Seasonal drought prediction over the contiguous United States (CONUS) based on the NCEP Climate Forecast System version 2 (CFSv2) is explored using drought indices, such as standardized precipitation index (SPI) and soil moisture percentile (SMP). This study explores the potential of using daily precipitation and temperature forecasts from CFSv2 with initial conditions obtained from the Variable Infiltration Capacity (VIC) Macroscale Hydrologic Model driven by daily precipitation and temperature forecasts from CFSv2 with initial conditions obtained from the simulation by the VIC model. Preliminary results show that SMP prediction using such framework is more skillful over the western United States than that using direct forecasts from CFSv2 because of superior initial conditions. However, errors over the Ohio Valley come from both the CFSv2 forecast and the VIC model.

Anomaly Correlation of P Hindcasts

- Averaged over the CONUS as a function of the lead time for ICs in (a) Oct-Nov, (b) Jan-Feb, (c) Apr-May, and (d) Jul-Aug.
- Skill is higher for winter (Feb and Nov) and lower for summer.
- For the one-month lead, CFSv2 is more skillful than CFSv1, and the 8-member ensemble performs better, and the skill for CFSv1 and CFSv2 is comparable.
- Therefore, we use 8-member ensemble for SPI forecasts.

Verification of Soil Moisture Forecasts

- SM forecasts were bias-corrected and downscaled to 0.5-degree grids using the BCSD method.
- Verified against CFSR 6-hr SM forecasts from the analysis-forecast cycle and the ensemble North American Land Data Assimilation System (NLDAS: Noah, VIC, SAC, and Mosaic).
- Skill depends on the data sets used for verification.
- If verified against ensemble NLDAS, skill is lower than persistence from the ensemble NLDAS.
- CFSR has large errors over the western interior region and the Ohio Valley due to spin-up problems.
- Errors in the ICs contribute to the errors in the CFSv2 forecasts.
- Direct downsampling and error correction of SM forecasts from CFSv2 has lower skill than persistence.

ICs

- Run VIC with daily P and T forecasts from CFSv2

Hydroclimate Forecasts

- Jan 1, 1979
- VIC simulation

Starting date

Forecast

Feb 5

Feb 6

Feb 7 ...

RMSE of SM Anomalies/STD for Lead-1 Forecasts

- SPI6 Prediction Skill

- Anomaly correlation averaged over the CONUS.
- Skill is seasonally and regionally dependent, and comes from both P analysis and lead-1 forecasts.
- Skill is higher in winter than in summer.
- Skill drops off when there is less P analysis in the time series.
- SPI6 is skillful out to 3-4 months.

SPI Experiments

- Use daily P and T forecasts from CFSv2 to drive VIC model with ICs from VIC simulation (8-member ensemble).
- Two sets of runs for Feb: one without correction, denoted VIC(CFSv2, NC); and the other with BCSD correction to the monthly mean P and T, denoted VIC(CFSv2).
- Daily forecasts of P and T are corrected, as the monthly mean of the corrected daily forecasts is the same as the corrected monthly mean.

Summary:

- VIC(CFSv2) is more skillful over the western region because the ICs are better and SM has high persistence over the region.
- Errors in monthly mean P and T are not systematic. Error correction only improves the forecasts slightly for Lead 1.
- Errors over the Ohio Valley come from both the CFSv2 forecast errors and the difference between the VIC and NLDAS models.
- VIC (or any hydrological model) will not correct the forecast errors from CFSv2. Multi-model or multi-method ensemble may have an advantage to correct the errors.