CGMS

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IMPLEMENTATION OF THE CCC METHOD INTO THE NOWCASTING SAF ATMOSPHERIC MOTION VECTORS SOFTWARE PACKAGE.

EUMETSAT and the Nowcasting Satellite Application Facility (NWC SAF) have implemented the new CCC AMV height assignment scheme (Borde and Oyama, 2008) into the NWC SAF AMV software for testing the impact of this method in the NWC SAF AMV retrieval software package. The implementation has been done in June 2010 at NWC SAF, and preliminary results show some improvements on the AMV products in HRV and IR10.8 channels. The present paper summarizes the current status of this work.

The paper is related to Recommendation 37.22: IWW 10 is requested to address the development of a stand-alone software package for the derivation of AMVs from imaging satellite instruments.

Implementation of the CCC method into the Nowcasting SAF Atmospheric Motion Vectors software package.

1 INTRODUCTION

The EUMETSAT Satellite Application Facilities (SAFs) are dedicated centres of excellence for the processing of satellite data, and form an integral part of the distributed EUMETSAT Application Ground Segment.

The main objective of the SAF on Support to Nowcasting and Very Short-Range Forecasting, NWC SAF, is to provide, develop and maintain software packages to be used with operational meteorological satellite data for Nowcasting applications by National Meteorological Services. More information about the project can be found at the NWC SAF webpage, http://www.nwcsaf.org.

The so-called PGE09 product of the NWC SAF/MSG software package refers to the component for the calculation of High Resolution Winds (HRW), using the MSG HRV (High Resolution Visible) and IR108 (Infrared 10.8) channels.
A complete description of the Algorithm Theoretical Basis Document (ATBD) for High Resolution Winds can be found on the NWCSAF internet website: http://www.nwcsaf.org/indexScientificDocumentation.html

The current NWC SAF/HRW AMV software uses the NWC SAF/Cloud type (PGE02) product to select the pixels used for the AMV Height Assignment (HA). 17 different cloud types can be identified for the moment. Possible cloud type values as they appear in NWCSAF software are presented in Table 1. Pixels of the most common cloud type present in the target box used to track the wind are considered for HA calculation. However, the amount of pixels of the most common cloud type must be at least 50% larger than the amount of the second one. If this is not the case, the target is considered as EUMETSAT a multilayer situation. Once the pixels are selected the AMV height is assigned to the cloud top or to the cloud base of the identified cloud type.

0	Non processed cloud type	14	Very high opaque cumulus/stratus
1	Cloud free land	15	High semitransparent thin clouds
2	Cloud free sea	16	High semitransparent meanly thick clouds
3	Land contaminated by snow/ice	17	High semitransparent thick clouds
4	Sea contaminated by ice	18	High semitransparent above other clouds
6	Very low cumulus/stratus	19	Fractional clouds
8	Low cumulus/stratus	20	Undefined cloud type
10	Medium cumulus/stratus	21	Multiple cloud types
12	High opaque cumulus/stratus		

Table 1: Possible values of the Tracer cloud type parameter provided to the AMV processing.

Selection of the pixels used for HA is a critical step in the AMV extraction algorithm, as it directly impacts the setting of AMV altitude. Borde and Oyama (2008) proposed to make a more direct use of the pixels used for the AMV tracking in order to perform the height

assignment (CCC method). The CCC method selects the pixels that most contribute to the tracking step, and then keeps a direct link between the feature tracked and the AMV HA.

EUMETSAT and NWC SAF planned to implement the CCC method in the NWC SAF/HRW AMV software and to test the impact on the AMVs extracted in HRW and IR10.8 channels.
It should be noted that HA is done before the tracking in the current NWC SAF/HRW AMV software, allowing to obtain a wind guess from the corresponding forecast profile and then to locate a priori the search area. This allows using smaller search areas and hence a reduced computing time. This is a major difference to the EUMETSAT algorithm which necessitated further changes in the quality control step of the algorithm, in order to use correctly the CCC method.

The pressure set to the AMV using CCC method is estimated using the cloud top pressure calculated by the NWCSAF/CTH (PGE03) product. Weighted pressures and standard deviations are calculated respectively. It has been implemented for MSG HRV and MSG IR10.8 channels.

2 EXAMPLE

Figure 1 shows the AMVs extracted in HRV and IR10.8 channels over Europe using the current scheme (upper) and CCC scheme (lower). Red and pink colours correspond to IR10.8 and HRV AMVs between 200 and 400 hPa, dark blue and light blue to IR10.8 and HRV AMVs between 400 and 600 hPa, orange and yellow to IR10.8 and HRV AMVs between 600 and 800 hPa and dark and clear green to IR10.8 and HRV AMVs between 800 and 1100 hPa.

Several differences can be noted regarding the amount of AMVs and their altitude.

AMVs extracted using the CCC method tend to redistribute AMVs to high levels and low levels whereas the current scheme gives more AMVs at mid-level. A vertical distribution mainly at high and low levels is in better agreement with the current AMVs extracted at EUMETSAT and CIMSS. Fewer AMVs are generally extracted at mid levels.

Some apparent improvements are:

- Neighbouring AMVs are more frequently at the same altitude using the new scheme, which show more homogeneous and coherent flows. The corresponding altitude is of course in agreement with the cloud top height product, which is directly used to calculate it.

- Preliminary comparisons against radiosonde observations show some improvements using CCC method on the Normalised RMS Vector Difference (NRMSVD) and/or speed biases, especially for low levels and mid level clouds. However the statistics were done on a very limited area and period. Further detailed statistical analyses are currently ongoing for a longer period.

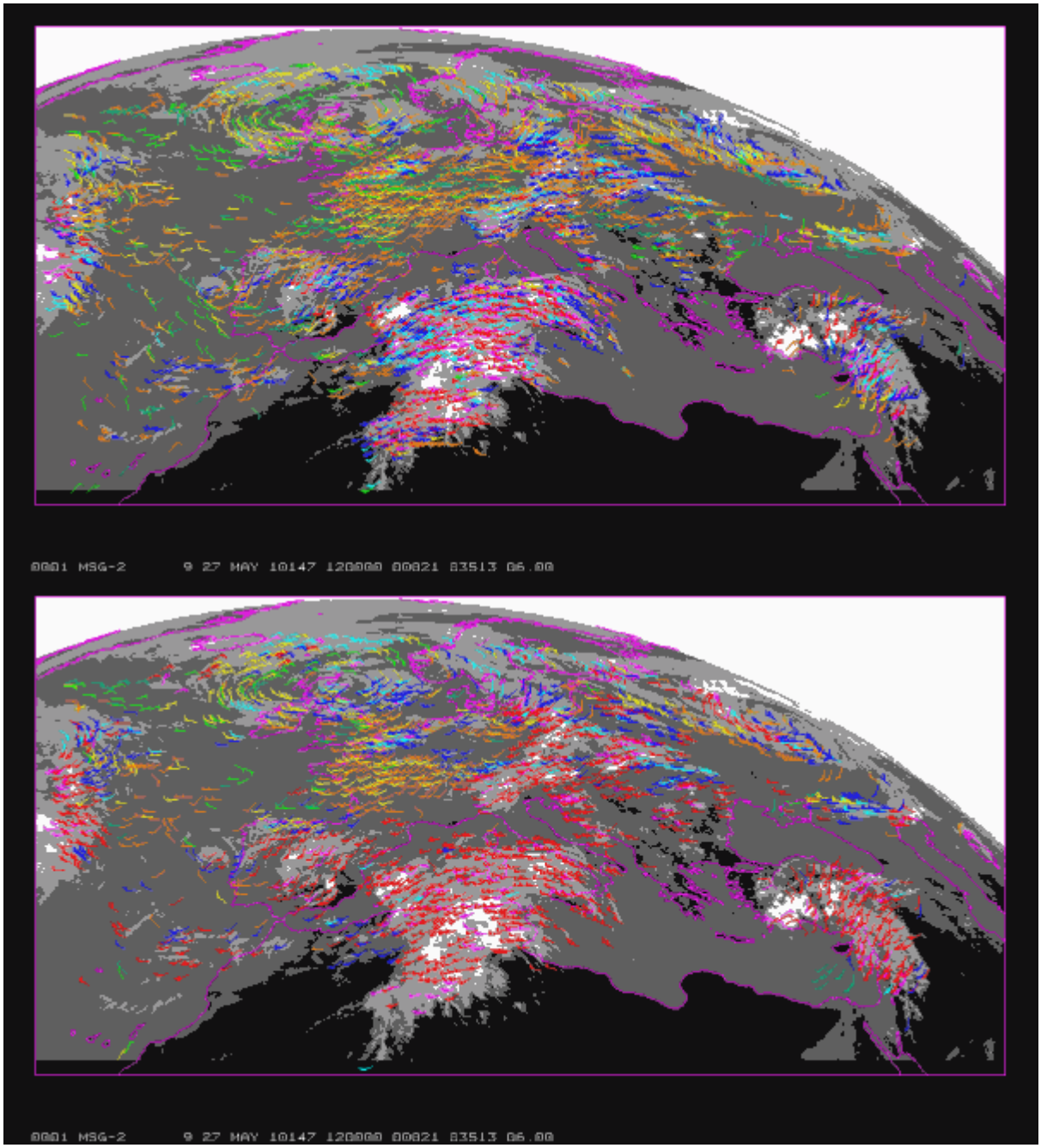

Figure 1: AMVs extracted using HRV and IR10.8 channels over Europe using the current software (upper) and CCC scheme (lower)

3 PRELIMINARY CONCLUSION AND DISCUSSION

- Tests showed that the CCC method has been introduced correctly in the NWC SAF/HRW AMV software. The correlation coefficients, weighted pressure and weighted standard deviations are correctly estimated for both HRV and IR10.8 channels.
- Use of the CCC method led to several other changes in the algorithm, especially regarding the use of the forecast fields, the estimation of the AMV quality, the use of wind guess for tracking. All these changes are important and needed for individual careful checks.
- A long period statistical analysis against radiosonde observations is currently ongoing to estimate the benefits of the CCC method on the HRW product.

Building a generic software package for extraction of Atmospheric Motion Vectors that can be easily installed and used by everyone has been discussed at last CGMS meeting and at IWW10. Various needs or wishes have been identified during discussions at IWW10, and it appears that the existing software developed at NWC SAF to extract HRV and IR10.8 AMVs can clearly meet most of those expectations.