



Assimilation of GOES-R Atmospheric Motion Vectors (AMVs) in the NCEP Global Forecast System

Methodology

Using Meteosat-9 & 10 SEVIRI imagery, proxy data have been created with the new GOES-R ABI Nested Tracking Algorithm. 4 AMV types have been processed to represent ABI Channel 2 (visible, VIS), 7 (infrared, NIR), 8 (cloud top water vapor, CTWV), and 14 (infrared, IR). CTWV height is determined from the cluster brightness temperature linearly interpolated to a height using the forecast GFS temperature while the other AMV types have heights which are based on the GOES-R ABI cloud height. Assimilating this data within the GFS allows:

1. Collection of departure statistics to determine quality control procedures
2. Evaluation of the specification of the observation error on the Gridpoint Statistical Interpolation (GSI) minimization
3. Analysis of the AMV impact on the GFS analysis state and forecast skill

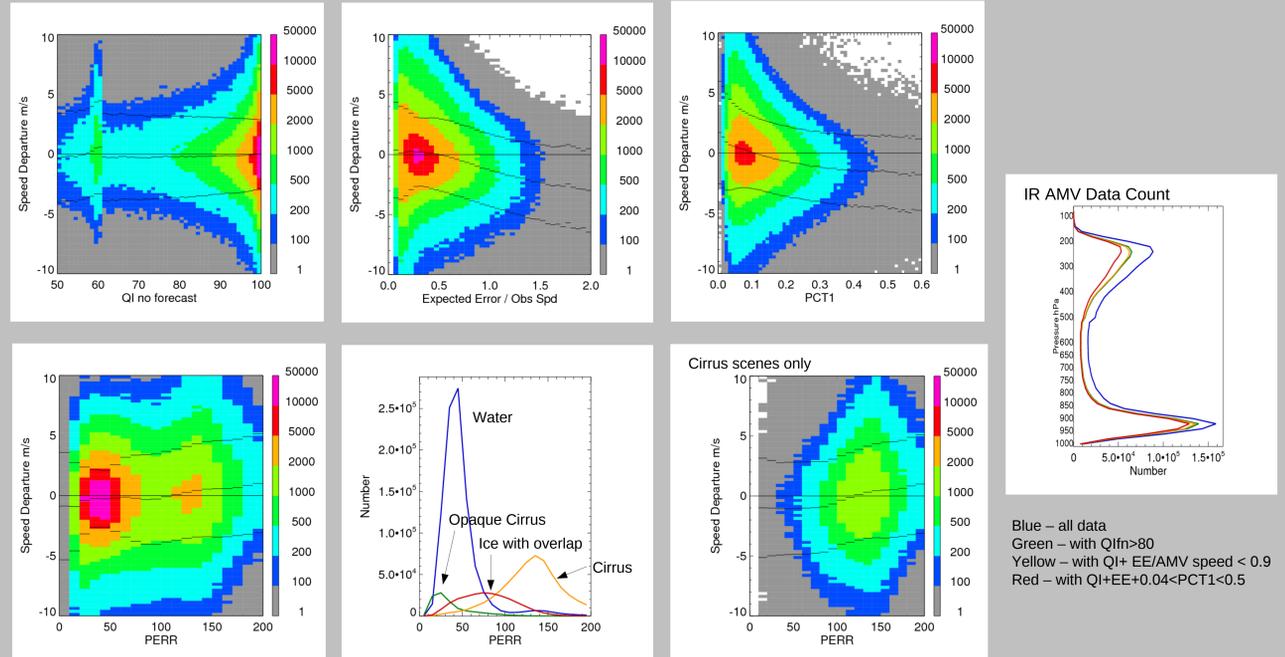
GFS results are shown for June 2012 using 6 hourly GOES-R AMVs. Future work includes investigating the impact of hourly GOES-R AMVs and modifications needed to the observation error settings. This work is funded by the GOES-R Risk Reduction Program.

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Quality Control

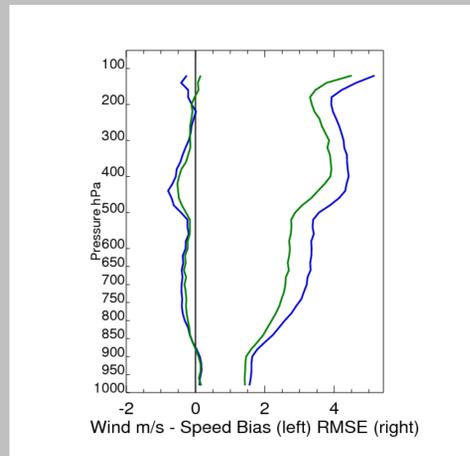
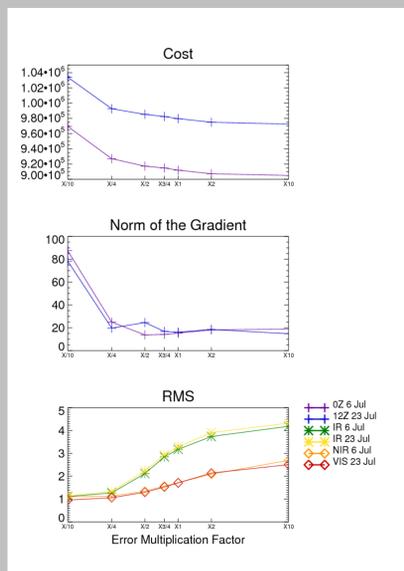
Parameters which were selected for quality control include Quality Indicator (QI, Holmlund 1998, top left), a normalized Expected Error (EE, Le Marshall et al. 2004, top center), as well as the nested tracking parameter PCT1 which is a measure of the standard deviation of the tracked cluster / distance the cluster traveled (top right). The top panels show the density plot of these parameter versus the AMV - GFS background speed for all IR AMV data in June 2012. The impact of the three quality control settings on the data count is shown as a function of pressure (far right). An estimate of the uncertainty of the cluster height in hPa (PERR) was not selected for quality control (bottom panels). PERR is a dependent on the cluster cloud type dominant in the scene (bottom center) and setting a maximum threshold value would mostly impact cirrus. The density plot for cirrus scenes versus speed departure does show a speed departure dependence on PERR but the fast bias at large values of PERR is of the same magnitude as the slow bias at small values of PERR which should indicate a more accurate measure of the cluster height.



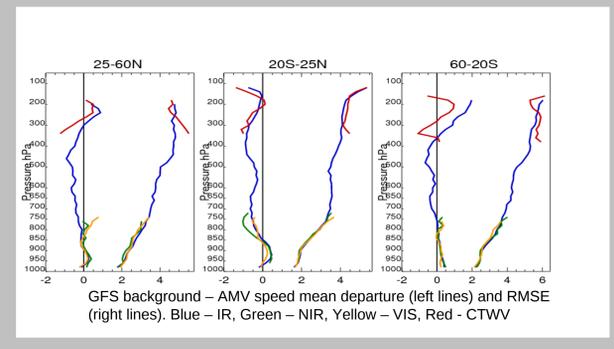
Holmlund, K. 1998. The utilization of statistical properties of satellite-derived atmospheric motion vectors to derive quality indicators. *Wea. Forecasting* 13.1093-1105.
Le Marshall, J., Rea, A., Leslie, L., Seecamp, R. and Dunn, M. 2004. Error Characterization of Atmospheric Motion Vectors. *Aust. Met. Mag.*, 53, 123 - 131.

Observation Error Settings

Experiments using a range of factors multiplied by the current GOES AMV observation error (X/10 to 10X) for one analysis cycle show increasing cost as the AMV error is reduced with a corresponding reduction in the AMV RMSE. Choosing a value of 75% (X3/4) of the GOES AMV improves the GOES-R AMV RMSE value without a large impact to the cost (left). Applying this observation error setting to a seasonal run shows a reduction in the GFS analysis - AMV speed departure as well as a reduction in the RMSE.

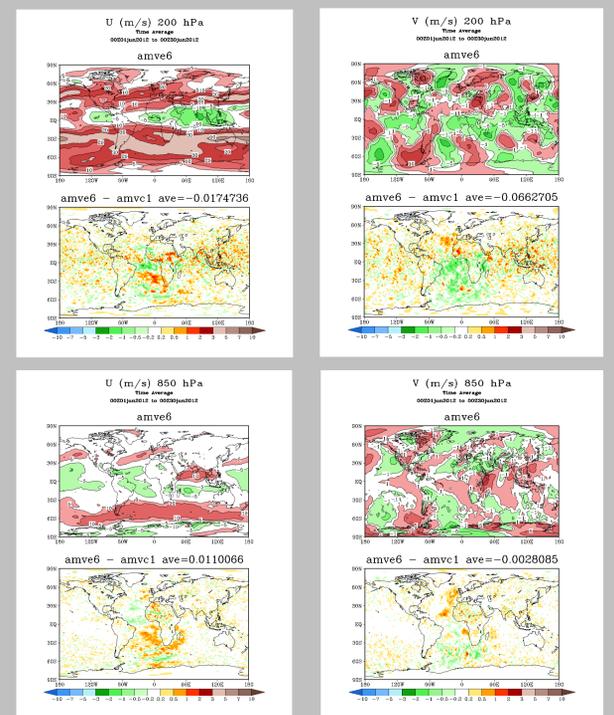


Departure Statistics



Impact on Analysis State

The U and V wind components is shown below for AMVE6 which included the GOES-R AMVs as well as the difference in the fields compared to the control run, AMVC1, which did not use AMVs from SEVIRI.



Impact on Forecast Skill

Experiment AMVE6 with GOES-R AMVs is compared to a control, AMVC1, which did not use AMVs from SEVIRI. Anomaly height correlation at 500 hPa shows small improvement within 48 hours (left). Tropical wind RMSE is reduced (center). Analysis vector wind fit to radiosondes is not degraded (right).

