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Decadal predictability of land hydrology over North America in CESM

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Potential longterm predictability of total water storage in North America is examined using a 900-year-long pre-industrial control simulation, conducted with the NCAR community earth system model (CESM). The dominant modes of simulated North American precipitation and soil water storage are characterized by similar meridional seesaw patterns. Whereas corresponding precipitation variability can be described to first order as a white noise stochastic process, power spectra of integrated soil moisture exhibit significant redness on timescales of years to decades. As a result statistical damped persistence hindcasts, following a 1st order Markov process, are skillful with lead times of up to several years. This skill estimate is consistent with ensemble hindcasts conducted with the CESM model for various initial conditions. A strong depth dependence is found for the predictive skill of moisture variations, in particular for the Northern US. Decadal variations in total water storage are shown to affect wildfire frequency. Our results suggest that predictions of decadal changes in integrated water storage are feasible, even with local statistical models, and may render useful for risk management related to water resources, forestry, and agriculture.