# Coupling metrics to diagnose land-atmosphere interactions

### **Conditional Correlations**

### References:

- Mei, R., and G. Wang, 2011: Impact of sea surface temperature and soil moisture on summer precipitation in the United States based on observational data. *J. Hydrometeor.*, 12, 1086–1099, doi: 10.1175/2011JHM1312.1.
- Mei, R., and G. Wang, 2012: Summer land—atmosphere coupling strength in the United States: Comparison among observations, reanalysis data and numerical models. J. Hydrometeor., 13, 1010–1022, doi: 10.1175/JHM-D-11-075.1.
- Originally focused on interannual variations looks at how a 2-category (or more) contingency affects correlation between day 1 soil moisture and days 2-22 total precipitation (or any variable SM is expected to affect) same date each year.
- o Bootstrap sample-with-replacement is used to build a PDF of expected correlations to determine whether categories have significant impacts on changing correlation.
- Categories could be:
  - Extremes (two outer quartiles) vs nominal years (two middle quartiles)
  - ENSO (or another climate index) phases or strengths... etc.

### • Data needs:

- o Daily or instantaneous land surface (e.g., soil moisture) states, daily, pentad or similar totals for the lagged variable
- Well suited to model output.

# • Observational data sources:

- Here is where occasional instantaneous soil moisture data could be used, but still need enough to define anomalies well.
- o Co-location of lagged variable needed.
- o Could apply to area averages to reduce data uncertainties.

## • Caveats:

As with Koster's lagged correlations, cannot assume cause-effect just because of lag.
It could be effect-effect with some third (remote) cause. Mei and Wang (2011) looked at SST also for that reason.