



The Contribution of High Resolution Medium Range Weather Forecast to Hydro-Climate Prediction

Dr. Li Xu & Kingtse C. Mo Climate Prediction Center/NCEP Innovim LLC







motivation

- Shukla et al. (2012) show the medium range weather forecasts (Hamill et al. 2006) do improve of seasonal hydrological prediction skill, compared with Ensemble Stream Prediction (ESP).
- Mo et al. (2012) shown the climate forecast (CFSv2) forced hydrological prediction system also improved in the relative short lead. But, it is no more skillful than the benchmark ESP, for most forecast leads and over the western United States.
- Question ? With new MRF-reforecast (Hamill et al. 2013), could we improve the current hydrological prediction system, by merging MRF and CFSv2 forecast? And how much could improve?





Model Data

- MRF Reforecast
 - Second generation MRF (Hamill et al. 2013)
 - based on the GEFS 2012
 version with ~0.5°
 Gaussian grid
 - 1 control run (based on data assimilation) and 10 perturbed runs by ensemble transform technique(ETR)

- CFSv2 hindcast
 - Second generation (Saha et al. 2013)
 - Coupled atmosphereocean-sea ice-land system with T126 grid (~ 100km)
 - Four forecast initialized at 00z,06z,12z,18z for every five days





MRF and CFSv2 ensemble forecast







Preprocessing

- The CFSv2 forecast
 - downscaled to the 0.5 degree grid over the CONUS
 - bias corrected by BCSD method (Yoon et al. 2012)
- MRF forecast
 - spatial interpolated to the same 0.5 degree grid
 - bias corrected by previous 45 day forecasts





Procedure

- Merging MRF&CFSv2:
 - The 1st 14th day used only MRF forecast
 - for smooth transient , 15th and 16th day are linear combination of two model (weight 2/3 and 1/3 for MRF and CFS in 15th day, and 1/3 and 2/3 for 16th day)
 - only CFS forecast after 16th day, until 90 days



P NEATHER SER

Merged forecast skills: Temperature







Merged forecast skills: Precipitation⁵







VIC hydrological model







Two kinds of ensemble method for hydrological forecast*

Mean(VIC(ens_mems)):

driven the VIC with each climate model forecast as forcing to get SM and then ensemble mean

 VIC(Mean(ens_mems)): Get the climate forecast's ensemble mean than to driven VIC model for SM

The second method will substantial reduce the computation cost.





ACC for two ensemble method: SM







ACC for two ensemble method: runoff*







SM forecast skills: lead 1 month











Conclusions

- The New MRF (Hamill et al. 2013) 1-14d forecasts show high skill for temperature and moderate skill for precipitation.
- Merging MRF 1-16day forecast with CFSv2 forecast will obvious enhance the first month temperature forecast skill, but little in the precipitation.
- For lead one month forecast, the merging MRF will enhance the SM forecast skill (ACC) over the most area of CONUS, but the most insignificant in the testing at 95% confidence.
- Similar, the runoff also be enhanced over the most hydrological subsections, but only few sections are significant in the statistics testing.





Thanks for attention!

Any question?