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An Effective Statistical-Dynamical Framework for Seasonal Drought Monitoring and Forecasting

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Although research on drought monitoring and prediction has shown some improvement over the past few years, accurate provisions of drought information in a timely manner is still a challenge. Both statistical and dynamical drought prediction methods have been attempted in research and practice. While these approaches have yielded skillful predictions in specific case studies, some limitations still restrict their use. One of the main limitations is the deterministic treatment of the land initial condition. This motivates development of a drought monitoring and prediction system that is based on full characterization of the initial condition. The framework employs a data assimilation (DA) method based on particle filter (PF) to quantify the uncertainties associated with antecedent land surface condition. The initial condition at each forecast step is probabilistically sampled from the ensemble of initial conditions characterized by data assimilation and through a multivariate approach based on copula functions resulting in probabilistic drought prediction. Large computational demands are overcome by developing a modular parallel computing framework which facilitates large ensemble sizes. Usefulness and effectiveness of this hybrid drought estimation framework is demonstrated over the Contiguous United States and the superiority in monitoring and prediction are compared with some current operational systems.