph 6.4.17 noted that monitoring of aircraft and satellite data quality was carried out by WMC Washington on the basis of information exchanged between RSMCs Bracknell, ECMWF and Tokyo. CBS 1990 also reviewed recommendations on the subject developed by WMO/ECMWF workshops, CBS working groups and endorsed procedures as given in the Annex IX to the report of that session (Appendix B).

The 1990 Extraordinary session noted in paragraph 6.4.19 that "these procedures were in fact embedded in a constant process of operational improvements of the participating centres and that further development would be best achieved by means of expert meetings and workshop, as appropriate. The coordinating role of the lead centres in their area of responsibility was emphasised".

2. Conclusion and WMO Proposed Activities

Review and further development of monitoring procedures for satellite data can therefore be achieved through expert meeting and/or Workshops, preferably with the co-ordinating role of the lead centre in Washington and participation of other GDPS centres as was foreseen by the Commission for Basic Systems. The participation of satellite product generating institutions as well, will be an advantage.

The present structure of the Open Programme Area Groups within CBS has not yet assigned this area to a particular Group. Thus, it would be appropriate for an expert meeting of the relevant lead centres where procedures for particular data types have not been firmly organized. The focus of the meeting would include satellite data; marine data and relevant aspects of aircraft data and address the issues and recommend agreed procedures for monitoring the quality of these types of observations. The participation of the lead centre for upper-air data would also facilitate its input and sharing of experience and updating of this data type procedure. As already noted, the participation of satellite product generating institutions will also facilitate implementation. It would be appropriate for NOAA/NESDIS and EUMETSAT to participate in such an Expert Meeting.

11.7-4 MANUAL ON THE GLOBAL DATA-PROCESSING SYSTEM

possible, centres should follow closely the procedures indicated in order that results from various centres be directly comparable with each other. It is particularly important that this should be the case when the annual global monitoring exercise is carried out. The procedures, together with the standard forms to be used for the provision of results, are given in Table D.

19. It is emphasized that nothing in the formal monitoring procedures prescribed in the attachment is intended to replace the normal day-to-day exchange of information and advice between adjacent centres. As far as possible, all problems should be resolved in this way and, after a time, only serious difficulties will be reflected in the formal monitoring reports.

QUALITY OF OBSERVATIONAL DATA

20. Centres with global, hemispheric or near-hemispheric models should monitor the quality of one or more of the main types of observations using techniques such as those listed in Table E. Statistics should be compiled separately for each land station by station index number, for each ship or aircraft by call sign, for each buoy by identifier, and for each satellite by identifier, and for various geographic areas and levels in the atmosphere.

21. The centres should analyse the results and produce in an agreed format lists of observations believed to be consistently of low quality, together with information on which element of the observation (pressure, temperature, etc.) is thought to be of low quality and the evidence for considering it as such. These lists should be based on data received over one month and should be exchanged monthly between participating centres.

22. For each type of observation a lead centre shall be nominated from time to time by the president of CBS. The lead centre should liaise with the participating centres to coordinate all the monitoring results of that observation type and to define common methods and criteria to be used for compiling the monthly statistics. The lead centre should draw the attention of appropriate focal points where they have been identified and of the WMO Secretariat to obvious problems as they are detected. It should also produce every six months a consolidated list of observations of the relevant observation type believed to be of consistently low quality. Information on problems with observing systems, as well as individual observations, should also be included. When compiling the consolidated lists of suspect stations the lead centres should be rigorous so as to identify only those stations where they are confident that the observations are of consistently low quality. They should state which elements of the observation are considered of low quality and provide as much information as possible identifying the problem. The list should be passed on to the participating centres and to the WMO Secretariat. Where focal points have not been identified the Secretariat should notify Members of agencies responsible for the observations which appear to be of low quality, and request them to make an investigation with a view to identifying and correcting any possible cause of error. Members should be asked to reply within a fixed period of time, reporting on any remedial action and stating if any assistance is required. Monitoring results including follow-up action should be made available to CBS, the Executive Council and Congress. In the case of enquiries made by WMO, feedback to the lead centres is requested.

STATISTICAL VERIFICATION OF NUMERICAL WEATHER PREDICTION

23. The accuracy of forecasts of numerical weather prediction models should be monitored by objective verification procedures.

- (a) Centres operating global, hemispheric or near-hemispheric models and regional models covering appropriate areas should compile verification statistics using the standard procedures described in Table F. The results, together with any relevant information such as improvements that have been made to their NWP systems, should be exchanged monthly between participating centres. Such information may enable centres to identify deficiencies or problems and make improvements in their NWP systems;
- (b) Centres receiving GDPS products over the GTS may wish to verify appropriate areas using the standardized measures listed in Table F and send the results to the producing centres.

TABLE E

Techniques for monitoring the quality of observations

1. Compilation of statistics on the difference between observed values and the analysis and first-guess field;
2. Compilation of statistics on observations which fail the routine quality-control checks
3. Examination of time series of observations from a particular station (particularly useful in data-sparse areas);
4. Compilation of statistics on the differences between reported values of geopotential height and geopotential height recalculated from significant level data for radiosonde stations, using common formulae for all stations;
5. For surface stations which report both mean sea-level pressure and station-level pressure, compilation of statistics on differences between reported mean sea-level pressure and mean sea-level pressure recomputed from reported stationlevel pressure and temperature and published values of station elevation;
6. Compilation of collocation statistics.

ANNEX IX

Annex to paragraph 6.4.18 of the general summary

RECOMMENDATIONS ON QUALITY CONTROL PROCEDURES
AND MONITORING DATA QUALITY

1. Recommended improvements for the real-time quality control at observing sites and collecting centres:

- (a) When it becomes feasible, data representation (BUFR) in binary form should be utilized to exchange, together with the observations:
 - (i) Information of instruments and observational procedures used;
 - (ii) Information on data corrections applied;
 - (iii) Information on quality control;
- (b) Minimum quality control procedures at observation sites for key elements (such as surface pressure, temperature and wind) should be defined. The WMO Secretariat should initiate action to provide appropriate guidance to perform such control, e.g. at manned sites, the use of time series diagram paper to enable a "minimum" core checking procedure;
- (c) Any computer-based quality control at the observation site or collecting centres should be supported by standard software modules. The WMO Secretariat is invited to study possibilities of making appropriate software modules available within the framework of the WW Implementation Support Activities in co-operation with potential donors;
- (d) In order to provide users with up-to-date information on the level of quality control which is applied before data are injected into the GTS, the Secretariat was invited to undertake a survey on the basis of a questionnaire amongst NMCs to that effect;
- (e) The value of providing quality control feed-back between GDPS centres and data producers in real-time has been established in a preliminary study for radiosonde data. Such feedback should be introduced more widely by lead centres and data providers;
- (f) The WMO Manual and Guide on the GOS should be reviewed by the WGGOS/study group in light of the new possibilities in information exchange provided under general code concepts.

2. Recommendations concerning the role of the appointed lead centres:

- (a) When compiling the consolidated lists of suspect stations and data platforms, they should be rigorous so as to identify only those stations where they are confident that the observations are of consistently low quality. Where possible, clear evidence should be passed to WMC defining the problems;

- (b) Information on problems with observing sub-systems should also be passed to WMO;
 - (c) Recognizing the fact that deteriorations in observation quality can be detected on time-scales much shorter than six months (the interval recommended by CBS for producing consolidated monitoring information), they should determine the appropriate response time for communicating suspect stations (or observing systems) to WMO and other GDPS centres;
 - (d) They should define common methods and criteria to be used for compiling monthly statistics, after liaison with the other participating centres.
3. Recommendations concerning the procedures and formats for the monthly exchange of monitoring results:
- (a) Monthly lists of suspect stations and data platforms should contain an indication of the number of "gross" errors detected;
 - (b) Monitoring information for wind data from aircraft and geostationary satellites should be exchanged in the form of mean wind vectors of observed minus first-guess values averaged over latitude/longitude boxes for designated levels;
 - (c) Monitoring information for satellite sounding data should be exchanged in two forms:
 - (i) Mean observed minus first-guess values of thickness averaged over latitude/longitude boxes for designated standard layers;
 - (ii) Co-location statistics with radiosondes displayed as vertical profiles;
 - (d) Recognizing the fact that the monthly lists of suspect stations could be misinterpreted if the methods of compilation are not completely understood, they should be circulated only to those centres which indicate that they should contain a clear explanation of the criteria used and the limitations of the system;
 - (e) Upper-air and marine observations:
 - (i) The reports attached to the consolidated lists sent to WMO should be short. They may have a technical attachment, and it should also be made clear that detailed information can be provided by the lead centre on request;
 - (ii) In the monthly lists, gross errors (see 6 (d) and 7 (a) above) should be handled by all the centres in the same way. Their number should be indicated and they should not be taken into account in the percentage of rejected data (in neither the numerator nor denominator);
 - (iii) The RMS-based criteria used for the monthly lists Of suspect upper-air stations are not efficient for all types of probles, for example they do not pick up those stations with a large bias but small standard deviation. To improve this, it is recommended that:

- For height, to add tests based on the standard deviation and mean departures from first-guess, and to make all tests dependent on the pressure level;
- For wind, in addition to the current test on the vector RMS departure, to explore the introduction of a test based on the speed and direction departures;

ECMWF as the lead centre should make a proposal in that respect to the other centres participating in the exchange;

- (iv) Concerning the consolidated list of stations reporting suspect height values, it is recommended to add a list of stations with consistently large bias but small standard deviation, this would enable further study to determine whether the verifying model, or the observations were showing a systematic bias, thus possibly enabling corrective measures to be taken;
- (v) In the list of suspect drifting buoys, the mean position of the buoy during the month should be indicated;
- (vi) The WMO TP.4 Volume A list of stations be brought up to date as many entries are incorrect;

(f) Aircraft and satellite observations:

- (i) The methods of monitoring these data are very different and not as well defined as in the case of marine and upper-air data;
- (ii) Concerning the quality of satellite sounding and cloud-track wind data, it would be useful for every centre to be informed of the predetermined data exclusion practices in use elsewhere. This information should be sent to NMC Washington for further distribution;
- (iii) When monitoring aircraft data, it is important to be able to distinguish true AIREP reports from PIREP coded in AIREP format. The practice of using XX as the identifier of these pseudo-AIREP should be generalized. It will also be important to have the capability of monitoring the performance of automatically transmitted reports (e.g. ASDARS) as opposed to the normal AIREPS.

4. Recommendations concerning the exchange of CBS standard verification scores:

- (a) As agreed by the GDPS meeting in April 1989, an update of the list of radiosonde stations to be used for the computation of the standard scores against observations has been proposed for implementation on 1 January 1990;
- (b) The need for exchanging standard scores by electronic means in addition to the current exchange of printouts was recognized at the same meeting.. It appears that electronic mail cannot easily be handled by all the participating centres. The use of the GTS should be explored further;

- (c) The standard format of the tables to be exchanged every month (CBS/Ext. (85)) does not include the mention of the forecast centre, and some centres indicate it only in the covering letters. It should be indicated in heading of the tables or at least on each page.