# Evaluation of Observing Systems variations on Central US Water Cycle

Michael Bosilovich[a], David Mocko[b], Franklin R. Robertson [c] and Arlindo M da Silva [a]

[a] *Global Modeling and Assimilation Office, NASA Goddard Space Flight Center, USA, Michael.Bosilovich@nasa.gov*
[b] *SAIC and Global Modeling and Assimilation Office, NASA GSFC, USA*
[c] *Earth Science Office, NASA Marshall Space Flight Center, USA*

NASA's latest reanalysis, the Modern-Era Retrospective analysis for Research and Applications (MERRA), has shown significant improvement over previous reanalyses in terms of global, continental and basin scale climatological precipitation. However, details of regional water cycles still exhibit biases that result from model physics uncertainties interacting with an observation suite that varies in space and time. This paper investigates biases at the regional scale to provide understanding of the data assimilation, assimilated observations and forecast water cycle terms.

The extent of regional biases can be deduced from the magnitude and behavior of the non-physical increment terms of the conservation equations which provide a wealth of information as to the biases in model physics as well as the utility and veracity of the observations being assimilated. A new data set just now being released is called the MERRA Gridded Innovations and Observations (GIO). MERRA-GIO includes not only the observations assimilated in MERRA, but also the forecast and analysis departures compared to each observing system, in a straightforward data format. Using this data, we can ascertain the degree to which the reanalysis agrees with each observing system and how the observations influence the increments. Ultimately, we can identify the major observing system controls on the moisture, heat and radiative fluxes and transports.

This paper focuses on North America, where a strong dipole structure in the vertically-integrated moisture increments during the warm season signifies a discrepancy between E-P from the model physics compared to that derived by moisture transport. In this conventional data rich region, we will use the MERRA-GIO data set to determine the relative constraining roles of various observations and to examine the systematic forcing from model physics (or lack thereof) that requires correction. While the water vapor increments are significant in the region, and comparable to the moisture flux divergence, significant changes in the numbers of aircraft and profiler measurements of wind occur through the period.