Quantifying observation influence on regional water budgets in reanalyses: Explaining excessive moisture divergence in the Central US Summer

PI: Michael G. Bosilovich Team: Franklin R. Robertson, J. Brent Roberts, Arlindo M. da Silva and David Mocko

NASA ENERGY AND WATER CYCLE STUDY NEWS

Problem:

- *Long term moisture flux over the Central US is divergent, implying E>P. This is a result of the data assimilation adding water (Fig 1). Trenberth (2011) hypothesizes a lack of simulated irrigation leads to the increment.. Sign and magnitude seem to agree, but it is not continuous in time.*
- *Can we provide strong evidence for an irrigation explanation, or are other factors driving the physical discrepancy? And, improve subsequent reanalyses*

Approach:

- Evaluate water budget over the Central US
- Implement a new MERRA data set called Gridded Innovations and Observations (GIO) which includes the forecast departure of each observations assimilated in the MERRA reanalysis.
- Relate assimilation statistics to the physical discrepancy to identify any observing system influence affecting variations in the water budget

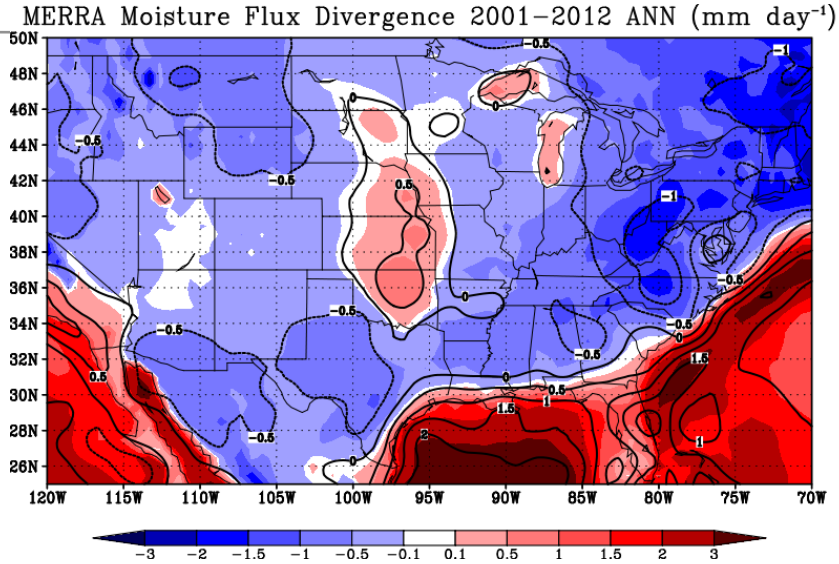

Figure 1. *Moisture flux divergence (MFD), following Trenberth (2011) showing divergence over the Central US, which implies E>P in the long term sense. Black contours show the analysis increment tendency for water vapor.*

Initial Results:

- MFD peaks in summer. Looking at summer budgets, the excessive MFD begins in 2001, and is not routinely occurring before.
- The change in MFD is concurrent with a change in the analysis increment of water vapor (Fig 2 top).
- Effective Gain shows how much the analysis draws toward an observation type. The water vapor effective gain is relatively unchanged through 2001 (Fig 2 bot).
- We are now working with a hypothesis that changes in the wind analysis are impetus for the changes in water vapor increment and MFD.
- Presently evaluating the background model MFD compared to analyzed.

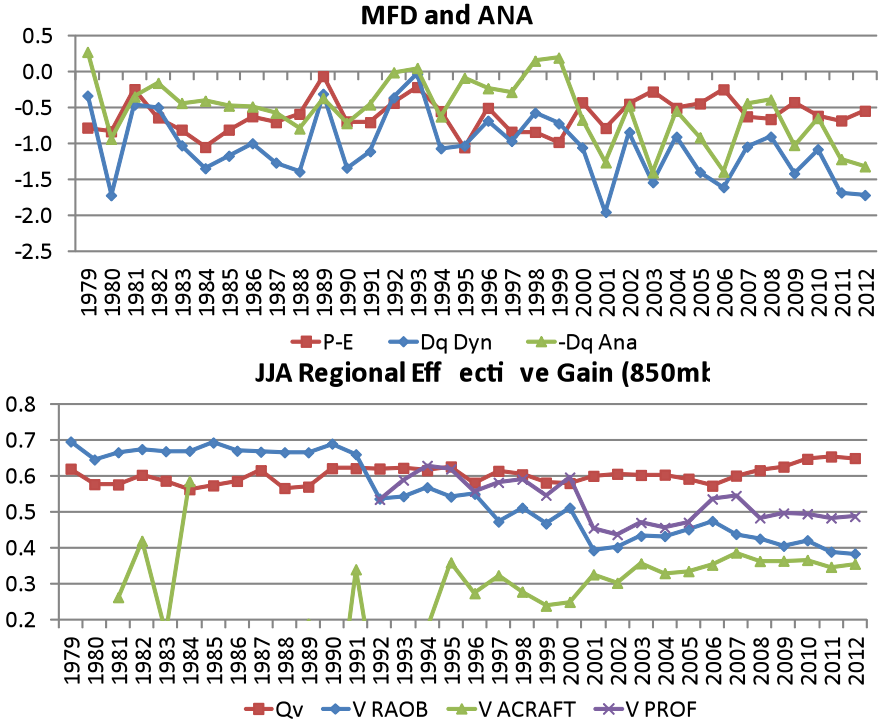

Figure 2. *Central US JJA MFD and analysis increment (top) and Effective Gain statistic for RAOB qv and wind, and the aircraft and profiler wind.*