An Online Tool For Operational Probabilistic Drought Forecasting System: A Statistical-Dynamical Framework

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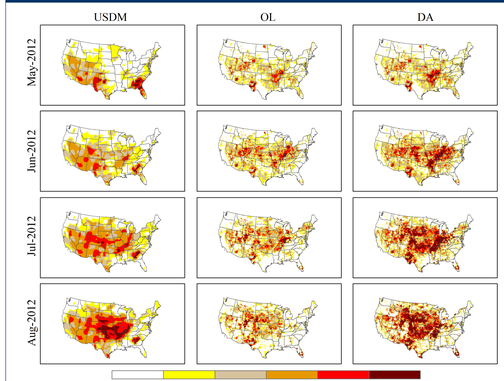
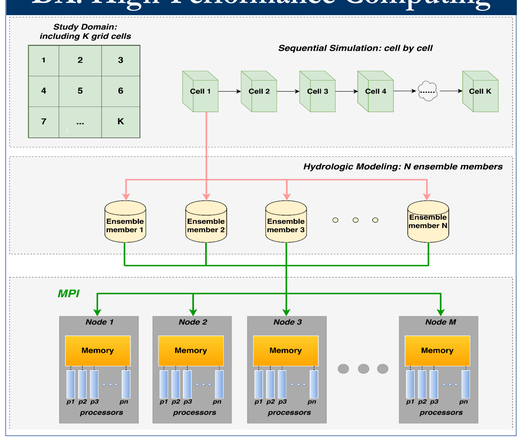
Introduction

- This study proposes a hybrid framework for probabilistic drought monitoring and forecasting systems (Yan et al., 2017a,b)
- Droughts have significant impacts on water supply, water quality, agriculture, domestic water supply, crop losses, crop stress, wildlife, etc.
- The 2012 summertime flash drought event across the Central U.S. resulted in a major curtailment of crop yields, and caused about $12 billion economic loss.
- The uncertainty of initial condition is found to have a key role in drought monitoring and seasonal drought forecasting skills.
- Data assimilation (DA) is used to characterize the uncertainty in initial condition and drought monitoring. And later it is coupled with a Statistical multi-variate approach (Copulas) to generate probabilistic seasonal drought forecast.

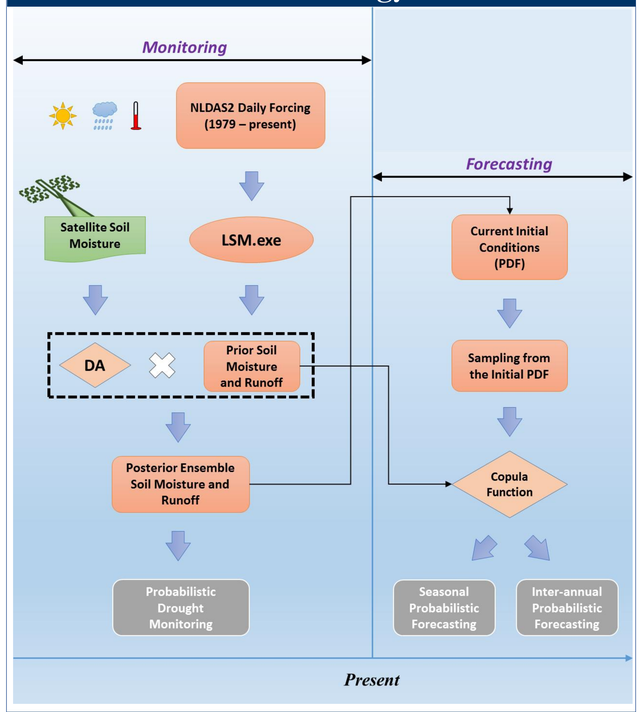
Drought Monitoring



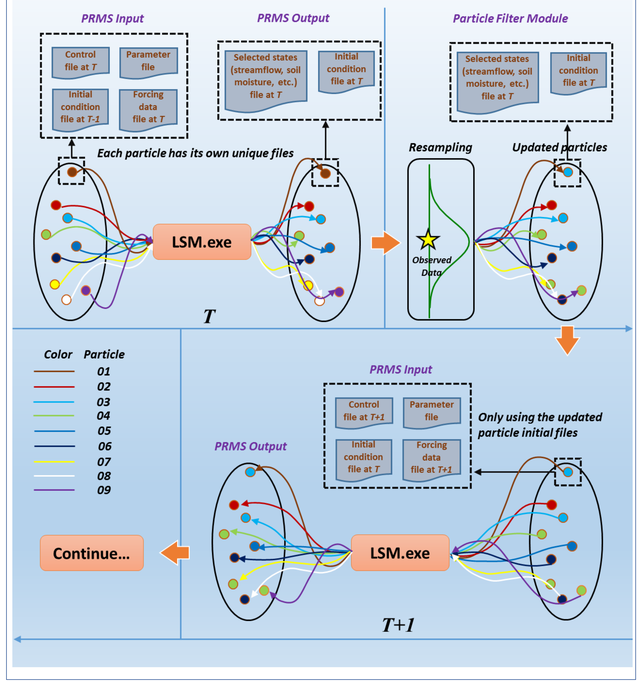
DA: High-Performance Computing



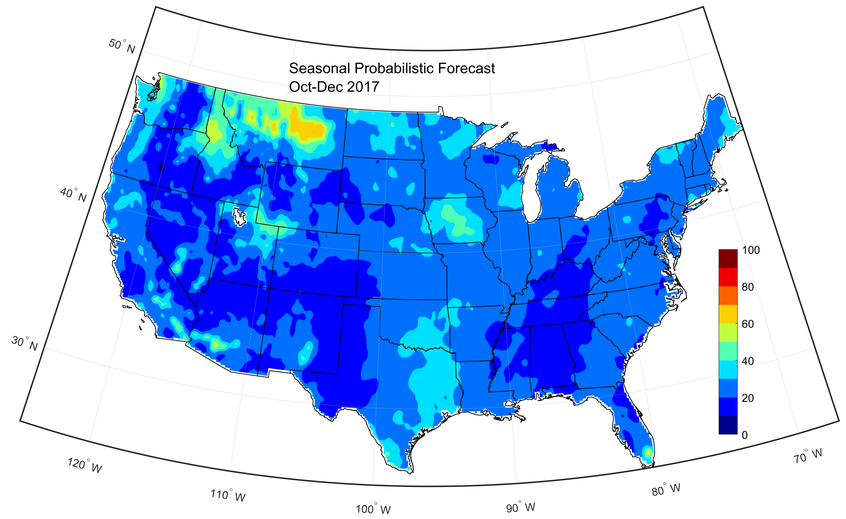
Methodology



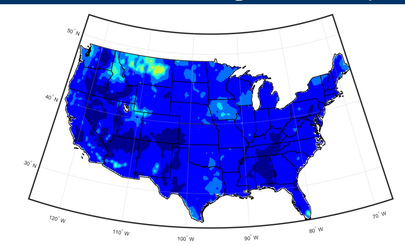
Data Assimilation



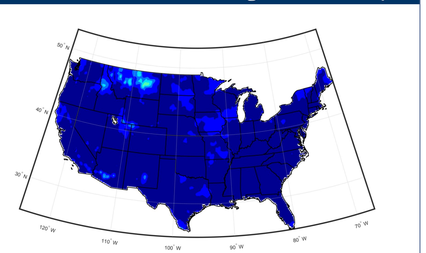
Operational Drought Forecasting: Fall 2017



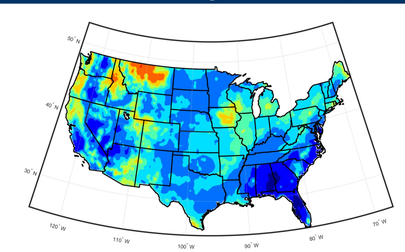
Fall 2017 Moderate Drought Probability



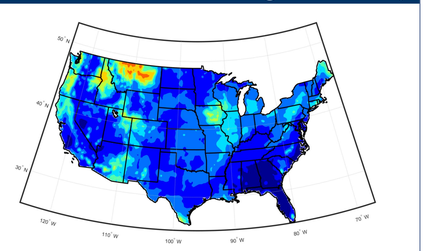
Fall 2017 Severe Drought Probability



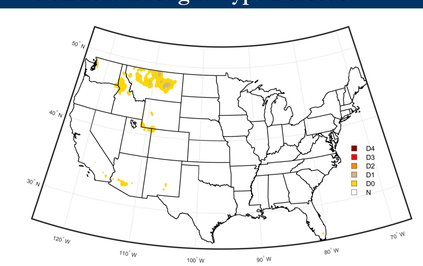
Oct 2017 Drought Probability



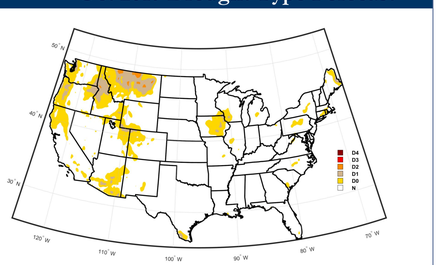
Oct 2017 Severe Drought Probability



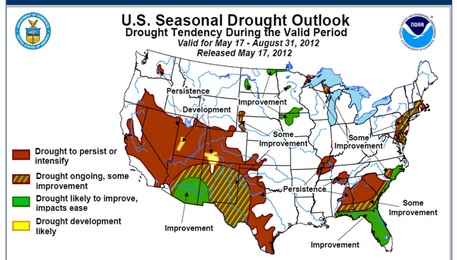
Fall 2017 Drought Type Forecast

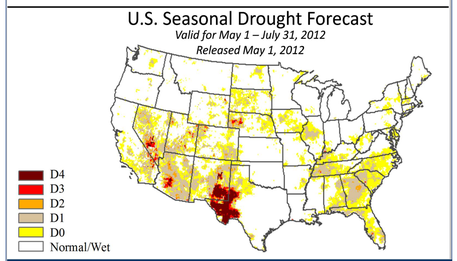


Oct 2017 Drought Type Forecast



Validation: Summer 2012





Discussion and Conclusion

- A novel dynamical-statistical approach for probabilistic drought forecasting is presented.
- Initial condition uncertainty is explicitly characterized by ensemble data assimilation.
- A multivariate approach using copula functions is coupled with the ensemble data assimilation.
- Results from both synthetic and real case studies suggest that the proposed drought forecasting system significantly improves the seasonal drought forecasting skills and can facilitate the drought preparation and declaration.

Reference

- Yan, H., Moradkhani, H., & Zarekarizi, M. (2017). A probabilistic drought forecasting framework: A combined dynamical and statistical approach. Journal of Hydrology, 548, 291–304. http://doi.org/10.1016/j.jhydrol.2017.03.004
- Yan, H., Moradkhani, H., Zarekarizi. M. (2017). Toward Improving Drought Monitoring using the Remotely Sensed Soil Moisture Assimilation: A Parallel Particle Filtering Framework. *Under Review*

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