CGMS-XXIX JPN-WP-12
Prepared by Japan
Agenda Item: III/4
Discussed in WG III

# Quality Check and BUFR Encoding for the Exchange of Cloud Motion Winds


In response to the Action 28.27 of the CGMS XXVIII meeting, JMA reports to CGMS XXIX on the status of the preparation of the standardized BUFR encoding for the products of Cloud Motion Winds (CMWs) and Water Vapor Motion Winds (WVMWs) at the Meteorological Satellite Center (MSC) of JMA.

In addition, this document describes preliminary result of evaluation with EUMETSAT QI toward the introduction of the combined UW-CIMSS RFF and EUMETSAT QI scheme for the BUFR format of the GMS wind products.

JMA thanks EUMETSAT and NOAA/NESDIS/UW-CIMSS for providing the software and sample data.

No action is required on this subject.

# Quality Check and BUFR Encoding for the Exchange of Cloud Motion Winds

## 1. Introduction

At the CGMS XXVIII meeting, the Working Group III fully supported the message of the fifth International Winds Workshop (IWW-5) to CGMS recommending the use of a standardized BUFR format to encode satellite wind data. WG III noted the progress made in the derivation of quality indicators associated with satellite-tracked wind vectors. As suggested by IWW-5, the standard software package for the computation of quality indicators has been requested by different wind producers and there is promise for a standard set of quality indicators to be distributed with the winds as requested by the NWP user community.

In response to the Action 28.27 of the CGMS XXVIII meeting, JMA reports to CGMS XXIX on the status of the preparation of the standardized BUFR encoding for the products of Cloud Motion Winds (CMWs) and Water Vapor Motion Winds (WVMWs) at the Meteorological Satellite Center (MSC) of JMA.

The standardized BUFR format is required to include the quality indices. A summary report of IWW-5 noted that all data providers should strive to implement quality control procedures equivalent to the combined Recursive Filter Flag (RFF) of the University of Wisconsin Cooperative Institute for Satellite Studies (UW-CIMSS) and EUMETSAT Quality Indicator (QI) scheme.

In this regard, MSC intends to introduce the combined UW-CIMSS RFF and EUMETSAT QI scheme to the GMS CMWs for the BUFR format. This document also describes the preliminary result of evaluation with EUMETSAT QI toward the introduction of the combined scheme for the BUFR format of the GMS wind products.

## 2. BUFR encoding

At MSC, the quality control for satellite wind derivation is currently performed by the man-machine interactive method, called the GMS manual Quality Control (QC). For the derivation of the high-density winds, the quality index should be automatically calculated taking into account the number of CMWs.

However, the number of CMWs is limited due to the capacity of the operational mainframe of the computer systems at MSC. Therefore, the software for the satellite wind derivation was transplanted from the mainframe to a workstation in order to prepare enough capacity and resources for the development of the high-density winds derivation. The encoder for the standardized BUFR format has already installed in the software and is under testing for the operational use.

## 3. Investigation with the EUMETSAT QI scheme

### 3.1 Preparation of the QI processing software

The EUMETSAT QI calculation software for GMS-5 CMWs was prepared in May 2001 referring to the software source code of EUMETSAT scheme, which was brought from EUMETSAT to JMA on 16 October 2000.

### 3.2 Preliminary result of EUMETSAT QI evaluation

Since June 2001, the quality of the GMS-5 CMWs has been investigated with the EUMETSAT QI scheme comparing with the rawinsonde data. This paper reports the result of preliminary evaluation of EUMETSAT QI for July 2001.

The evaluation was made in the area from 50N to 50S and from 90E to 170W with the CGMS wind validation statistics, namely RMSVD: root-mean-square values of cloud motion vectors difference (m/s), BIAS: average of speed differences (m/s), SPD: average of wind speed measured by rawinsonde (m/s), NCMV: number of cloud motion vectors (histogram).

#### 3.2.1 VIS and IR winds

The relationships between the QI and the accuracy of CMWs compared with rawinsonde are shown in Figure 1 for VIS low-level winds and in Figure 2 for IR high-level winds respectively. The altitude in troposphere is divided into three levels, i.e. low-level (up to 700 hPa), middle-level (more than 700 hPa and up to 400 hPa) and high-level (more than 400 hPa). The QI is divided into ten classes, more than zero to 0.1, more than 0.1 to 0.2 and so on.

In these figures, it is found that the RMSVD and BIAS for VIS and IR are decreasing corresponding to the increase of QI as same as the results of the METEOSAT derived winds reported by EUMETSAT at the thirds International Winds Workshop (IWW-3). The wind vectors with QI larger than 0.8 have the accuracy almost as same as that of the GMS manual QC as shown in Table 1.

In this regard, it is possible that the QI in VIS and IR channels is effective for the automatic QC of CMWs in operational use, although the further investigation is required for the justification of the evaluation.

#### 3.2.2 WV winds

The relationships between the QI and the accuracy of WVMWs compared with rawinsonde are shown in Figure 3 for the high-level WVMWs and in Figure 4 for middle-level WVMWs respectively. The BIAS for high-level WVMWs becomes positive as increasing of QI.

The RMSVD and BIAS for the middle-level WVMWs become very bad with the positive bias in the classes of QI from 0.4 to 0.9, because it is assumed that the heights of many vectors in clear region are assigned lower than the actual heights. The improvement of the height assignment for WVMWs is indispensable for the operational use of the middle-level WVMWs.

## 4. Future plan

### 4.1 Improvement of GMS wind derivation software

MSC will continue to develop the GMS winds derivation software. The main targets for the development are:

- to improve the method of height assignments for the WVMWs in the clear region and the semi-transparent CMWs and
- to increase the low-level wind vectors in the night.

### 4.2 Investigation on quality index for GMS winds

UW-CIMSS kindly prepared JMA with their satellite winds derivation software and a sample of the BUFR data including the quality index of RFF in June 2001. JMA will investigate the accuracy of the GMS CMWs with RFF. JMA thanks EUMETSAT and NOAA/NESDIS/UW-CIMSS for providing the software and sample data and hopes to cooperate with EUMETSAT and UW-CIMSS through NOAA/NESDIS in order to improve the quality indices of QI and RFF.

**Table 1 Accuracy of EUMETSAT QI compared with GMS Manual QC**

| Cannel | VIS | | IR | |
|---|---|---|---|---|
| Quality check | Manual QC | QI (>0.8) | Manual QC | QI (>0.8) |
| RMSVD | 3.5 | 4.4 | 9.0 | 8.1 |
| BIAS | -0.1 | 0.7 | -1.5 | -1.9 |

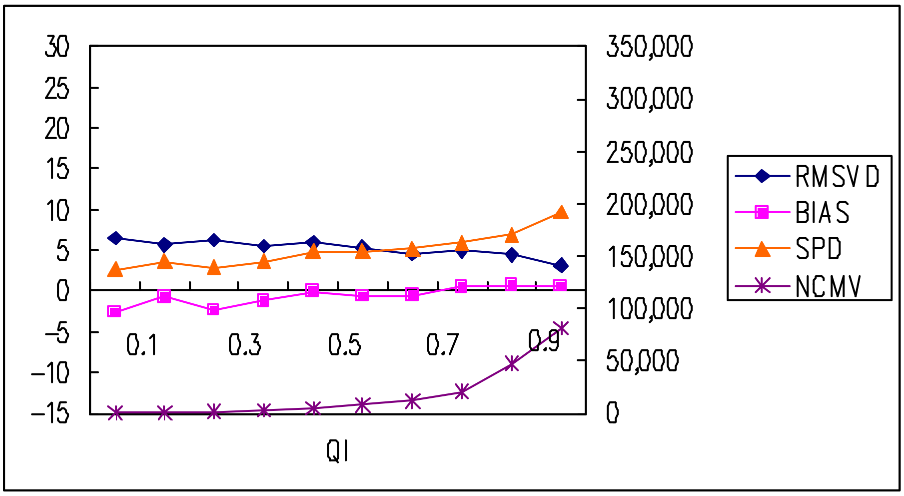


**Fig. 1 Relationship between QI and CMW-Rawin for VIS low-level winds (July 2001)**

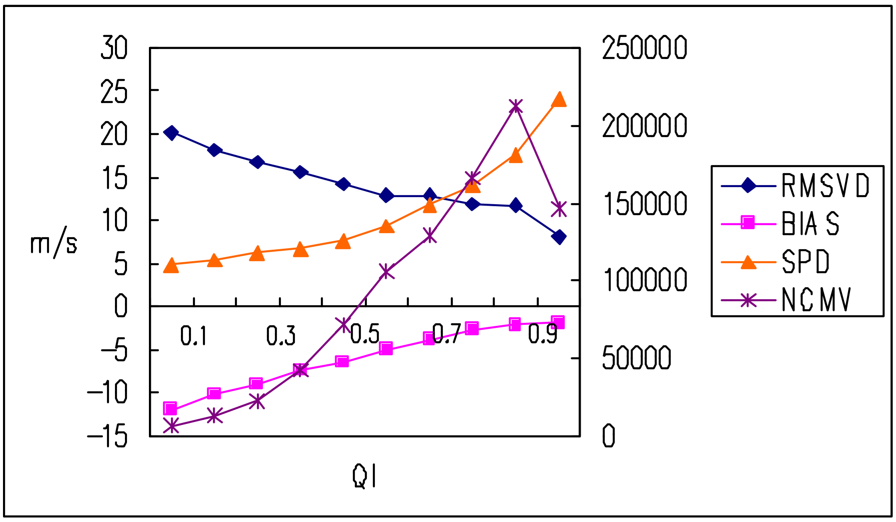


**Fig. 2 Relationship between QI and CMW-Rawin for IR high-level winds (July 2001)**

Right axis: NCMV (histogram number)
Left axis: RMSVD, BIAS and SPD (m/s)
RMSVD: Root-Mean-Square values of Cloud Motion Vectors Difference (m/s)
BIAS: Average of speed differences (m/s)
SPD: Average of wind speed measured by rawinsonde (m/s)
NCMV: Number of Cloud Motion Vectors (histogram)

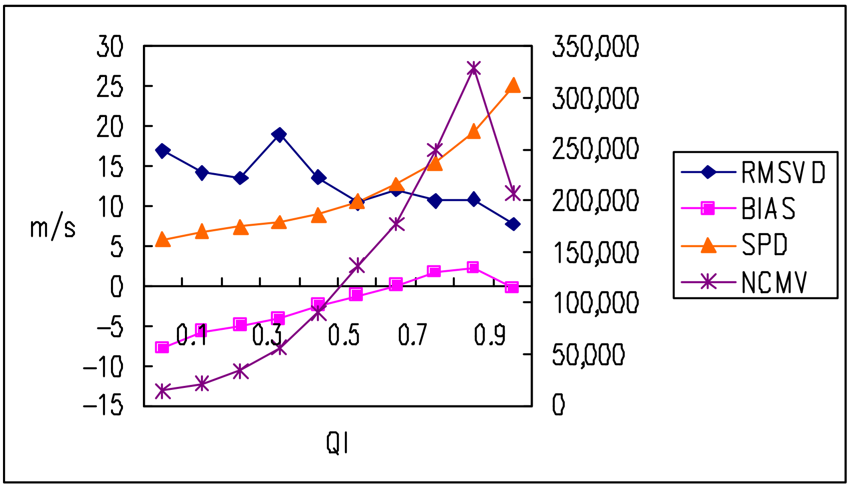


**Fig. 3 Relationship between QI and WVMW-Rawin for WV high-level winds (July 2001)**

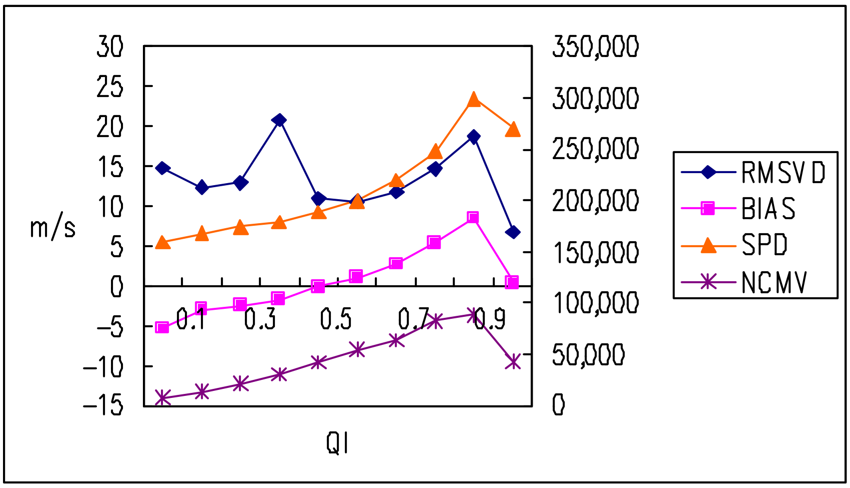


**Fig. 4 Relationship between QI and WVMW-Rawin for WV middle-level winds (July 2001)**

Right axis: NCMV (histogram number)
Left axis: RMSVD, BIAS and SPD (m/s)
RMSVD: Root-Mean-Square values of Cloud Motion Vectors Difference (m/s)
BIAS: Average of speed differences (m/s)
SPD: Average of wind speed measured by rawinsonde (m/s)
NCMV: Number of Cloud Motion Vectors (histogram)