The Impact of the Evolving Satellite Data Record on Reanalysis Water and Energy Fluxes During the Past 30 years.

[1*]Franklin. R. Robertson, [1]T. L. Miller, [2]M. G. Bosilovich, [2]J. Chen

[1]NASA/MSFC, 320 Sparkman Dr., Huntsville, AL

[2]NASA / GSFC Global Modeling and Assimilation Office, Greenbelt, MD

*Corresponding Author Email: pete.robertson@nasa.gov

Abstract

Retrospective analyses (reanalyses) use a fixed assimilation model to take diverse observations and synthesize consistent, time-dependent fields of state variables and fluxes (e.g. temperature, moisture, momentum, turbulent and radiative fluxes). Because they offer data sets of these quantities at regular space / time intervals, atmospheric reanalyses have become a mainstay of the climate community for diagnostic purposes and for driving offline ocean and land models. Of course, one weakness of these data sets is the susceptibility of the flux products to uncertainties because of shortcomings in parameterized model physics. Another issue, perhaps less appreciated, is the fact that the discreet changes in the evolving observational system, particularly from satellite sensors, may also introduce artifacts in the time series of quantities.

In this paper we examine the ability of the NASA MERRA (Modern Era Retrospective Analysis for Research and Applications) and other recent reanalyses to determine variability in the climate system over the satellite record (~ the last 30 years). In particular we highlight the effect on reanalyses of discontinuities at the junctures of the onset of passive microwave imaging (Special Sensor Microwave Imager) in late 1987 as well as improved sounding and imaging with the Advanced Microwave Sounding Unit, AMSU-A, in 1998. We examine these data sets from two perspectives. The first is the ability to capture modes of variability that have coherent spatial structure (e.g. ENSO events and near-decadal coupling to SST changes) and how these modes are contained within trends in near global averages of key quantities. Secondly, we consider diagnostics that measure the consistency in energetic scaling in the hydrologic cycle, particularly the fractional changes in column-integrated water vapor versus precipitation as they are coupled to radiative flux constraints. These results will be discussed in the context of implications for science objectives and priorities of the NASA Energy and Water Cycle Study, NEWS.