Alexis Berg (IRI, columbia University), Benjamin Lintner (Rutgers University, Environmental Sciences), Kirsten Findell (GFDL/NOAA), Sergey Malyshev (Princeton University), Pierre Gentine (Columbia University)

**Impact of soil moisture-atmosphere interactions on surface climate variability**

Soil moisture is one of the key variables affecting the surface energy budget over land. Driven by atmosphere variability, soil moisture variations in turn modulate land-atmosphere fluxes and can thus feed back on the atmosphere. This soil moisture-atmosphere coupling has the potential to affect climate variability and extremes over land. Here we use simulations from a suite of state-of-the-art climate models from the GLACE-CMIP5 experiment to investigate the role of soil moisture-atmosphere interactions on surface climate variability. Beyond first-order measures of variability, emphasis is placed on probabilistic distribution functions (pdf) and higher-order moments of variability, as well as multivariate relationships, such as coupling between temperature and precipitation. We show that soil moisture-atmosphere coupling strongly determines the shape of the pdf of daily summertime temperature, with spatially-varying impacts on different moments of variability. In contrast to previous single-model studies, we also show that that summertime temperature-precipitation covariability over land arises from varying combinations of land surface and cloud-radiative processes in the different models.