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# Results of recent improvements in the quality of operationally derived CMVs from INSAT data.

**Summary**

This paper summarizes the results of improvements incorporated during last two years in the operational scheme for derivation of CMVs from INSAT data. Change were introduced in three phases after which the quality of operational CMVs has improved and improved quality is being sustained since last two years. Other operational centers have also confirmed improved quality of INSAT CMVs and these are found useful by the NWP centers.

**Action Proposed : None**

**Results of recent improvements in the quality of**

**operationally derived CMVs from INSAT data.**

## 1. Introduction:

As a result of persistent efforts over the last two years for improving the quality of operational CMVs derived from INSAT, sufficiently good quality of CMVs are now being derived with INSAT for operational use by a number of users. Prior to this, the main problems identified in the INSAT CMVs were;

- Quite high values of rms and biases for all levels .

- Low level CMVs of comparatively poor quality and not fitting the normal synoptic scale flow patterns.

- Tendency of CMVs to show more zonal flow.

- Comparatively large negative bias of high level CMVs.

- No winds derived over the areas influenced by synoptic scale tropical disturbances.

## 2. Changes made in the operational scheme:

With a view to make significant improvements in the quality of operational CMVs, systematic studies were conducted to identify the best possible solutions to the above problems recognizing the existing limitations of highly inclined orbit of the INSAT-1D satellite and the comparatively coarse resolution of the infrared channel ( 11 Km ).

**Changes in the operational scheme of CMV derivation were introduced in three phases.**

### Phase – 1 ( 1 Nov, 99 ):

During the first phase, use of Limited Area Model(LAM) forecast, being run operationally at IMD, for automatic quality control of CMVs was started as a first step. Since LAM assimilates operationally the INSAT CMVs as an important input for initialization of the model, it is expected that use of LAM for quality control will improve INSAT-CMVs . In addition, in the height assignment scheme for the CMVs, LAM forecast was used to assign the nearest pressure level ( hPa ) based on the brightness temperature ( Tbb) for the tracer type.

INSAT derived CMVs were compared with the LAM forecast. Results showed improvement in the quality of operational CMVs as a result of above mentioned changes.

**Phase-2 (1 Dec, 1999)**

Proper navigation of tracer and target images is a very important requirement from the point of view of deriving good quality CMVs. Prior to introduction of changes in the CMV derivation scheme,operational practice in use was to copy the navigation of central image to the other two images of the triplet taken at half hourly intervals

Considering that INSAT-1D had started operating in an inclined orbit mode,it was thought that proper navigation of each image is very important. Hence the earlier practice of copying navigation of central image to the other two was discontinued. Navigation of each triplet image was started. As a result of this improvement in the quality of operational CMVs, spurious wind component was also minimized. RMSE and biases at all levels were also improved as a result of introducing this change.

**Phase-3 (1 Feb,2000)**

Proper height assignment to the derived wind vectors is very important in order to ensure good quality of CMVs. In the original scheme of CMV derivation the methodology in operational use was to assign height on the basis of modal temperature of all pixels in the scene. Recognising the limitations of this scheme, modifications were introduced to make use of the mean temperature of 25% of coldest pixels and use this as brightness temperature(TBB) for the purpose of height assignment.

This method yielded more CMVs of acceptable quality. Because of better height assignment quality of middle and high level CMVs was also improved. Some winds around synoptic scale tropical disturbances were also derived which were found to fit the general synoptic scale flow pattern.

After making all changes as indicated above in 3 phases, the INSAT-CMVs were compared with the co-located METEOSAT-5 derived CMVs. Much better agreement was found between the two data sets as compared to the earlier comparison when changes were not introduced. UK Met Office has also confirmed improvement in the quality of INSAT CMVs since last 2 years or so. ECMRWF monitoring reports also indicate improvements in the quality of operational CMVs.

## 3. Results of long-term comparison:

The quality of operational INSAT derived CMVs were evaluated on the basis of bias and rms error computed for a long time series of data set(Jan.,1999 to

Aug.,2001). The rms and bias of INSAT derived CMVs were also computed by the UK Met office against their Model forecast and supplied to IMD every month. The rms and bias of Meteosat-5 against the UK model forecast were also supplied every month by them since Jan. 1999. We have also been computing the rms and bias of INSAT derived CMVs against the LAM model at IMD, New Delhi on a monthly basis since November, 1999.

The rms and bias are computed for four different regions. These are computed at various pressure levels and then grouped into low level (1000 – 700hPa), Medium level (699-400hPa), and high level( 399-100 hPa) for each region. On the basis of this analysis ,it may be stated that the rms and bias of INSAT derived CMVs are comparable to that of Meteosat–5, after the improvements were carried out. The rms and bias of tropical region is shown in fig. 1(a,b) where the number of CMVs are high compared to other regions. The blue line shows the rms and bias of Meteosat –5 and red line shows rms and bias of INSAT-1D in Fig-1(a & b) respectively. In both the cases the errors were computed against the UK model forecast, while yellow line shows the rms and bias of INSAT-1D derived CMVs against LAM forecast model. It may be seen that rms and bias error of CMVs derived from INSAT-1D computed against LAM and UK model forecast are close to each other. These errors are also within the range of $\pm$1 m/sec for bias and 4-8 m/sec for rms both for INSAT and Meteoset-5 CMVs. In case of tropical region, the bias and rms of low level CMVs are $\pm$ 2 m/sec and 4-8 m/sec respectively [Fig-1(a,b)]. These errors appear to be little less in case of medium [fig.2(a,b)] and little higher in case of high level due to less number of winds at higher level [fig.3(a,b)] .

## 4. Conclusion:

It can therefore be concluded that the quality of operational CMVs derived from INSAT has improved considerably. The improved quality is being sustained for last two years. They are also found to be useful by the Numerical weather forecast centers.