# Water Cycle Variability and Predictability in a Changing Climate


Abstract

I hypothesize that *the seasonal to interannual global water cycle (precipitation, evaporation, runoff) is predictable and the slowly varying boundary conditions (ocean and land) are essential factors governing its predictability*. In this proposed study, the validity of this hypothesis will be tested through analyzing observed and simulated water cycle variables in present and future climate scenarios.

Evidence of potential water cycle predictability during the past century will be sought using the Madden's signal-noise-ratio formula with recently emerging in-situ, satellite and model reanalysis information. Then seasonal to interannal water cycle variability over the regions with relatively high potential predictability will be investigated to identify their association with ocean and land conditions by employing optimal persistence analysis (OPA).

Canonical correlation analysis (CCA) will be utilized to specify the predictive nature inherent in the observed seasonal to interannual water cycle variability by including ocean state and land conditions. The derived predictability behavior will then be compared with the potential predictability derived from the Madden's signal-noise-ratio formula. The degree of consistency between these two predictable patterns will preliminarily reveal the degree to which the proposed null hypothesis is valid.

The conclusions would be refined through comparisons of modern model simulations to observational evidence; here I will examine whether state-of-art models

are capable of reproducing the observed water cycle variability and predictability using the previously described methods, thus gaining insight on the confidence in the water cycle prediction of climate model. Finally, the potential predictability in the twenty-first century will be examined through analyzing climate model projections. The possible global water cycle potential predictability changes between various climate scenarios and the mechanisms that result in changes will be explored by comparing the model outputs from twentieth and twenty-first centuries.