CGMS-XXVIII JPN WP-13
Prepared by JAPAN
Agenda Item : III/1

# UTILIZATION OF AMVS DATA IN THE GLOBAL NWP MODEL AT JMA

The purpose of this document is to review the status and present the future plan of the utilization of AMVs in the global model at JMA.

# Utilization of AMVs data in the global NWP model at JMA

## 1. INTRODUCTION

This is the report which responds to the Action Item 27.17 of CGMS-XXVII. The item requires satellite wind producers to report the review of the utilization of AMVs in their respective NWP centers, especially the usage of AMVs over land.

JMA also conducted an impact experiment of GMS cloud motion vectors on the performance of JMA's global numerical weather prediction model.

The result of the experiment is accompanied as an appendix of this document.

## 2. PRESENT STATUS (as of 15 July 2000)

<u>Physical characteristics of NWP model</u>

- T213 (55-km Gaussian grid)
- Vertical resolution: 30 vertical levels, hybrid-eta configuration
- Run times: 00,06,12,18Z
- Data acceptance times: within 3 hours of model run time

<u>Data assimilation method</u>

- 3 dimensional Optimum Interpolation (3D OI)

<u>Prior rejected satellite wind types</u>

- All INSAT winds
- All IR BUFR winds
- All WV BUFR winds
- METEOSAT ELW BUFR winds

<u>Thinning applied</u>

- Thinning within a horizontal distance of 50km for the AMVs
- All AMVs are rejected if any report from radio sonde, wind profiler, AIREP, AMDAR is available within 50km.

<u>Quality control (cf. Onogi, 1998)</u>

- Internal consistency check
  *Climatological* Check
- Quality Control using statistics of First Guess
  *Black List*
  *Reassignment of reported height of satellite wind*
  Height is *reassigned* to 200hPa if the reported height is more than 200hPa.
- External consistency check using real time First Guess
  *Gross Error Check (GEC)*

Each observed value is examined by D-value, which is defined as the observed value minus the first guess value (6hour forecast value) interpolated to the observation position. The observed value is classified as acceptable, suspect, and reject by two thresholds.

*Space Consistency Check (SCC)*

The suspected value from GEC is compared with the interpolated value (Int.D) at its position from surrounding D-values classified as acceptable or suspect. If the difference |Int.D – D| is smaller than or equal to threshold, then the observation is accepted.

Note: The thresholds of GEC and SCC are variable according to the local atmospheric situation (Dynamic QC).

Observation errors

- Observation errors for all satellites, all wind types are given in Table 1.
- Observation errors for levels other than those provided in the Table 1 are interpolated.

**Table 1:**
**Observation errors in m/s assigned to AMVs at JMA. Values pertain to u and v components**.

| Level (hPa) : | 1100 | 1000 | 850 | 500 | 100 |
|---|---|---|---|---|---|
| Error (m/s) : | 3.0 | 3.0 | 3.0 | 3.0 | 4.5 |

Other points to note

- All types of AMVs are treated in exactly the same way. There are no differences of data selection and observation errors between over land and over ocean for each AMV.

## 3. PLANS

T213L40 will replace T213L30 spectral model in March 2001. However, the replace might make no change into the utilization of AMVs data because the vertical levels of T213L40 model will not be changed so much around the observation levels of AMVs.

Observation errors of AMVs will be re-assigned for the use in 3D-VAR analysis, which will replace the 3D-OI analysis in mid-2001. Different values will be assigned by type of AMVs, by QC information added by AMVs producer, and so on.

Reference:

Onogi,K., 1998: A Data Quality Control Method Using Forecasted Horizontal Gradient and Tendency in a NWP System: Dynamic QC, J. Meteor. Soc. Japan, 76, 497-516.

**Appendix**

# Impact of GMS Cloud Motion Vectors on the Performance of JMA Global Model

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The impact of the possible loss of GMS-5 on the performance of JMA's global model was investigated. An observation system experiment (OSE) was conducted with a low horizontal resolution version (T63L30) of operational global model (T213L30).

The OSE consisted of:

(1) Six hourly intermittent assimilation cycles with GMS cloud motion vectors (CMVs) for the period of 30 days starting from September 1st 1999, and thirty-two cases of eight day forecasts from 00 and 12 UTC analyses from 8th to 23rd September 1999.
(2) The same assimilation cycles and forecasts as stated above but without GMS CMVs.

The performance of eight day forecasts with GMS CMVs (control runs or CNTL) and without GMS CMVs (test runs or NO-GMS) was intercompared by use of anomaly correlation and root mean square error of sea level pressure (see Figure.1), wind at 850hPa (see Fig.2) and other elements.

Fig.1 and Fig.2 show that the forecasts after day-5 are significantly deteriorated in the southern hemisphere when CMVs are not assimilated. The impact is almost nil or slightly negative in the northern hemisphere.

The differences of analyzed geopotential height and wind vector fields at 850 hPa and 500 hPa on the first day of assimilation (September 1st ) are shown in Fig.3 and Fig.4. Changes in wind vector fields in the GMS coverage area are marked.

This OSE shows that CMVs obtained by geostationary satellites are very important over ocean where other kinds of observational data are sparse and CMVs significantly contribute to the improvement of forecast performance in the lower atmosphere in the southern hemisphere.