Himawari-8 Atmospheric Motion Vector
Kazuki Shimoji
Japan Meteorological Agency / Meteorological Satellite Center

1. Introduction

The Himawari-8 (JMA) launched Himawari-8 on December 23, 2014 and started operation in May 2015. The Himawari-8/9 (JMA) has 14 channels with a spatial resolution of 2.5 km and forward motion vectors derived. Himawari-8/9 AMV data coverage has been improved as follows (figure 6) by upgrade to AHI and introduction of new tracking algorithm. In comparison with MTSAT AMVs, middle level (400-700hPa) winds are retrieved well in Himawari-8 winds. Root Mean Square Vector Difference (RMSE) of Himawari-8 AMV against sonde (table 1) is about 3-4m/s at high level (100-400hPa), 4-5m/s at middle level (400-700hPa) and 6-7m/s at low level (700-1000hPa) for June 2015. Wind speed BIAS (AMV - sonde) of AMV against sonde is less than ±1 m/s for all levels. Looking at AMV consistency against JMA-GSM first guess (figure 7), RMSE over land area is larger than over oceanic area.

4. Characteristics of Himawari-8 AMV

Himawari-8 AMV using Himawari-8 imagery and new algorithm

Table 2  : Himawari-8 6.9um (WV) AMVs sonde statistics for June 2015 (QI>85)

<table>
<thead>
<tr>
<th>Category</th>
<th>BIAS</th>
<th>RMSVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>2.96</td>
<td>6.23</td>
</tr>
<tr>
<td>Low</td>
<td>-0.20</td>
<td>5.33</td>
</tr>
<tr>
<td>Trop</td>
<td>2.92</td>
<td>6.23</td>
</tr>
<tr>
<td>ALL</td>
<td>0.59</td>
<td>5.33</td>
</tr>
</tbody>
</table>

Himawari-8 B13 and MTSAT-2 IR AMV (QI=60, 17UTC 14th January 2015)

Himawari-8 AMV using Himawari-8 imagery and new algorithm

MTSAT-2 AMV using MTSAT-2 imagery and heritage algorithm

References

Shinjo, K., 2014: Motion tracking and cloud height assignment methods for Himawari-8 AMV. Proc. 12th Int. Winds Workshop, Copenhagen, Denmark, ELAM/MTSAT.


2. Tracking Algorithm

It is considered that using small target box for AMV derivation is an easy way to retrieve small scale wind but use of small target box does not lead to give results necessarily because tracking error is significantly increased. In such case, spurious peaks on cross correlation surface can be appeared. This means that results necessarily because tracking error is significantly increased. In such case, It is considered that using small target box for AMV derivation is easy way to exclude spurious maxima is required. In tracking algorithm of Himawari-8 AMV, derived from averaged surfaces.

3. Cloud Height Estimation

Height assignment algorithm for Himawari-8 AMV is based on maximum likelihood estimation method as same as tracking method. The height assignment consists of five processes.

Test data satellite in 2014 and started its operation in July 2015. It is the first operational geostationary satellite in Japan. Himawari-8 AMV data coverage has been improved as follows (figure 6) by upgrade to AHI and introduction of new tracking algorithm. In comparison with MTSAT AMVs, middle level (400-700hPa) winds are retrieved well in Himawari-8 winds. Root Mean Square Vector Difference (RMSE) of Himawari-8 AMV against sonde (table 1) is about 3-4m/s at high level (100-400hPa), 4-5m/s at middle level (400-700hPa) and 6-7m/s at low level (700-1000hPa) for June 2015. Wind speed BIAS (AMV - sonde) of AMV against sonde is less than ±1 m/s for all levels. Looking at AMV consistency against JMA-GSM first guess (figure 7), RMSE over land area is larger than over oceanic area.

4. Characteristics of Himawari-8 AMV

Himawari-8 B13 and MTSAT-2 IR AMV (QI=60, 17UTC 14th January 2015)

Himawari-8 AMV using Himawari-8 imagery and new algorithm

MTSAT-2 AMV using MTSAT-2 imagery and heritage algorithm

References

Shinjo, K., 2014: Motion tracking and cloud height assignment methods for Himawari-8 AMV. Proc. 12th Int. Winds Workshop, Copenhagen, Denmark, ELAM/MTSAT.


2. Tracking Algorithm

It is considered that using small target box for AMV derivation is an easy way to retrieve small scale wind but use of small target box does not lead to give results necessarily because tracking error is significantly increased. In such case, spurious peaks on cross correlation surface can be appeared. This means that information included in very small target box is not enough for pattern matching. In order to compensate this lack of data, information of neighboring pixels are required. In tracking algorithm of Himawari-8 AMV, averaged surface of four correlation surfaces computed in forward and backward matching for small and large target box under assumption that natural atmospheric motion should have temporal and spatial continuity. We use cross correlation itself in the same as MTSAT AMV tracking algorithm. The only difference is that motion vectors for quality control and final output are derived from averaged surfaces.

4. Characteristics of Himawari-8 AMV

Himawari-8 B13 and MTSAT-2 IR AMV (QI=60, 17UTC 14th January 2015)

Himawari-8 AMV using Himawari-8 imagery and new algorithm

MTSAT-2 AMV using MTSAT-2 imagery and heritage algorithm

References

Shinjo, K., 2014: Motion tracking and cloud height assignment methods for Himawari-8 AMV. Proc. 12th Int. Winds Workshop, Copenhagen, Denmark, ELAM/MTSAT.

