

Global (Antarctica excluded) OSSE experiment:

- LSM: Noah-MP 3.6
- Meteorological forcing: NLDAS2
- Simulations:
 - Nature run (NR): January 2011 to December 2015
 - Open-loop runs (OL):
 - dry condition: halving input precipitation
 - wet condition: doubling input precipitation
 - Data Assimilation runs (DA):
 - Direct Insertion
 - Assimilation of daily synthetic LAI observations sampled from the NR run

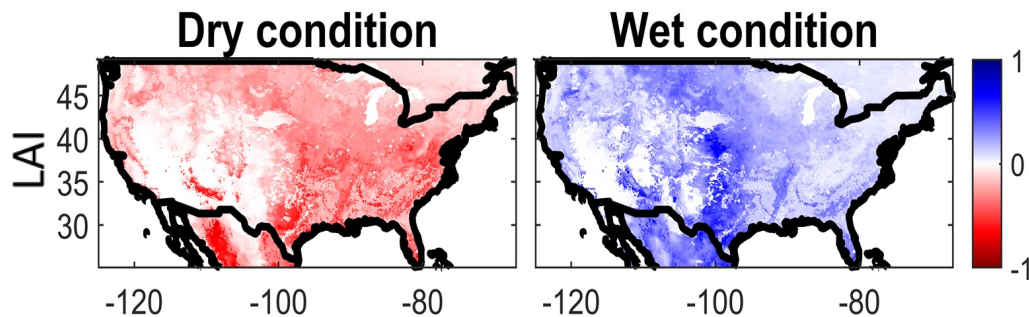
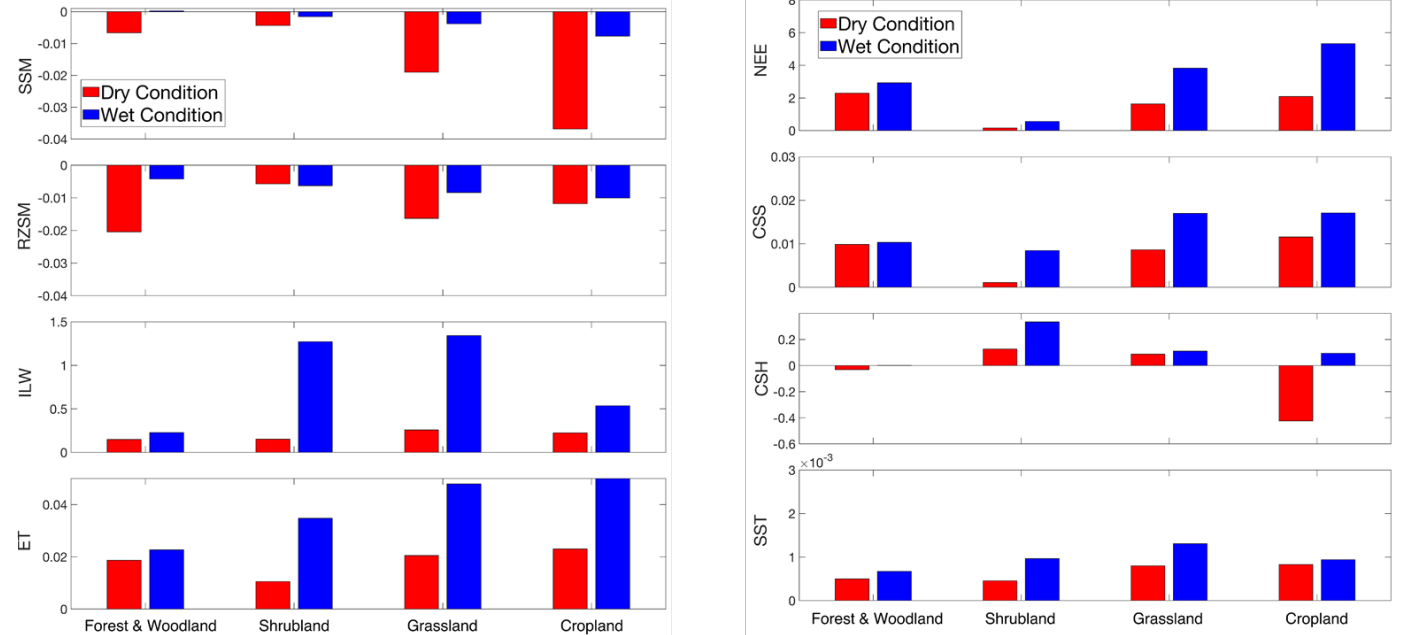


Figure: Difference in LAI simulated by the OL and DA runs for dry (left) and wet (right) conditions. Red indicates an increase and blue indicates a decrease in LAI due to the DA of LAI .

Rahman, A., Zhang, X., Xue, Y., Houser, P., Sauer, T., Kumar, S., Mocko, D., & Maggioni, V. (2020). A synthetic experiment to investigate the potential of assimilating LAI through direct insertion in a land surface model. *Journal of Hydrology X*

Relative bias (RB) difference between DA and OL for different land cover types



- $RB_{DA} - RB_{OL} < 0$: DA degrades the OL
- $RB_{DA} - RB_{OL} > 0$: DA improves the OL

- For the selected water variables, LAI DA degrades surface soil moisture (SSM) and Root Zone Soil Moisture (RZSM); but improves Intercepted Liquid Water (ILW) and Evapotranspiration (ET) across all vegetation covers under wet and dry conditions.
- All four carbon and energy variables (Net Ecosystem Exchange (NEE), Carbon in Shallow Soil (CSS), Canopy Sensible Heat (CSH), and Surface Soil Temperature (SST)) present an overall improvement after the application of DA.
- For SSM, ILW, and ET, forest and woodland areas are less impacted by the LAI DA compared to the other vegetation covers as the short rooted plants are dependent on rain and suffer under dry condition.
- CSH shows degradation after DA in forest and cropland in dry experiment. CSH is the combined heat flux from ground (dominant factor) and vegetation to the atmosphere and gets impacted by the degradation in soil moisture.