Merits of a competitive proposal

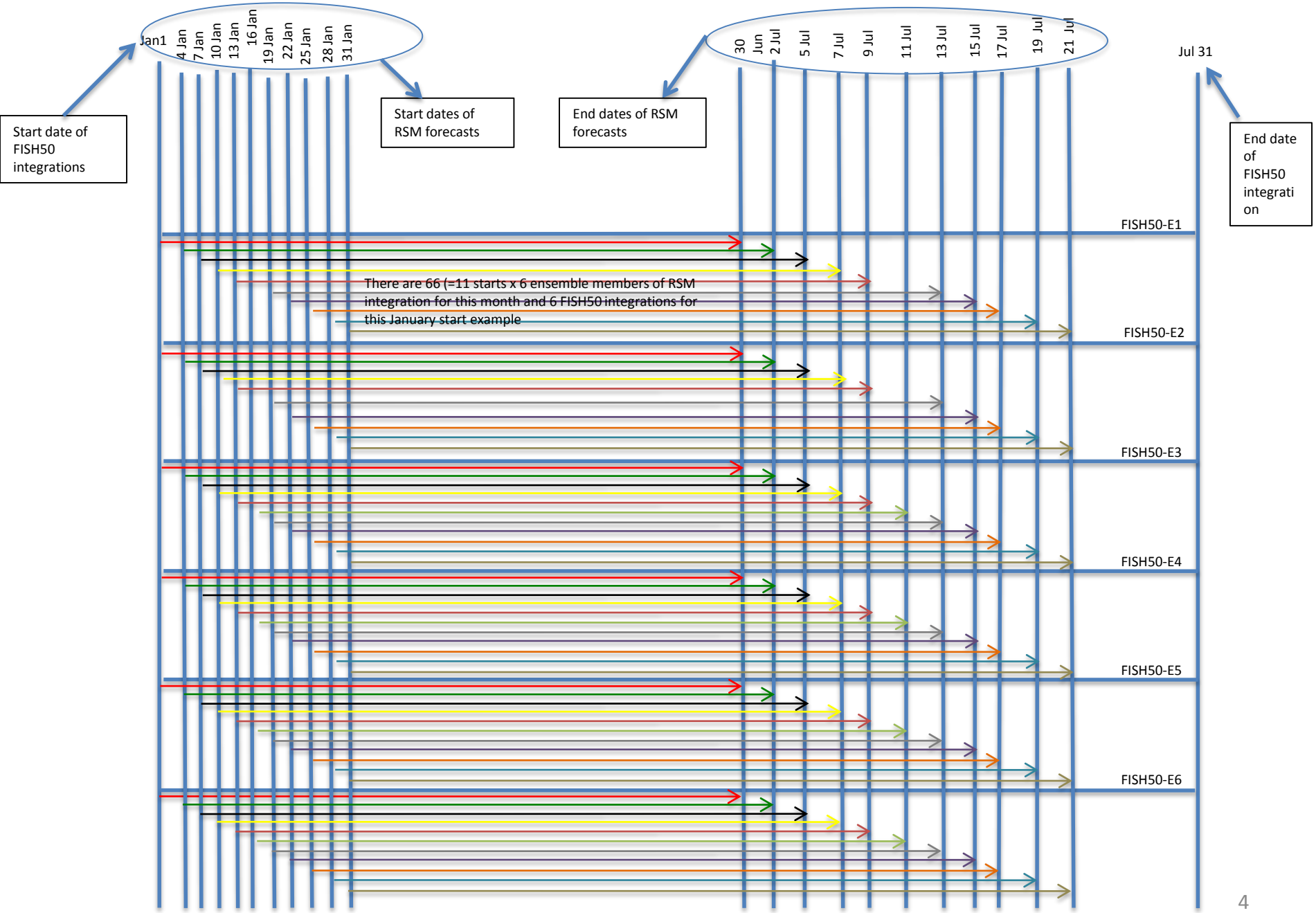
- Is the methodology backed up by prior work?
- Do the PI's have the required experience in carrying out the work?
- Is the group coalescing for the sake of the proposal or is their history of this group working together?

Merits specific to this NASA proposal

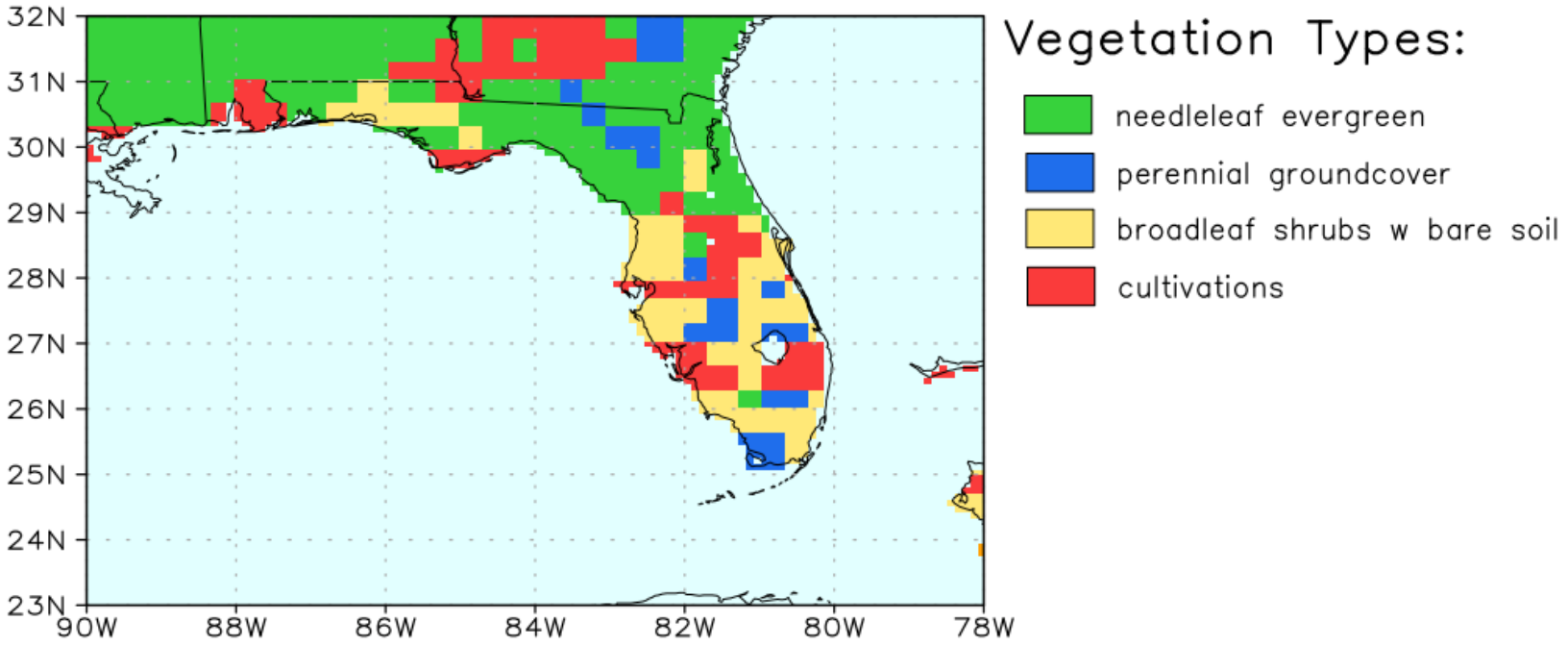
1. Integration of NASA Earth science data and models into water resource management for sustainable use. ✓
2. Advance the long-term (30-180 day) outlooks of water supply anomalies ✓
3. An Application Concept of science (related to water resources) should already be discovered. ✓
4. Project teams should consider including experts in the areas of management, planning, statistics, economics, and/or policy analysis to support assessments of the performance and decision-making improvements resulting from the project ✓
5. Principal Investigators or Co-Principal Investigators that are from or are very familiar with the needs of the end-users and decision-making organization ✓
6. Addresses on limitations of current water management tools ✓
7. Must integrate with existing water resource decision process ✓
8. Must include multiple sites, demonstrate broader regional impacts✓
9. Demonstrate end-user financial sustainability (budget to implement the solution after the project, line 122-129, page A. 45-3) ??

The Overarching Plan

An example of the lattice of global and regional model integrations every month



Regional domain



Number of model months to be integrated

- We will conduct a hindcast from 1982-2014 (33 years) so that we can deploy any necessary bias correction to model forecast, practice the applicability to decision support tools, and develop fodder for sustainability
- Number of FISH50 months to integrate: 12 (months to initialize) x 7 (months-duration of integration) x 33 (years) X 6 (ensemble members) = 16632 months
- Number of RSM months to integrate: 11 (~start dates of regional forecasts every month) x 12 (months) x (6 months-duration of integration) x 33 (years) x 6 (ensemble members) = 156,816 months

Steps for operational forecasts

1 Prepare SST field from NASA observations and NMME forecast

2 Run FISH50 with 6 ensemble members at the beginning of each month for 7 month duration

3 Prepare land surface initial conditions from the retrieved NASA top soil moisture on every 3rd day of the month beginning from the month ➔ entails running the land surface model offline at 10km resolution

4 Run the RSM with 6 ensemble members (all 6 have identical land surface initial condition) every 3rd day of the month starting from the beginning of the month forced with the corresponding ensemble member of the FISH50 initiated in the beginning of the month

5 This forecast design will provide at any given time the following:

a) 66 forecasts with 0, 1, 2, 3, 4, and 5 month lead time

b) 132 forecasts with zero and one month lead forecasts

c) 198 forecasts with zero, one, two month lead forecasts

d) 264 forecasts with zero, one, two, and three month lead forecasts

e) 330 forecasts with zero, 1, 2, 3, 4 month lead forecasts

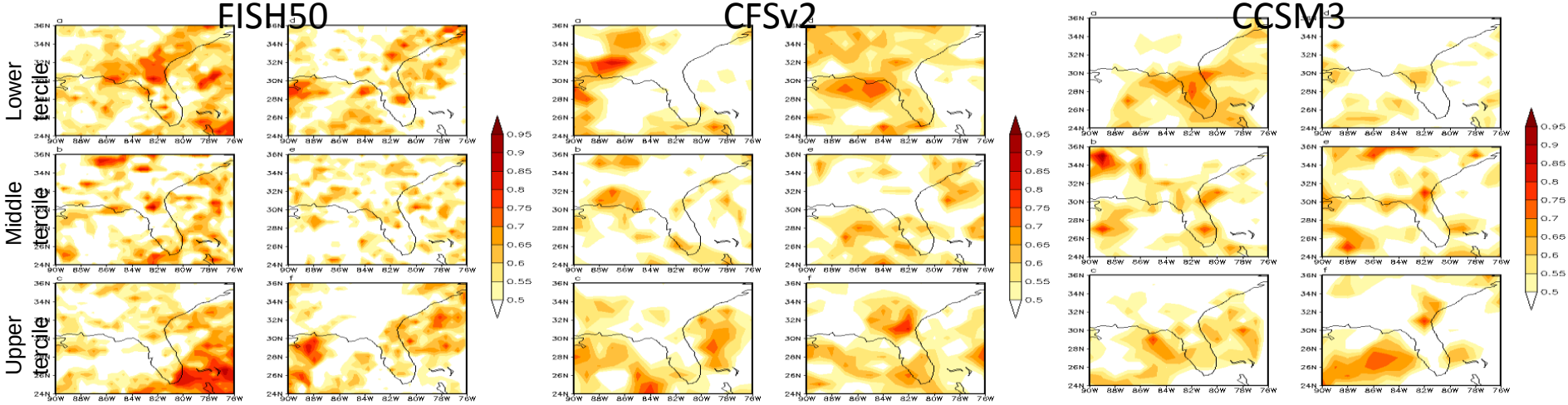
f) 396 forecasts with zero, 1,2 ,3 4, and 5 month lead forecasts

NASA products to be used

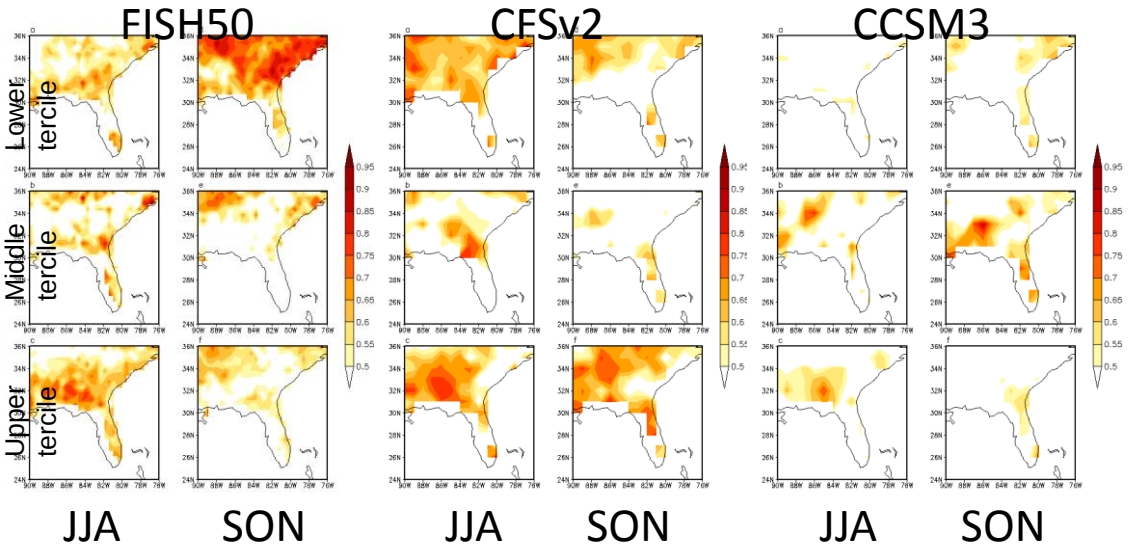
- SST
- Soil moisture (GRACE, NLDAS
- NMME SST forecast (NASA supported)
- MODIS LAI/FPAR
- MERRA (NASA reanalysis)

Preparedness or Application concept of Science already discovered?

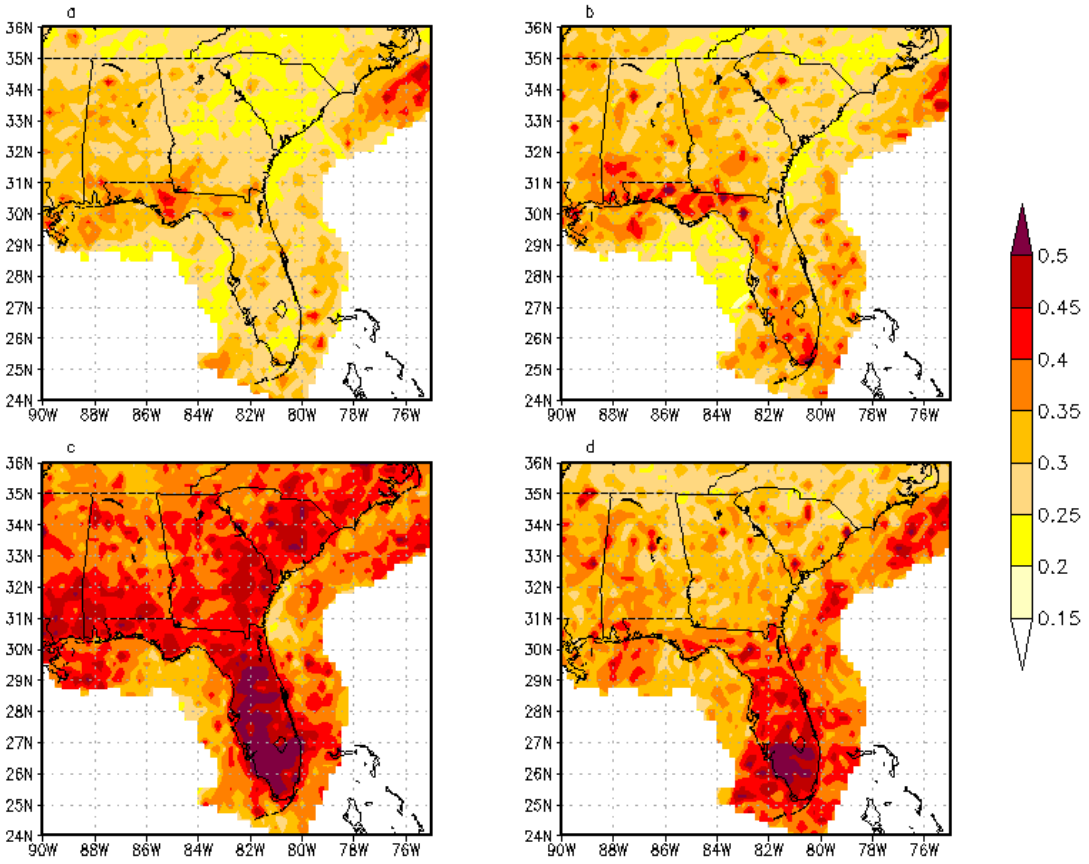
Area under the ROC for seasonal mean precipitation



Area under the ROC for seasonal mean temperature



FISH50 is as good or better than the current operational models over the southeastern US in the most difficult season

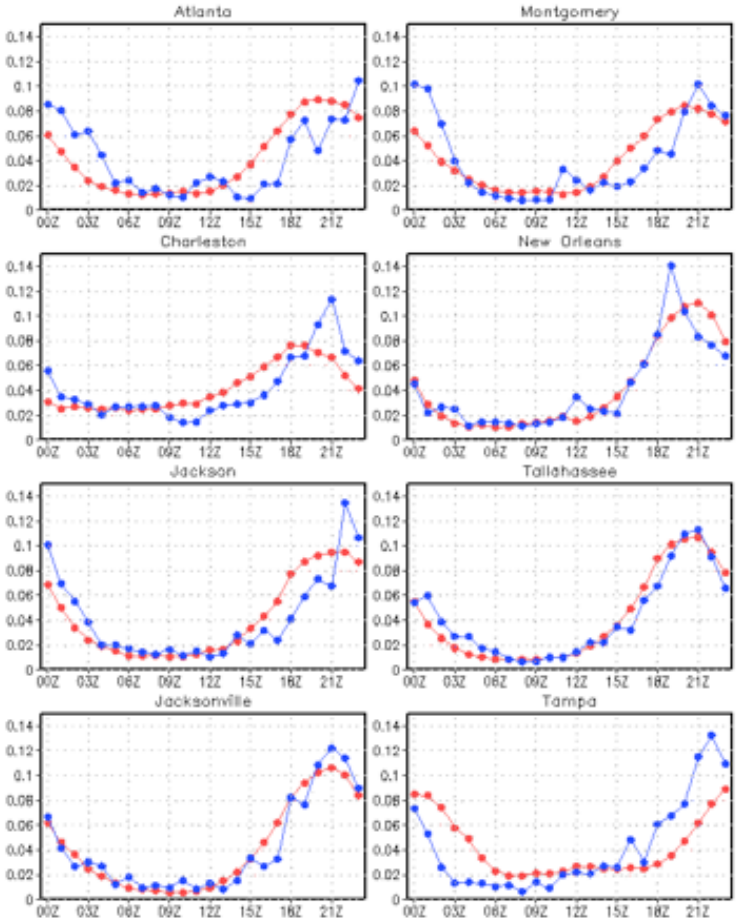


Diurnal variations of rainfall especially over Florida are important in all 4 seasons of the year. Therefore high resolution RSM should help!

The fraction of diurnal variability that explains the total seasonal variability in (a) December-January-February, (b) March-April-May, (c) June-July-August, and (d) September-October-November for NCEP Stage IV data.

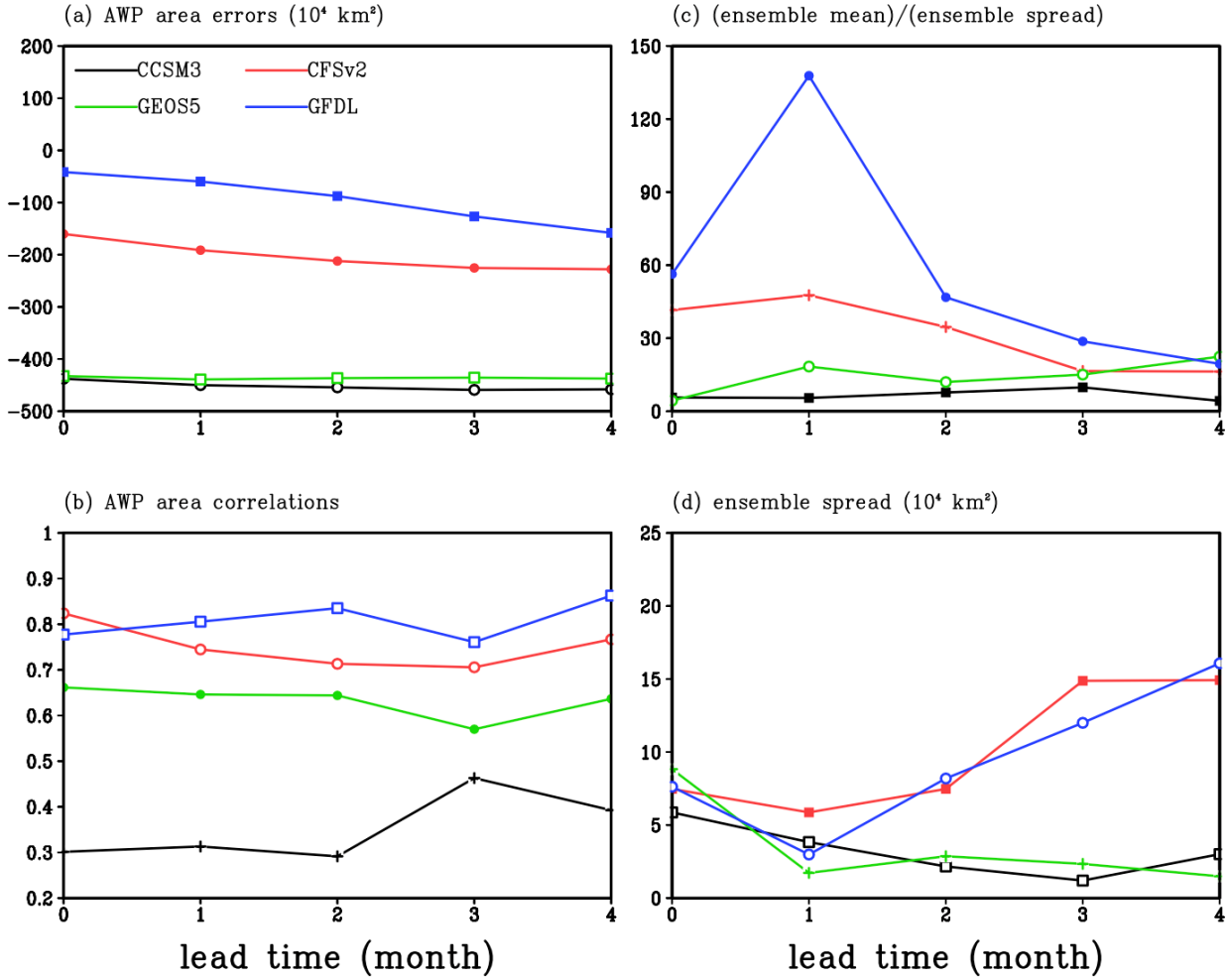
FLAReS1.0: Florida Climate Institute-Florida State University **L**and-**A**tmosphere **Re**analysis for the **S**outheastern United States at 10-km resolution version **1.0**

- RSM simulates diurnal variations reasonably well-DiNapoli and Misra (2013)



The fraction of JJA precipitation falling at each hour of the day for several major cities from FLAReS1.0 (red) and the NCEP/EMC hourly precipitation data (blue).

Despite IPCC AR5 models showing very poor skill in simulating tropical Atlantic, especially in summer and Fall, the NMME seasonal forecasts do quite well in seasonal predictions.



So there is merit in using NMME SST forecast.

1. FISH50 has shown its efficacy vis-à-vis NMME (Misra et al. 2013; Li and Misra 2013; Misra and Li 2013)
2. RSM shows sensitivity to soil moisture initialization
3. Downscaling helps in hydrological applications (Bastola and Misra 2013; Bastola et al. 2013)

Products available

All of these will be available in probabilistic terms at lead times of 0 days to 1 season in advance:

1. Start and end date of wet season
2. Start and end date of winter
3. How wet or dry the season is (qualitative and quantitative) at 10km resolution?
4. How cold or warm the season is?
5. Frequency of extreme events (as you as user define) in the season
6. What else do you want?—The temporal resolution of the model forecast (seasonal, monthly, daily, hourly) mean will be dictated by your needs and scientific basis—for example it is futile to provide hourly or daily forecast beyond a few days unless you are interested in the frequency of the high frequency phenomenon.

FAQ's

1 Isn't this a huge bulk of work to conduct? Remember the hindcast (which is bulk of the work) is done only once. The operations is doing about 66 RSM forecasts per month with additional 6 forecasts of global FISH50

2 Why can't the users use NMME or CPC products? We are customizing the forecasts for applications over Florida by:

a) Providing 10km grid resolution seasonal and sub-seasonal forecasts

b) Initializing with local soil moisture

c) Generating a huge ensemble of regional forecasts that would be more useful to the proposed utility at watershed scale