

NASA Science Mission Directorate Earth Science Division Applied Sciences Program



**Integrating NASA Earth Systems Data into Decision-Making Tools
of Member Utilities of the Florida Water and Climate Alliance**

Water Resources
Christopher J. Martinez
7/1/2020



Water Resources – Project Summary



- Project Title: Integrating NASA Earth Systems Data into Decision-Making Tools of Member Utilities of the Florida Water and Climate Alliance
- Project PI: Christopher J. Martinez
- Solicitation: NNH18ZDA001N-WATER
- Project Summary: Improve water allocation and storage decisions by two member utilities of the Florida Water and Climate Alliance using high-resolution dry season forecasts initialized using remotely sensed soil moisture
- Geographic scope: Peninsular Florida
- Earth observations / models / technologies applied: SMOS/SMAP, MODIS, NMME, TRMM



Project Partners

Role	Name(s)	Affiliation
Co-I / Collaborator / Partner		
Co-I	Tirusew Asefa	Tampa Bay Water
Co-I	Traci Irani	University of Florida
Co-I	Jasmeet Judge	University of Florida
Co-I	Vasu Misra	Florida State University
Co-I	Kevin Morris	Peace River Manasota Regional Water Supply Authority

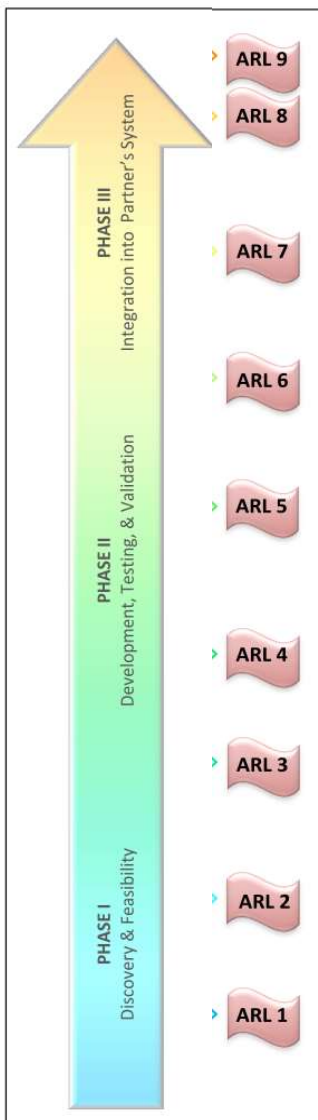


End-Users / Stakeholders

Role	Organization Name	Organization Type
Co-I/ Stakeholder	Tampa Bay Water	State Agency/Water Wholesaler
Co-I/ Stakeholder	Peace River Manasota Regional Water Supply Authority	State Agency/Water Wholesaler
Stakeholders	The Florida Water and Climate Alliance (www.FloridaWCA.org)	Multiple User Working Group (Utilities, State Water Management Districts, Municipalities, University Researchers)



Performance/ARL



- Start of project ARL = 3 (6/18/2019)
- Current ARL = 3
 - Project initiation
 - PI's have conducted previous work in using remotely sensed products and running regional models for Peninsular Florida
- Expected Ending ARL = 6 (6/17/2022)
 - Integration of forecasts into end-user tools and efficacy demonstrated
- Final ARL with no cost extension = insert # (if applicable)
 - Supporting evidence



Schedule

Milestone	Year	1				2				3			
	Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Quantify dry season onset/demise					X								
Downscale FGSM by RSM using SMAP							X						
Skill maps of hindcasts									X				
Delivery of forecasts to end-users													X
Streamflow forecasts using reanalysis									X				
Integration of forecasts into end-user tools													X
Model of decision-making process													X
Scheduled FloridaWCA workshops				X	X		X						



Project Risks

Rank	Type*	Risk	Mitigation Action
1	T	Availability of data	Use what is available/alternative soil moisture estimates
2	T	Loss of post-doctoral associates	Hire new personnel, push back schedule
3	T/S	Level of skill improvement impact on stakeholder adoption	Work with stakeholders
4	T/S	In person meetings cancelled due to CoVid19	In-person interviews and meetings have been moved online. A webinar series is planned for the future to keep stakeholders engaged
5			
...			

* Please designate risk type as: Technical (T), Budget (B), Stakehold / End User (S), or Project Management (PM)



Summary of Accomplishment / Progress: Q1 – 6/2019 – 9/2019

Technical Progress

- Graduate students recruited for project arrived in August

Capacity Building / Stakeholder Engagement

- Stakeholders are included as PIs on the project. Project personnel have been working together since 2010 as members of the Florida Water and Climate Alliance (www.FloridaWCA.org)
- FloridaWCA workshops scheduled:
 - February 6-7, 2020 – Orlando, FL
 - May 29, 2020 – Miami, FL
 - September 25, 2020 – Tallahassee, FL



Summary of Accomplishment / Progress: Q2 – 9/2019 – 12/2019

Technical Progress

- Global forecasts have been produced for 11/1/2000 – 3/1/2001 using sea surface temperatures from the CCSM4 model
- Global forecasts used as forcing fields in regional model
- Preliminary regional climate model runs have been conducted with 2 different model physics to determine which is most appropriate

Capacity Building / Stakeholder Engagement

- Stakeholders are included as PIs on the project. Project personnel have been working together since 2010 as members of the Florida Water and Climate Alliance (www.FloridaWCA.org)
- FloridaWCA workshops scheduled:
 - February 6-7, 2020 – Orlando, FL
 - May 29, 2020 – Miami, FL
 - September 25, 2020 – Tallahassee, FL



Summary of Accomplishment / Progress: Q3 – 12/2019 – 3/2020

Technical Progress

- Global forecasts have been produced for 11/1/2000 – 3/1/2001 using sea surface temperatures from the CCSM4 model
- Global forecasts used as forcing fields in regional model
- Preliminary regional climate model runs have been conducted with 2 different model physics to determine which is most appropriate

Capacity Building / Stakeholder Engagement

- Florida Water and Climate Alliance Workshop held in Orlando, FL on February 6-7, 2020.
- 21st Workshop since 2010. 37 participants
- Presentations and Workshop Report are available at www.FloridaWCA.org



Summary of Accomplishment / Progress: Q4 – 3/2020 – 6/2020

Technical Progress

- Regional forecasts for November-February have been completed for 2000-2019
- 30 Ensemble members at 10km resolution for Peninsular Florida
- 32 daily and monthly variables archived
- These forecasts do not include remotely sensed data, but will serve as the baseline to evaluate forecast improvement when the regional models are initialized with remotely sensed soil moisture and leaf area index
- Multiple Machine Learning Models continue to be evaluated for climate-driven streamflow forecasts
- Interviews with stakeholders are ongoing

Capacity Building / Stakeholder Engagement

- May 29, 2020 Florida Water and Climate Alliance workshop in Miami was cancelled due to CoVID19
- In its place, a webinar has been scheduled for July 22, 2020 entitled “Water, Climate and CoVID-19). More information can be found at www.FloridaWCA.org



Presentations

- Martinez, C.J. 2020. Improving Dry Season Hydrological Forecasts by Utilities of the Florida Water and Climate Alliance using Remotely Sensed Data and Regional Climate Models. Presented at the Water, Wetlands, and Watersheds Seminar, Center for Wetlands, University of Florida, January 29.
- Asefa, T*. 2020. Best Practices in Climate Adaptation: The Water Utilities Climate Alliance Example. Presented at the University of Florida Water Institute Symposium, February 25-26.
- Maran, C*. 2020. Future Extreme Rainfall Projections in Broward County. Presented at the University of Florida Water Institute Symposium, February 25-26.
- Martinez, C*. 2020. Using Seasonal Climate Forecasts to Improve Source-Allocation Decisions by Member Utilities of the Florida Water and Climate Alliance. Presented at the University of Florida Water Institute Symposium, February 25-26.
- Misra, V*. 2020. A Coupled Ocean-Atmosphere Downscaled Climate Projection for the Peninsular Florida Region. Presented at the University of Florida Water Institute Symposium, February 25-26.
- Morris, K*. 2020. Aquifer Storage and Recovery (ASR) System Recovery Initiation Index. Presented at the University of Florida Water Institute Symposium, February 25-26.

* Abstracts and presentations may be viewed at

<https://conference.ifas.ufl.edu/waterinstitute/speaker-presentations.html>



Publications

- Martinez, C.J., Asefa, T., Irani, T., Judge, J., Misra, V., Morris, K., Staal, L. 2019. Using High-Resolution Forecasting of the Dry Season of Peninsular Florida to Improve Source-Water Allocation Decision Making Presented at the 2019 Fall Meeting of the American Geophysical Union, San Francisco, CA, December 9 – 13.
- Misra, V., Irani, T., Staal, L., Morris, K., Asefa, T., Martinez, C., Graham, W. The Florida Water and Climate Alliance (FloridaWCA): Developing a learning community to create actionable science in climate adaption and water resource management. Submitted to the Bulletin of the American Meteorological Society.
- Misra, V. 2020. Regionalizing Global Climate Variations: A Study of the Southeastern US Regional Climate. Elsevier, 324p.



Example Figures or Posters

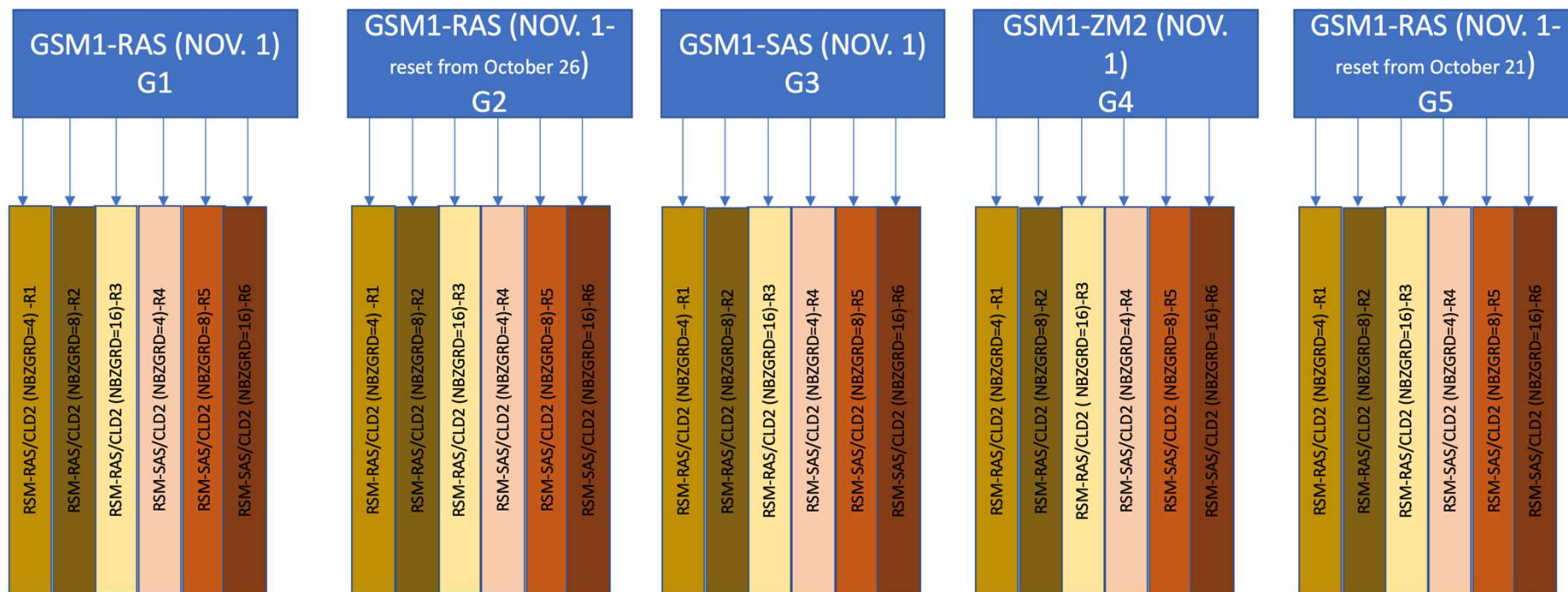
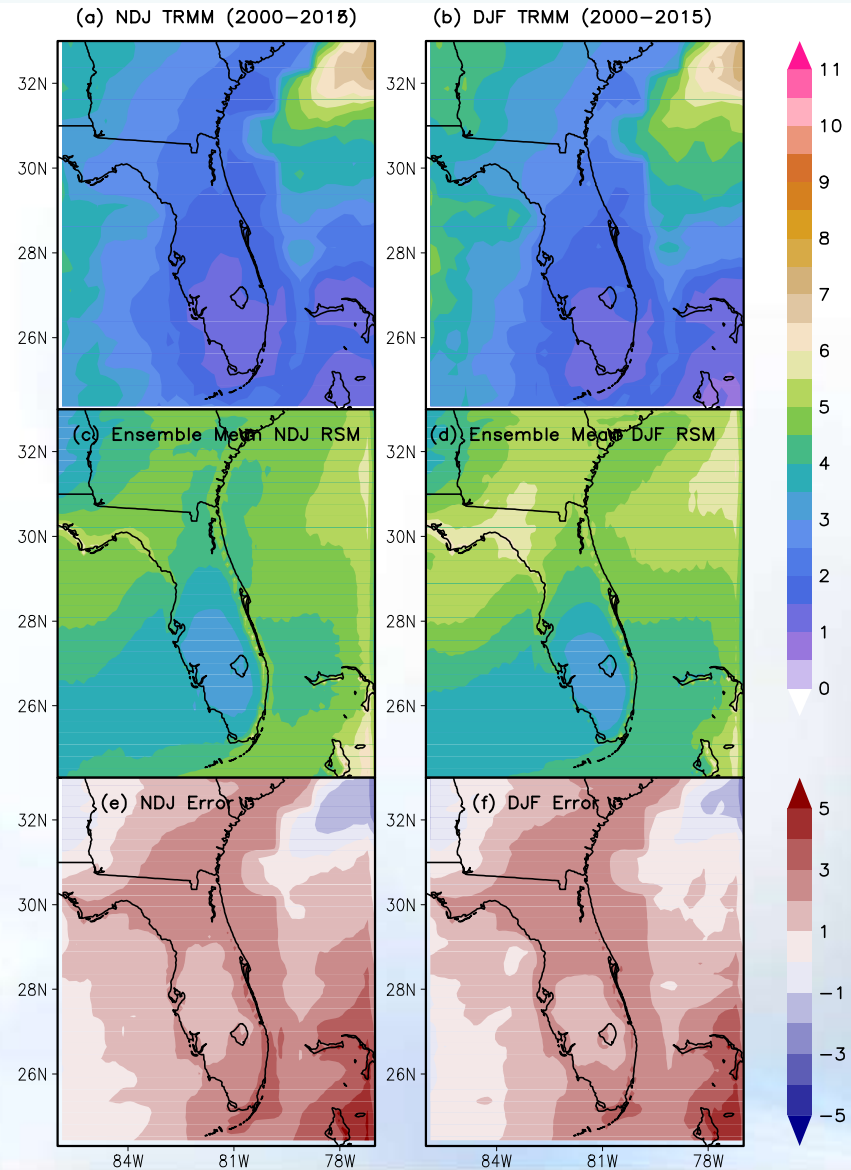


Figure 1: Schematic of the global model ensemble (5 members, top row), and regional model ensemble (6 members for each global model run, bottom row)



Example Figures or Posters

Figure 2: Climatological seasonal mean precipitation (mm/day) for (a, b) November-December-January (NDJ) and (d, e) December-January-February (DJF) from (a, d) TRMM and (b, e) ensemble mean RSM reforecast. Note that NDJ is at 0-month forecast lead in (b) and DJF is at 1-month forecast lead in (e). The corresponding climatological errors (RSM reforecast-TRMM; in mm/day) are shown for (c) NDJ and (f) DJF seasons.





Example Figures or Posters

Figure 3: Climatological seasonal mean surface temperature ($^{\circ}\text{C}$) for (a, b) November-December-January (NDJ) and (d, e) December-January-February (DJF) from (a, d) CPC and (b, e) ensemble mean RSM reforecast. Note that NDJ is at 0-month forecast lead in (b) and DJF is at 1-month forecast lead in (e). The corresponding climatological errors (RSM reforecast-CPC; in degrees C) are shown for (c) NDJ and (f) DJF seasons.

