Title: The Impact of Satellite Atmospheric Motion Vectors in the GMAO GEOS-5 Global Data Assimilation System

Authors: Gelaro, R., D. Merkova, K.-S. Tai, and W. McCarty

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Abstract

The impact of satellite-derived atmospheric motion vectors (AMVs) on numerical weather forecasts is examined using the GEOS-5 global atmospheric data assimilation system. Cycling data assimilation experiments, including twice-daily 5-day forecasts, are conducted for two 6-week periods during the 2010 Atlantic hurricane season and 2010-2011Northern Hemisphere winter season. Results from a control experiment that includes all AMVs and other data types assimilated operationally in GEOS-5 are compared with those from an experiment in which the GEOS-5 AMVs (only) are replaced by ones produced by the U. S. Navy's NAVDAS-AR atmospheric data assimilation system. The Navy AMVs are assimilated in their entirety as well as in various subset combinations. The primary objective of these experiments is to determine whether aspects of the NAVDAS-AR data selection and quality control procedure, especially the use of carefully averaged ("super-ob") wind vectors and large volume of AMVs, explain the typically larger beneficial impact of these data in the Navy system as compared with most other forecast systems. Adjoint-based observation impact calculations are assessed and compared with traditional metrics such as forecast geopotential height anomaly correlations and observation-minus-forecast departures. Results so far indicate that that the greater number of NRL AMVs is primarily responsible for their larger impact, although superobing also appears to be beneficial. Map views show that the impact obtained from assimilation of the NRL AMVs is more uniformly beneficial, perhaps due to the averaging of individual observations in creating the super-obs. While the NRL AMVs have a much larger impact in GEOS-5 than do the control AMVs, their impact is still smaller than in the Navy forecast system, suggesting that the mix of observations may play an important role in modulating the impact of any one data type. At the same time, reducing the number of satellite radiances assimilated in GEOS-5 does not significantly alter the impact of the AMVs.