AMVs – how to make better use of them in NWP?

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Atmospheric Motion Vectors (AMVs) are wind observations derived by tracking clouds or water vapour features in consecutive satellite images. It is assumed that the tracked features act as passive tracers of the atmospheric flow. Traditionally AMVs are interpreted as single-level wind observations assigned to a representative pressure level provided by the AMV producers. AMVs are obtained both from geostationary and polar-orbiting satellites, and already for several years they have provided an important source of tropospheric wind information for global and regional data assimilation systems. AMVs have complicated error characteristics due to the nature of the derivation process. Thus, the key question is how we could get the full potential from these observations for numerical weather prediction. In this presentation two aspects, observation errors and observation modelling are discussed.

The two main sources of errors for AMVs are the wind vector tracking and the height assignment of the observations. The latter is considered to be the dominant source of error and its impact is highly situation dependent. It can be very significant in regions where wind shear is strong but on the other hand it is less relevant in areas where there is not much variation in wind speed with height. These error characteristics can be accounted in data assimilation by estimating the tracking error and error in wind due to error in height assignment separately and combining the estimates as a total, situation dependent, observation error for each AMV. This kind of approach has been recently tested in the ECMWF system. Experiments indicate significant positive forecast impact especially at low levels. The use of situation dependent observation errors has also enabled simplifications to the quality control applied for AMVs. As a result slightly more observations are accepted to be used in the model analysis.

Another area for possible improvements is the interpretation of AMVs. Several studies have suggested some benefit from interpreting AMVs as layer averages instead of single-level wind observations. Studies are ongoing to investigate this aspect in the data assimilation context, and the latest results will be discussed in the presentation.