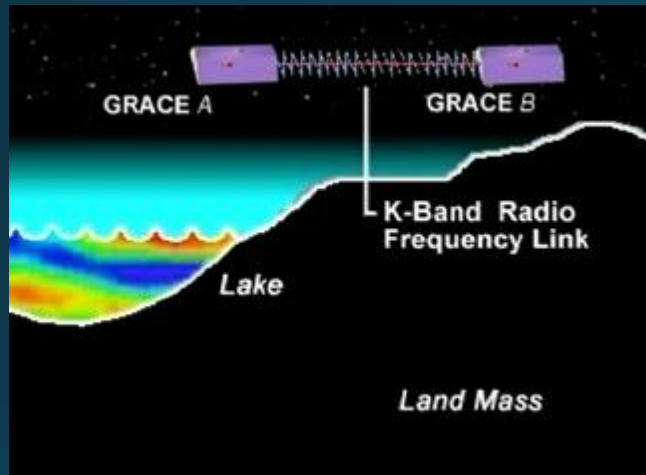


Assimilation of GRACE terrestrial water storage (TWS) for improving land surface modeling and drought monitoring

Bailing Li (ESSIC)/ Matthew Rodell (GSFC)

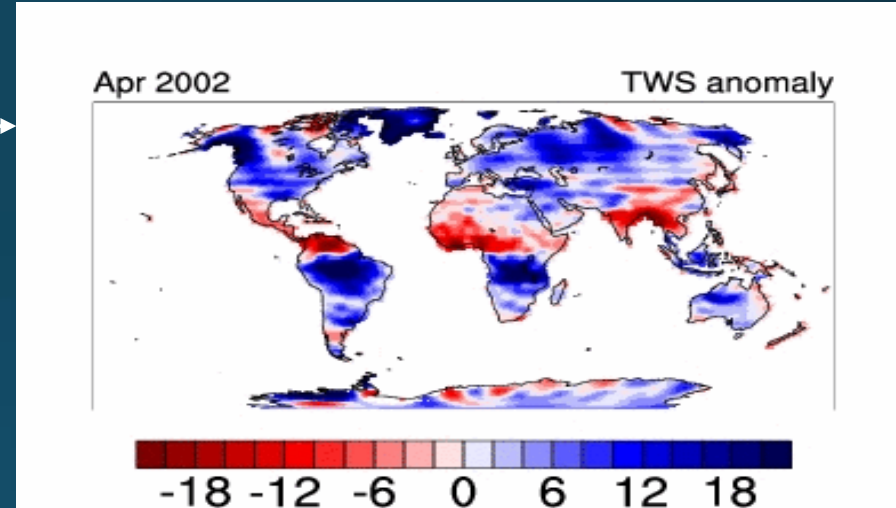
1. GRACE measures gravity



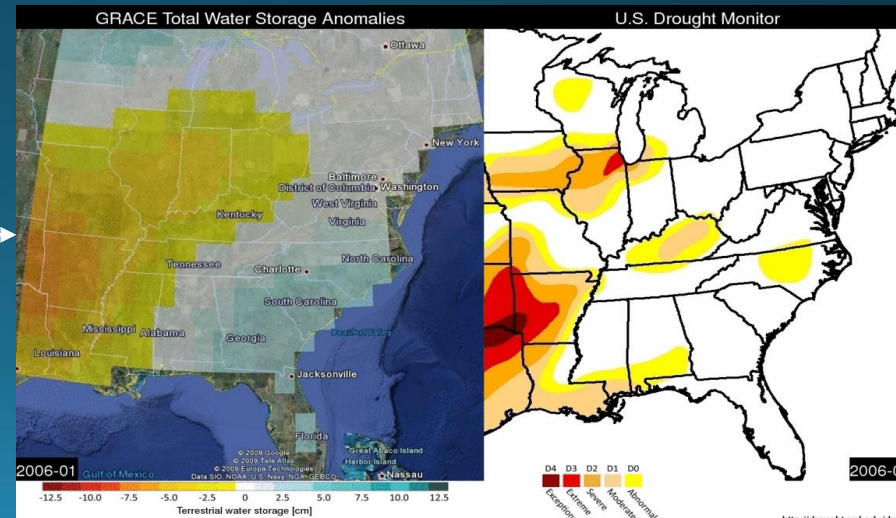
over land
↓
atmosphere
TWS
solid earth

- ## 2. GRACE derived TWS anomalies (water heights)
- include snow, soil moisture, **groundwater** and surface water
 - monthly and effective resolution 150,000 km²

GRACE
derived
TWS

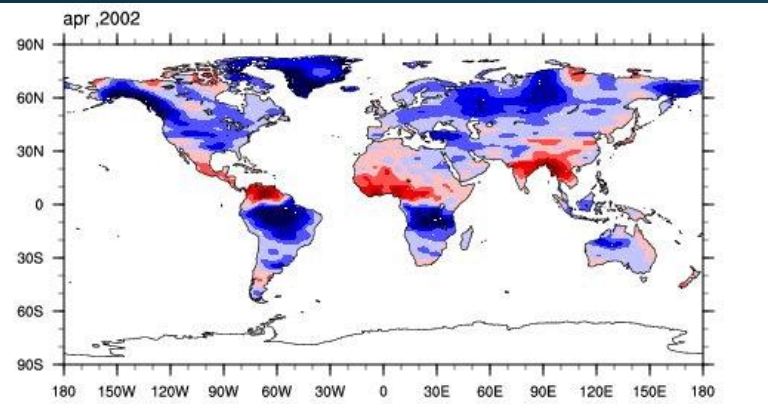


GRACE
captured the
evolution of
2007-2008
drought in SE
US.

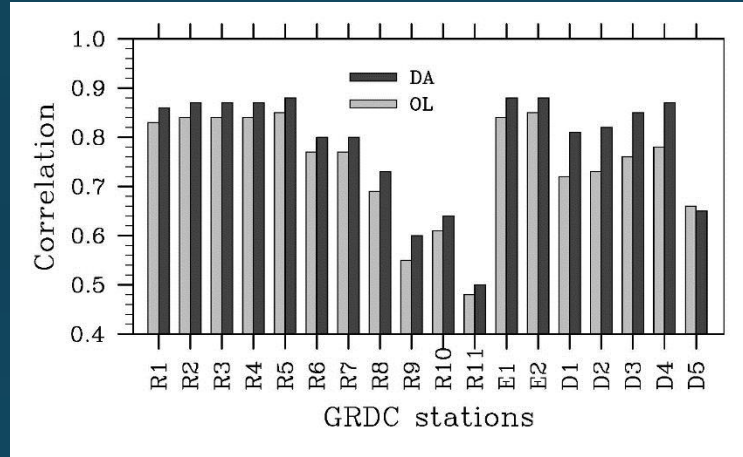


Data assimilation of GRACE TWS improved land surface processes and drought monitoring

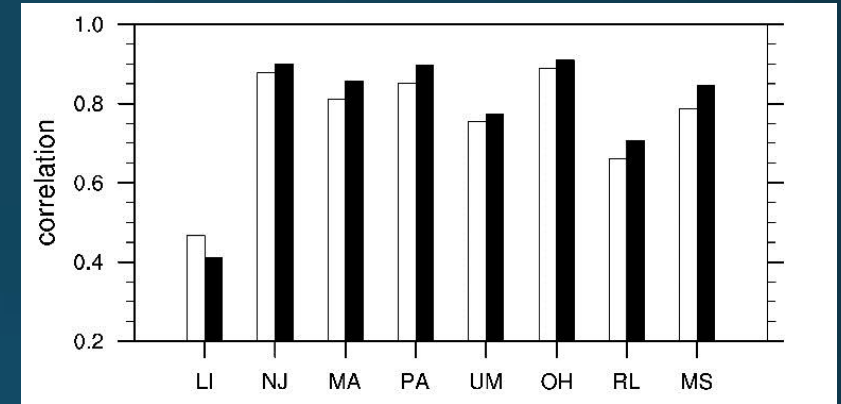
GRACE TWS observations at 1x1°



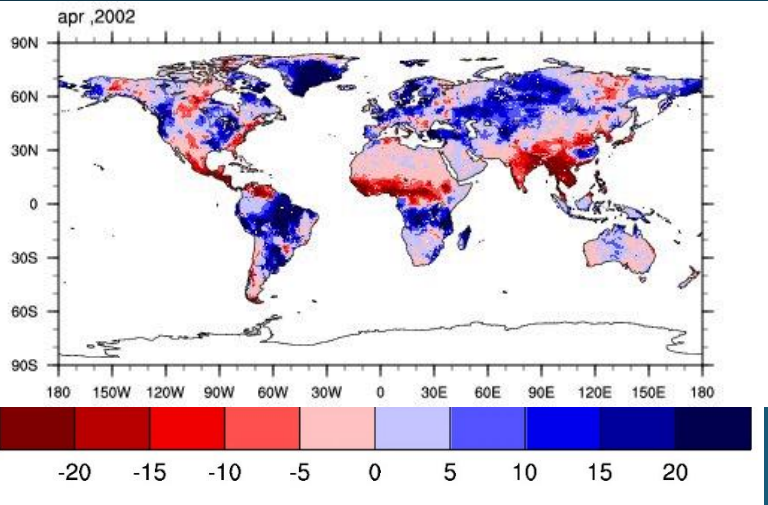
Improved runoff estimates in Europe



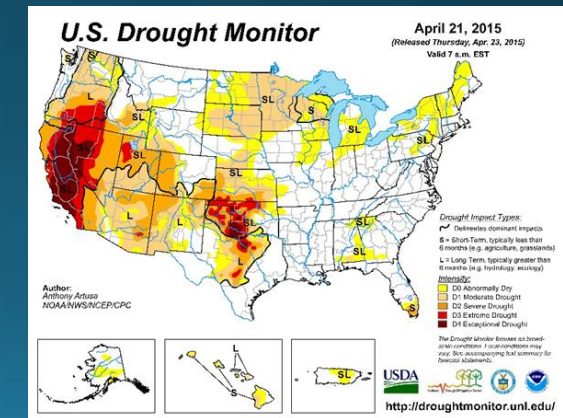
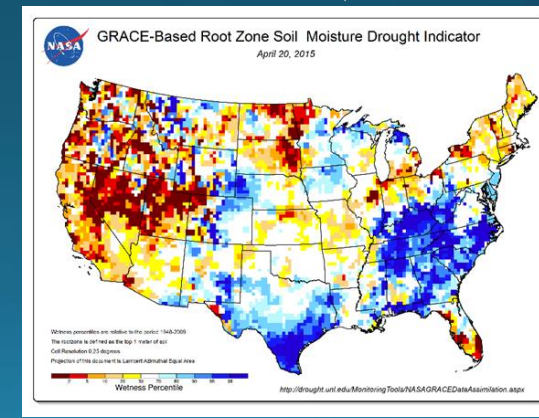
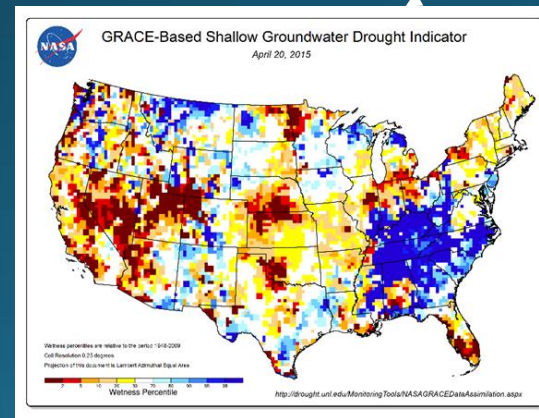
Improved groundwater storage estimates in US



GRACE assimilated CLSM TWS at 0.25°



GRACE based groundwater and soil moisture drought indicators

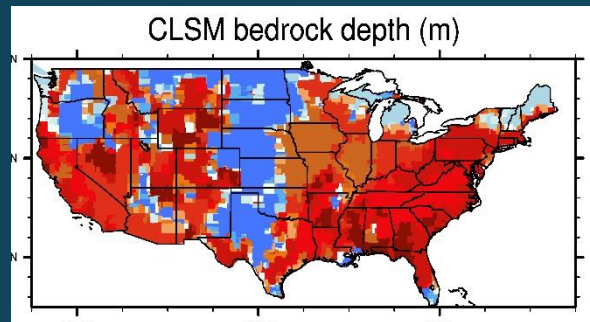
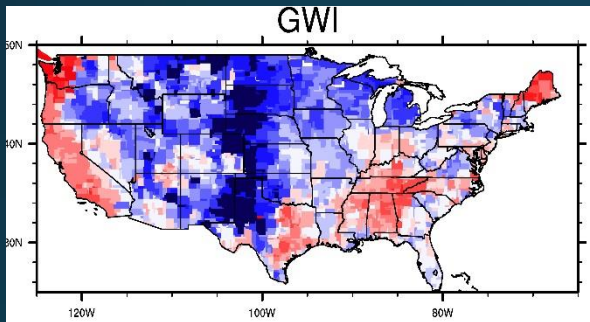


Assimilating gridded GRACE

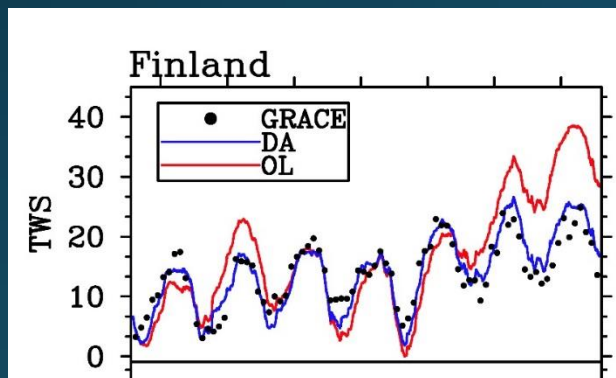
GRACE for NCEP/EMC

Noah-MP

- Noah-MP not implemented in LIS yet
- Assimilation of GRACE into Noah-MP
- Model configuration (temporal variability of groundwater)



- Model evaluation (ability to predict trend correctly)



References:

Zaitchik et al. 2008. Assimilation of GRACE terrestrial water storage data into a land surface model: results for the Mississippi river basin, *J. Hydrometeor.*, 9, 535-548, doi: <http://dx.doi.org/10.1175/2007JHM951.1>.

Houborg, R., M. Rodell, B. Li, R. Reichle, and B. F. Zaitchik (2012), Drought indicators based on model-assimilated Gravity Recovery and Climate Experiment (GRACE) terrestrial water storage observations, *Water Resour. Res.*, 48, W07525, doi:10.1029/2011WR011291.

Li, B., M. Rodell, B. F. Zaitchik, R. H. Reichle, R. D. Koster, T. M. van Dam, 2012. Assimilation of GRACE terrestrial water storage into a land surface model: Evaluation and potential value for drought monitoring in western and central Europe, *J. Hydrology*, 446–447 (2012) 103–115, <http://dx.doi.org/10.1016/j.jhydrol.2012.04.035>.

Li, B. and M. Rodell, Evaluation of a model-based groundwater drought indicator in the conterminous U.S. *J. Hydrol.* (2014), <http://dx.doi.org/10.1016/j.jhydrol.2014.09.027>