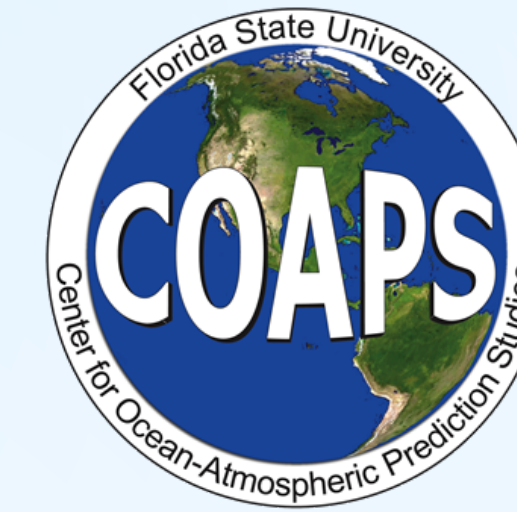# Integrating NASA Earth Systems Data into Decision-Making Tools of Member Utilities of the Florida Water and Climate Alliance
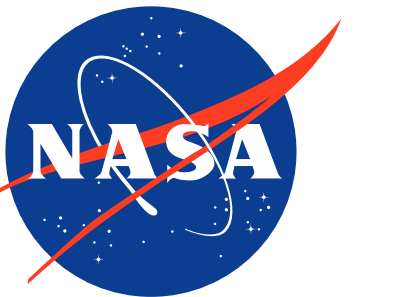
Jasmeet Judge[1], Hui Wang[2], Tirusew Asefa[2], Tracy Irani[1], Vasu Misra[3], Kevin Morris[4], Chris Martinez, Lisette Staal, Darlene Saindon Velez[1]

[1]University of Florida; [2] Tampa Bay Water; [3]Florida State University; [4]Peace River Manasota Regional Water Supply Authority

CHALLENGE
How to use the right source at the right time?

GOALS

- Improve water allocation and storage decisions by two Florida Water and Climate Alliance (FloridaWCA.org) utility members through a tool co-development process.
- Resolve land-ocean interactions in the Florida peninsula that are not available in current seasonal climate forecasts.
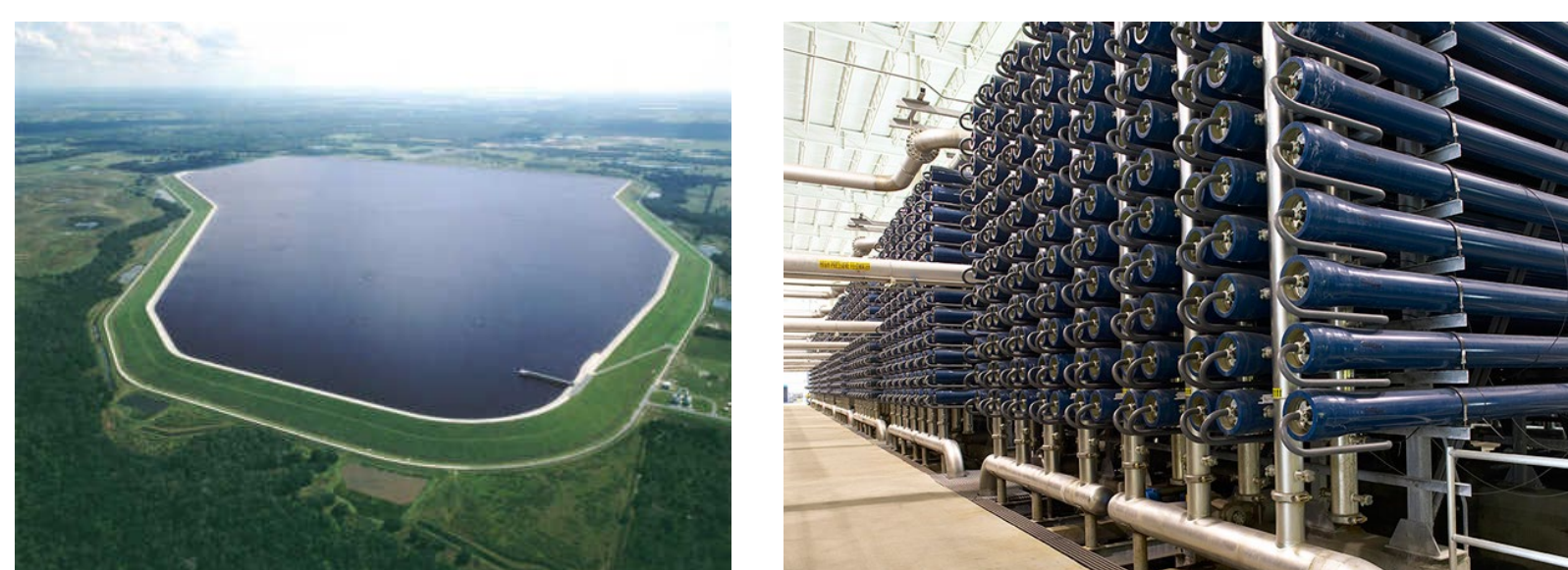
OBJECTIVES

- Develop real-time monitoring to anticipate the onset and demise of the of the distinct wet and dry seasons in Peninsular Florida.
- Develop high-resolution regional dry season forecasts.
- Integrate these forecasts into existing decision-making tools.
- Understand how participating in a stakeholder-scientist partnership affects adoption and integration of the scientific outputs into decision-making tools.
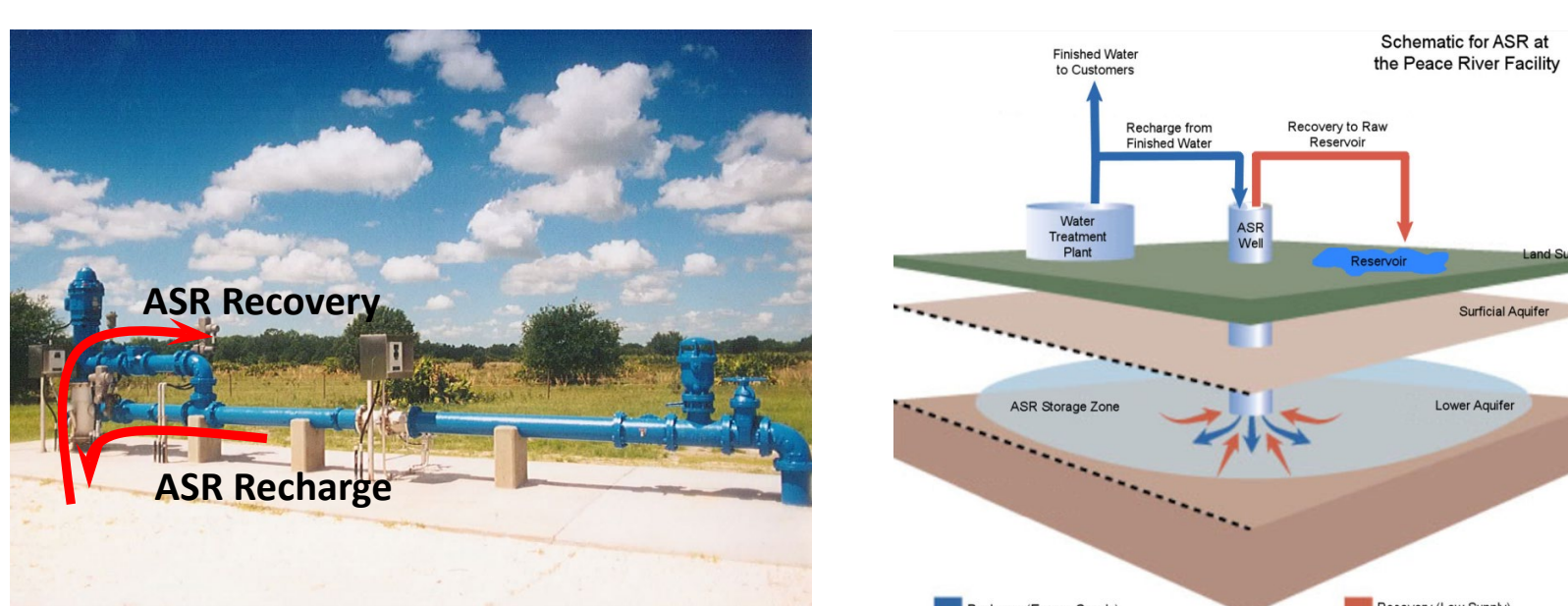
WATER MANAGEMENT SOURCES

Tampa Bay Water

- Sources: Groundwater, Hillsborough and Alafia Rivers, CW Bill Young Reservoir, Desalination Plant
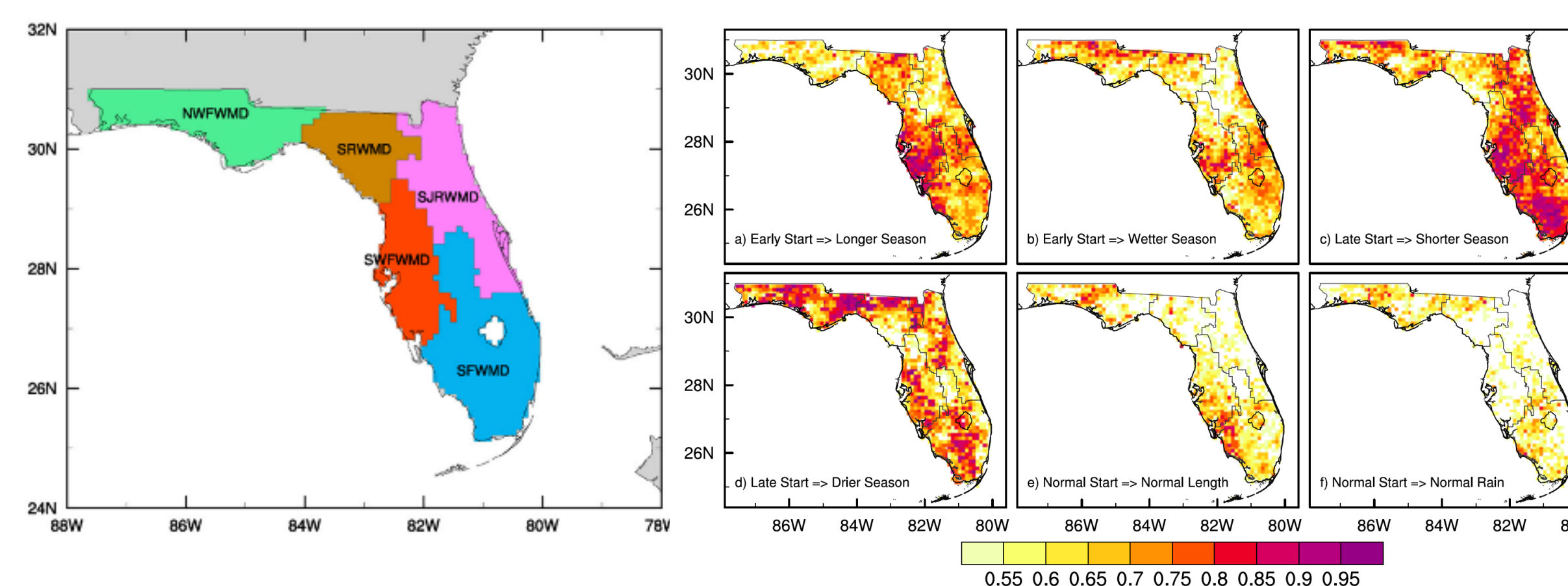

Peace River Manasota Regional Water Authority

- Source: Peace River
- Largest Aquifer Storage and Recovery system east of the Mississippi

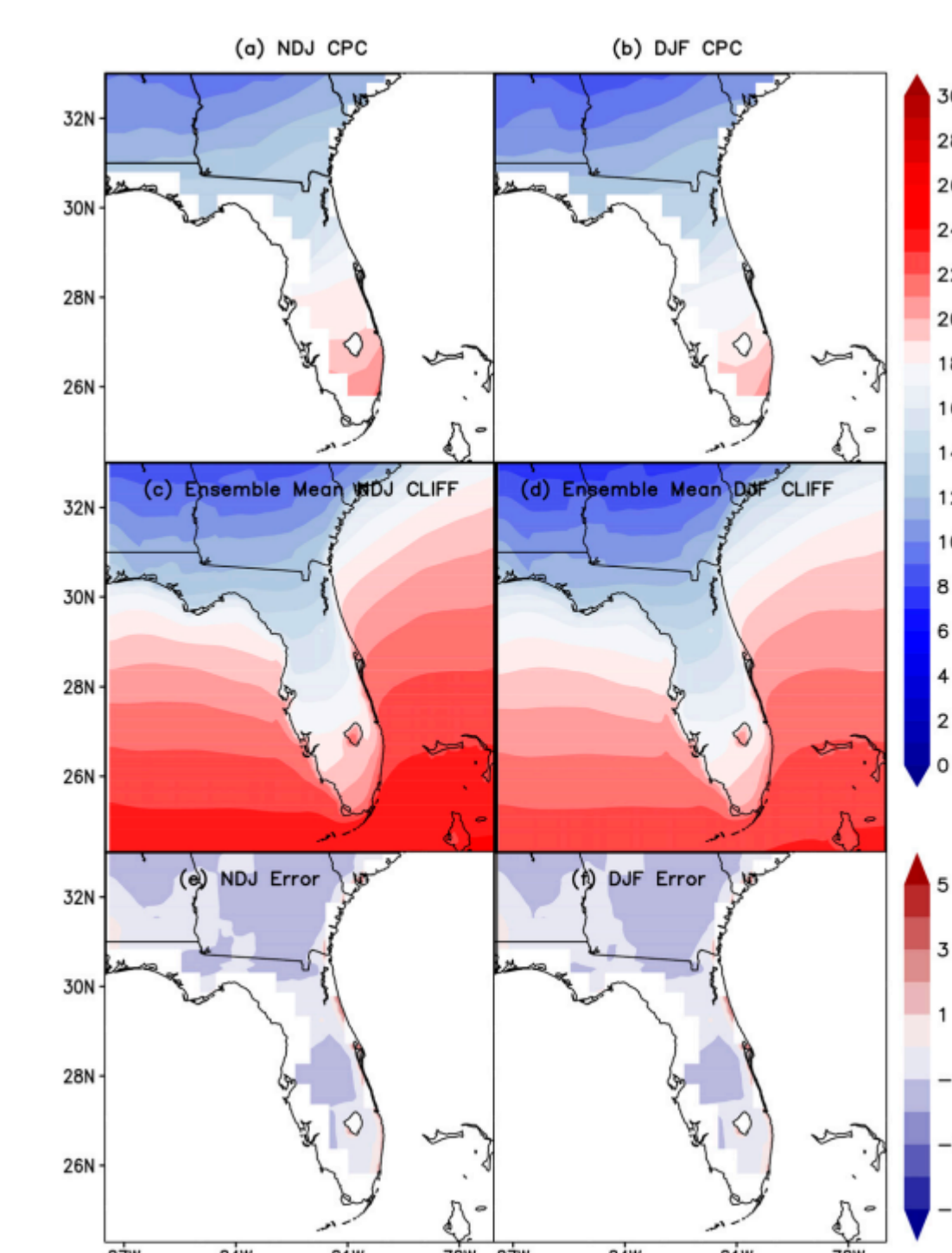

WHAT WAS ACCOMPLISHED

Real time summer (rainy) season forecasts by monitoring the onset

The domains of the five Florida Water Management Districts (WMDs):
1) South Florida (SFWMD),
2) Southwest Florida (SWFWMD),
3) St. Johns River (SJRWMD),
4) Suwannee River (SRWMD),
5) Northwest Florida (NWFWMD).

Shading shows where our seasonal outlooks incorporating wet season onset perform better than random seasonal forecasts of the rainy season. The larger the value, the more skillful the forecast is, with 1.0 being a perfect forecast.

Real time winter (dry) season forecasts at an unprecedented 10 km grid resolution

Climatological seasonal mean surface temperature (8C) for (a),(c) NDJ (Nov-Jan) and (b),(d) DJF (Dec-Feb) from (a),(b) Observations (CPC) and (c),(d) ensemble mean from 10km (CLIFF) forecasts.

Note that NDJ and DJF are a zero-month and one-month forecast lead, respectively, in CLIFF.

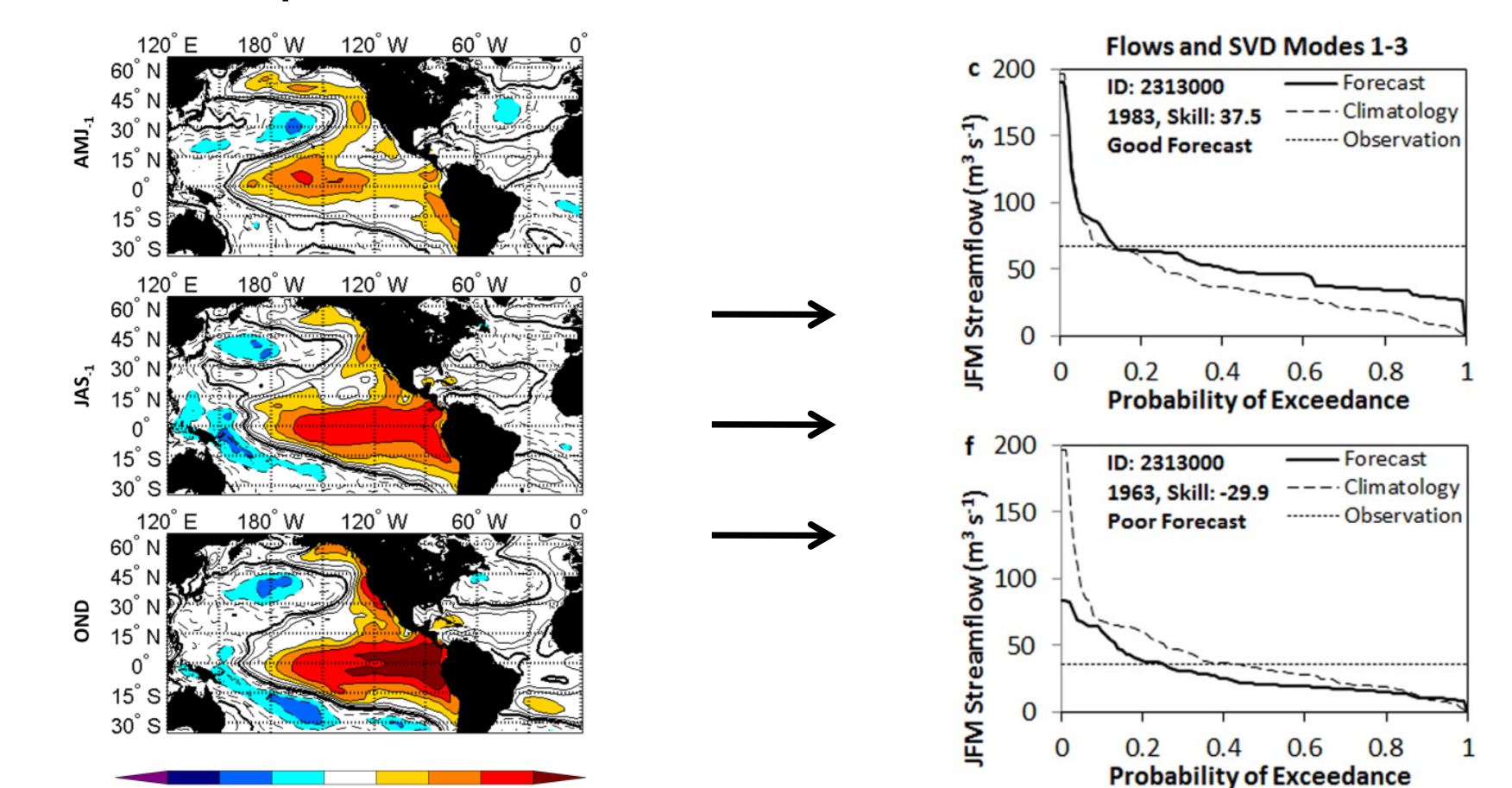The corresponding climatological errors (CLIFF-CPC) are shown for (e) NDJ and (f) DJF seasons.
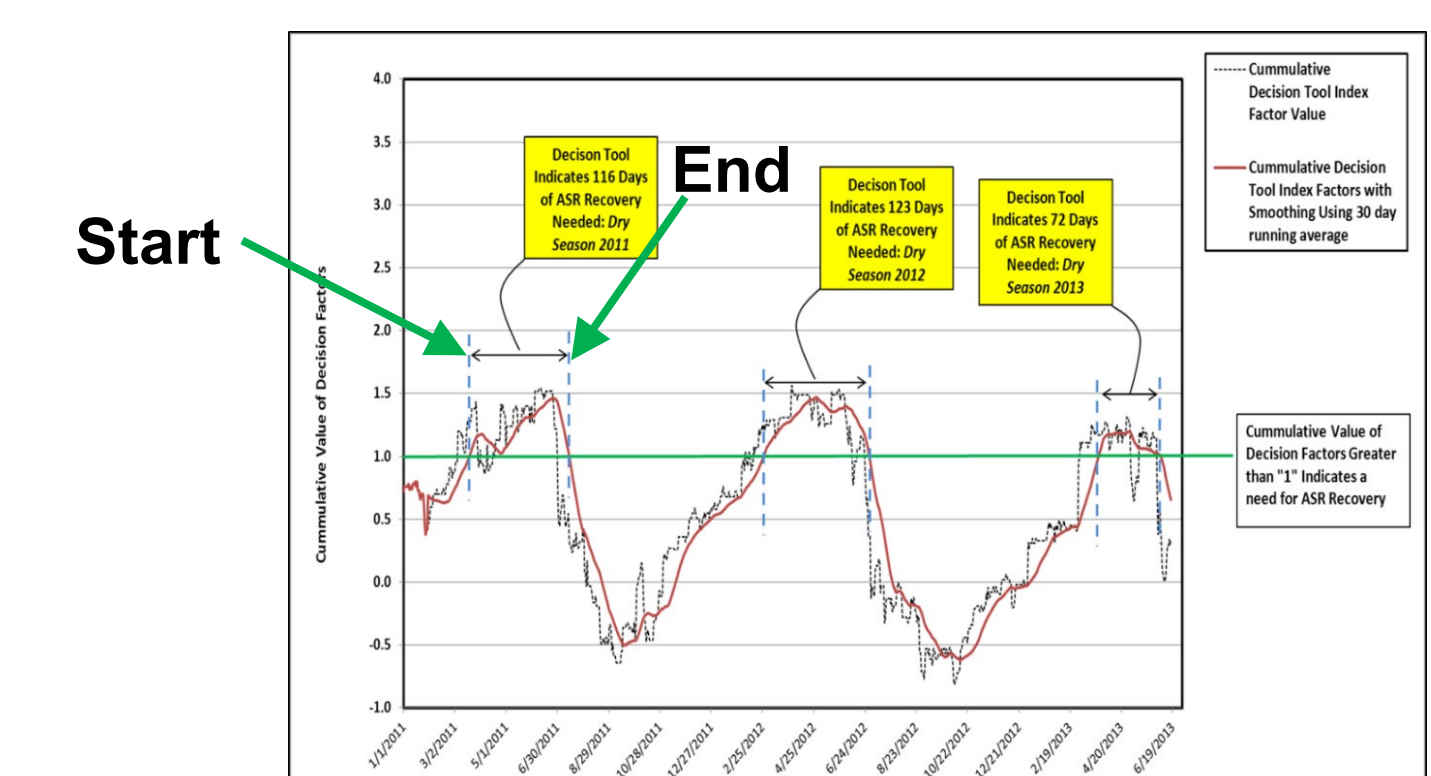
(Bhardwaj et al. 2021)

INTEGRATION INTO OPERATIONS

- 3-state hidden Markov model (conditioned on CPC Outlooks)
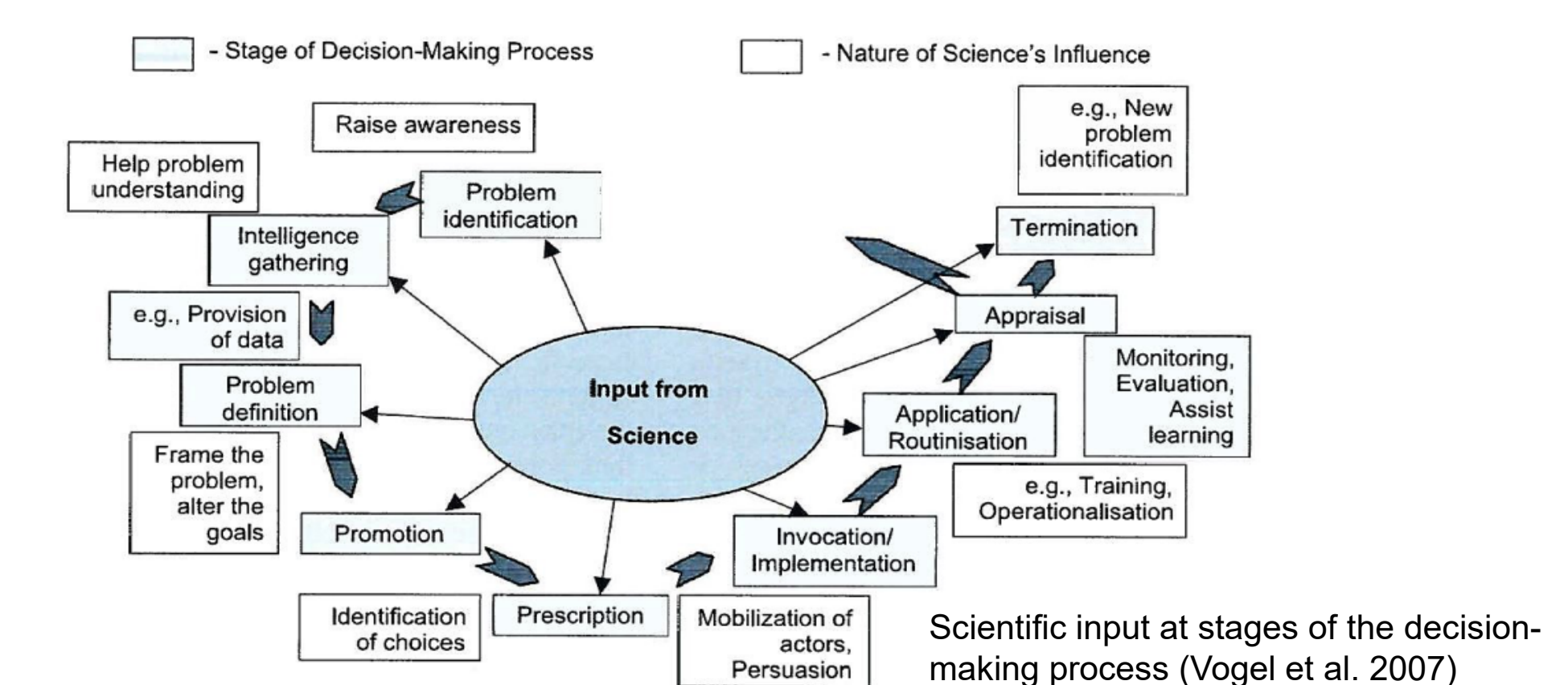- Probability of Exceedance streamflow forecasts using SSTs/atmospheric variables

- Aquifer Storage and Recovery Index (based on CPC outlooks, current streamflow, & Keetch-Byram drought index)

https://toolkit.climate.gov/tool/asr-recovery-initiation-index

- Formal assessment of the adoption and integration into decision-making processes

Scientific input at stages of the decision-making process (Vogel et al. 2007)

FUTURE RECOMMENDATIONS

- Water suppliers, regulators, and managers have a strong desire for climate projections at 10km or greater horizontal resolutions.
- Analysis of NASA datasets with long time records could be used to inform/supplement the model climate projections.
- The end users want to understand the mechanisms driving the long-term changes in climate that impacts resource management (e.g. higher temps = increased ET → less water with same rainfall)

OUTPUTS AND PUBLICATIONS

- Creation of a high-resolution retrospective seasonal forecast dataset from 2000-2022 for state of Florida.
- Improved forecasts compared to CPC outlooks with desired frequency, lead time, & resolution for hydrologic application.
- Improved water source operations in anticipation of forecasted drought or wetter than normal conditions.
- Over 18 related reports and publications found at https://www.FloridaWCA.org/activities/projects/