ATMOSPHERIC MOTION VECTOR (AMV) ANALYSIS TOOLS IN THE NSMC AMV DERIVATION SCHEME

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ABSTRACT

Atmospheric Motion Vector (AMV) derivation tools used in NSMC AMV derivation scheme are introduced. The AMV product is sensitive to the data processing scheme. A small change in algorithm may cause a big difference at the results. Statistics of product performance is often utilized to estimate impact from changes at data processing algorithm. Although statistics has ability to diagnose inappropriate points at data processing, it needs a long validation period and a larger amount of samples to perform well.

In the NSMC AMV derivation scheme, man machine interactive tools have been designed. With these tools, image animations, parameters, scatter diagrams, even measurements of individual pixels at the screen in form of images, graphics or texts can be visualized. The calculation process of individual wind vectors can therefore be monitored providing a way to watch the data and learn from the data.

The major tools are as follows:
- Watch image of any individual tracer at different channels
- Watch animation of any individual tracer on the image
- Watch correlation of any individual tracer on the image
- Watch scatter diagram of any individual tracer on the image
- Watch intermediate parameters of individual AMVs, such as position of tracers expressed as i j accounts latitudes and longitudes, maximum and minimum measurements, maximum and minimum brightness temperatures, correlation coefficient between IR and WV measurements, slope at IR WV scatter diagram, brightness temperature before and after adjustment, pressure level, wind velocity etc.
- Watch NWP and radiosonde reports
- Display AMVs at different projections
- Simultaneously display AMVs, radiosonde wind vectors, radiosonde temperature and humidity profile, and parameters useful at height assignment
- Error statistics and display
- Comparison at different ways of error statistics is discussed.

1. Introduction

AMV derivation programs are large and complex. In the programs, judgements and paths need to be decided. Thresholds are chosen at making decisions. AMV product quality is sensitive to thresholds or paths chosen. A small difference at thresholds or paths chosen may cause a big difference at AMV calculation results.

Statistics of AMV product performance are often adopted to estimate impact of AMV programs or algorithms at the product quality. Although statistics does have ability at diagnosing algorithm or program performance, it needs a long validation period and a large amount of samples.

In the NSMC AMV derivation scheme, man-machine interactive tools are used to assist thresholds choosing and performance estimation. In this paper, tools of analysis and diagnose used in the NSMC AMV derivation scheme are introduced.

2. Display Functions

The display program shows not only AMV products, but also detail information of individual AMVs and comparison data.

On the screen, AMVs are overlapped with image. Overlay display of AMVs with image supplies sophisticated tool in image analysis. It also helps at diagnosing the AMV distribution pattern.

The detail information of each wind vectors can be accessed with mouse clicking. This information helps AMV derivation personal to understand the calculation process. Four times a day AMVs are processed. The latest products always cover the previous ones. Thus, only the detail parameters of the latest processed are maintained in the system and accessible. The content of accessible parameters is shown in Table 1.

Table 1. The content of accessible parameters

Position of tracer (i, j)
Position of tracer (Lat., Lon.)
Movement of tracer
Correlation coefficient matrix at tracing component
Maximum and minimum measurements in the tracer region
Maximum and minimum bright temperature (BT) in the tracer region
Correlation coefficient between IR and WV measurements
Slope at IR—WV scatter diagram
5% minimum BT before and after adjustment
Wind velocity
Wind direction
Pressure level of AMV

In order to estimate quality of AMVs, NWP grid data, radiosonde data and AMV data from other centers are assessable together with NSMC AMV data. Radiosonde data are also shown in graphic form.

Variety display function can easily be reached by mouse clicking at menus: view latest IR images, view latest WV vectors, view archived vectors, Lat./Lon projection display (NWP grid data display included), Animation display, screen zooming display and comparison display. At present, the detail information of each wind vectors can be accessed only at viewing latest IR or WV images. In viewing archived images, this is not yet reached, because the information is not maintained in the historical data. The Projection, animation, and zooming functions are available for users.

3. Utilization Examples

3.1 Tracing Component

In order to diagnose tracing results, the following parameters can be monitored by mouse clicking:

- Position of tracer (i, j)
- Position of tracer (Lat., Lon.)
- Movement of tracer
- Correlation coefficient matrix at tracing component

Display to (i, j)/(Lat., Lon.) position and movement of individual tracer helps the AMVs derivation personal to judge the correction of tracing result.

Maximum correlation is the bases of tracer tracing. Sometimes multi maxims appear on the correlation matrix. In the NSMC scheme, the most continuous first and second maximum peaks between two continuous tracing pairs are chosen to calculate wind vector. To diagnose, mouse clicking can monitor the first and second maximum peaks.

3.2 Height Assignment Component

The NSMC scheme does not make efforts to select targets. After monitoring a great number of cases, it is considered not necessary to select targets. Mouse clicking displays the following height assignment information:

- Maximum and minimum measurements in the tracer region
- Maximum and minimum bright temperature (BT) in the tracer region
- Correlation coefficient between IR and WV measurements
- Slope at IR—WV scatter diagram
- 5% minimum BT before and after adjustment
- IR—WV scatter diagram

IR—WV scatter diagrams are helpful at height assessment. By comparison of individual cases, appropriate thresholds are chosen to distinguish high and low clouds. In the NSMC scheme, target height assessment is performed before target height adjustment.

3.3 Quality Control Component

Although quality controls are made at the end of each component, total quality assessment is still performed. Wind velocity, wind direction, pressure level of AMVs is accessible by mouse clicking. Radiosonde data and AMV data from other centers are displayed together with NSMC AMV data. Radiosonde data are also shown in graphic form. At present, this function is not performed in real time. When radiosonde data and AMVs of other centers arrive, the AMV operation has already terminated, and the AMV products sent out. The simultaneous display function helps at diagnosing.

4. Summary

Variety of display function of the NSMC AMV derivation scheme that monitors the whole process of AMV derivation and help at improving product quality has been presented.

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