Using Data & Models in Local and Regional Modeling Effort

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Data-Informed Multi-Step Decisions

- Week to week Operations
- Seasonal demand outlook and source allocation
- Annual Budget Preparation
- Long-term Planning

Am I meeting my members demand (quality & Quantity)?

Am I within permit and my supply allocation targets?

Am I within budget (responsibility to rate payers)?

Am I prepared for the long-haul?

Local Context very Important!

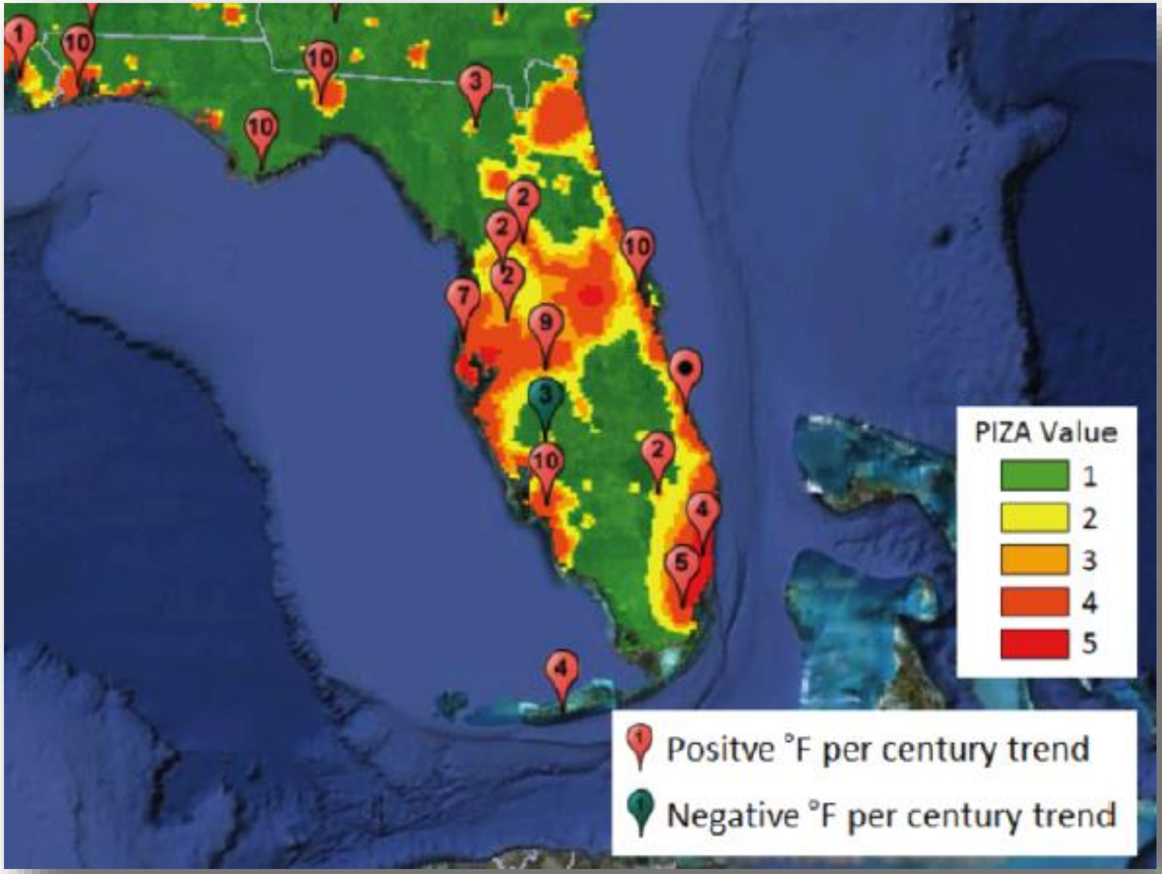
More Intense Rains in U.S. Midwest Tied to Farm Mechanization

Replacement of horses by machines since the 1940s allowed central U.S. farmers to change the crops they planted, which may have altered regional climate.

A tractor sprays a soybean field. Credit: iStock.com/fotokostic

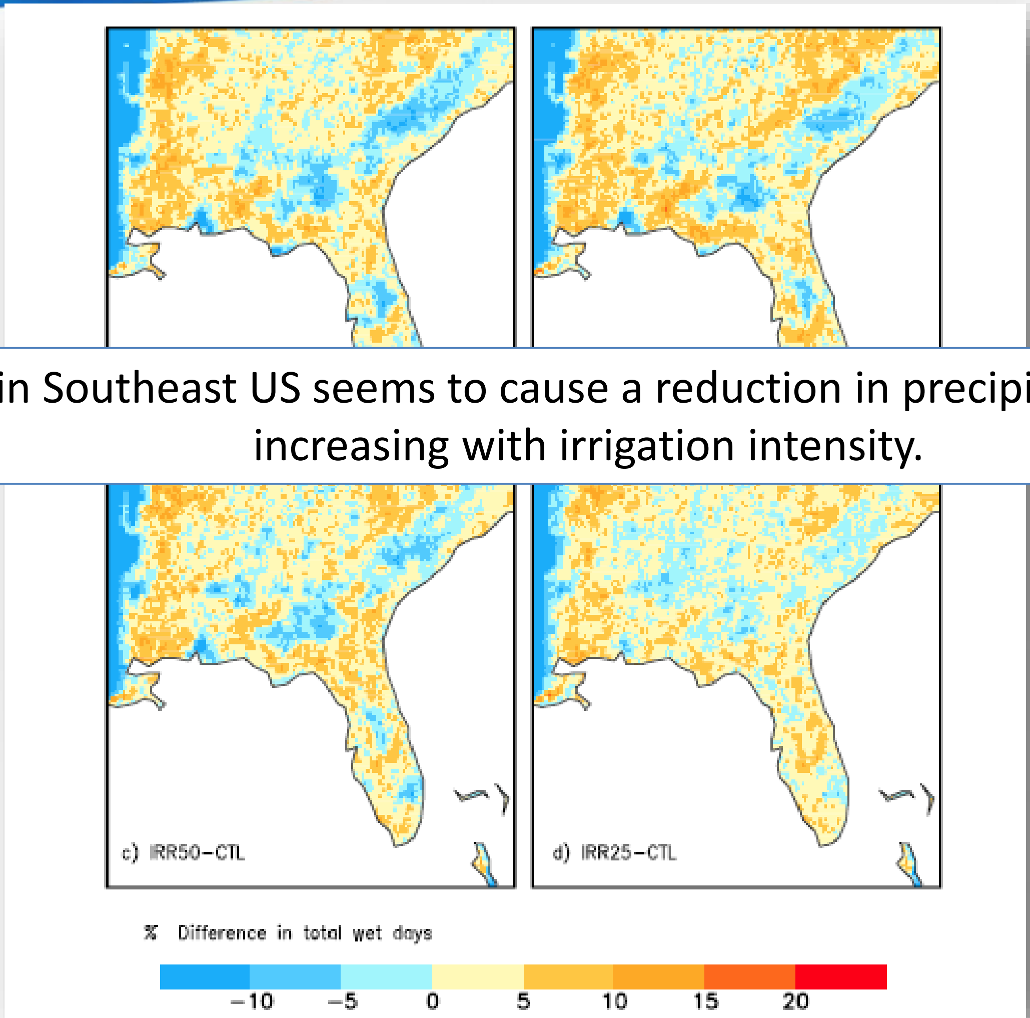
EOS Buzz, May 5th, 2017

Local Context: Florida



Misra et al. (2012), J. Climate

Local Context: Southeast



Irrigation in Southeast US seems to cause a reduction in precipitation…reduction increasing with irrigation intensity.

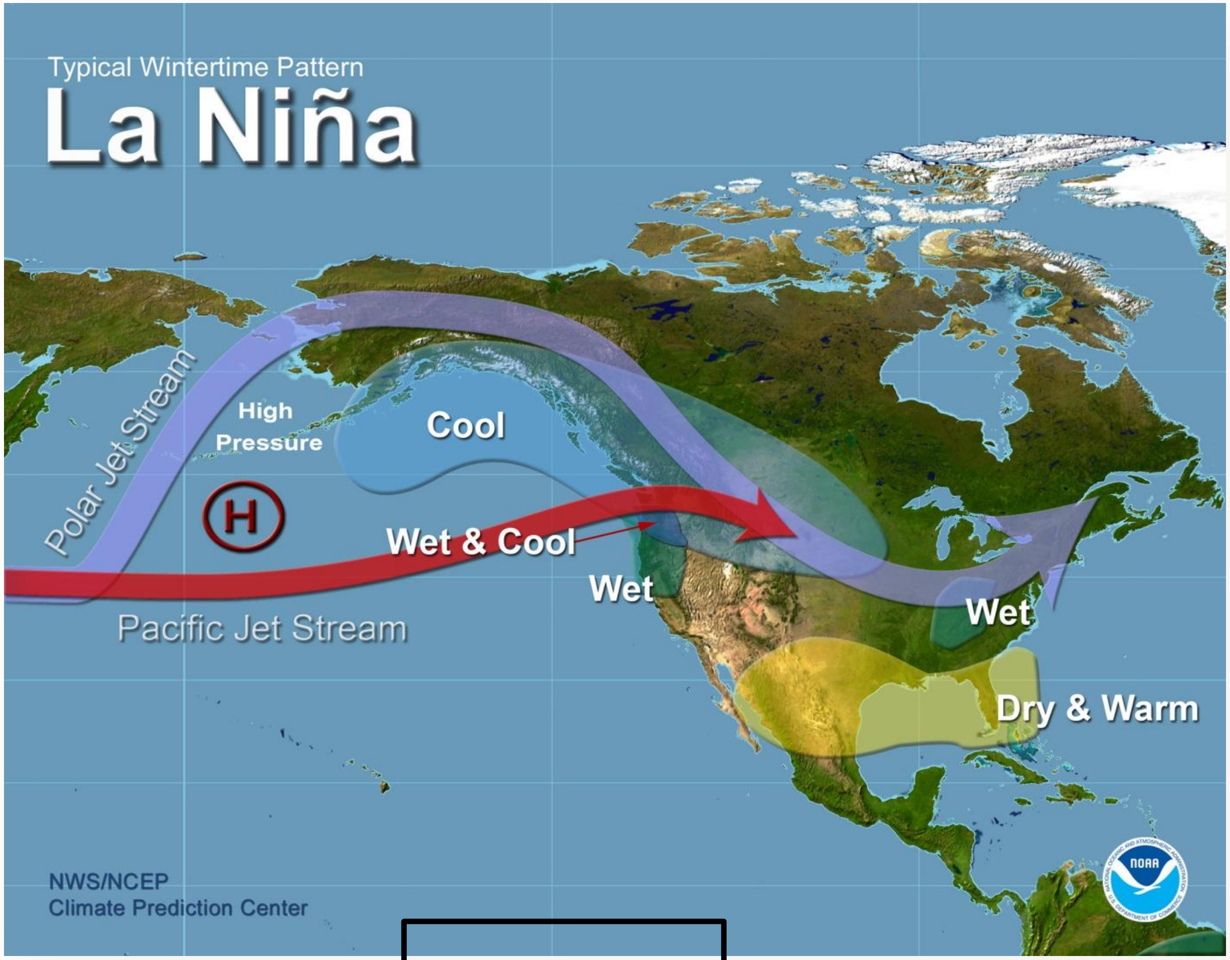
Selman and Misra (2016) J. Geophyical Res.

TAMPA BAY WATER

Climate Outlook: Weak La Niña

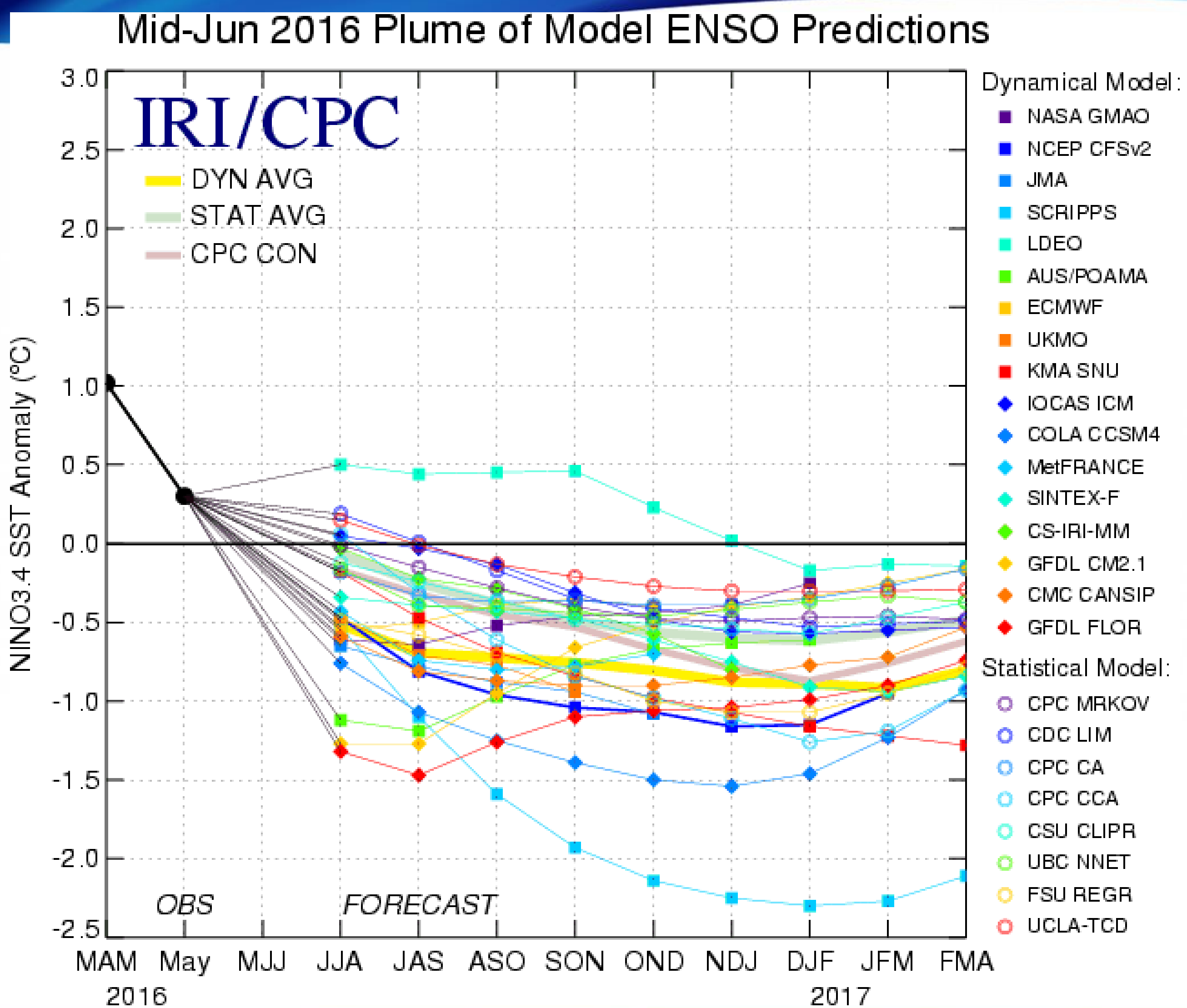
La Niña Advisory issued

Below average rainfall and warmer than normal forecast



Typical La Niña circulation pattern (Source: NOAA)

Fall/Winter 2016, Spring 2017



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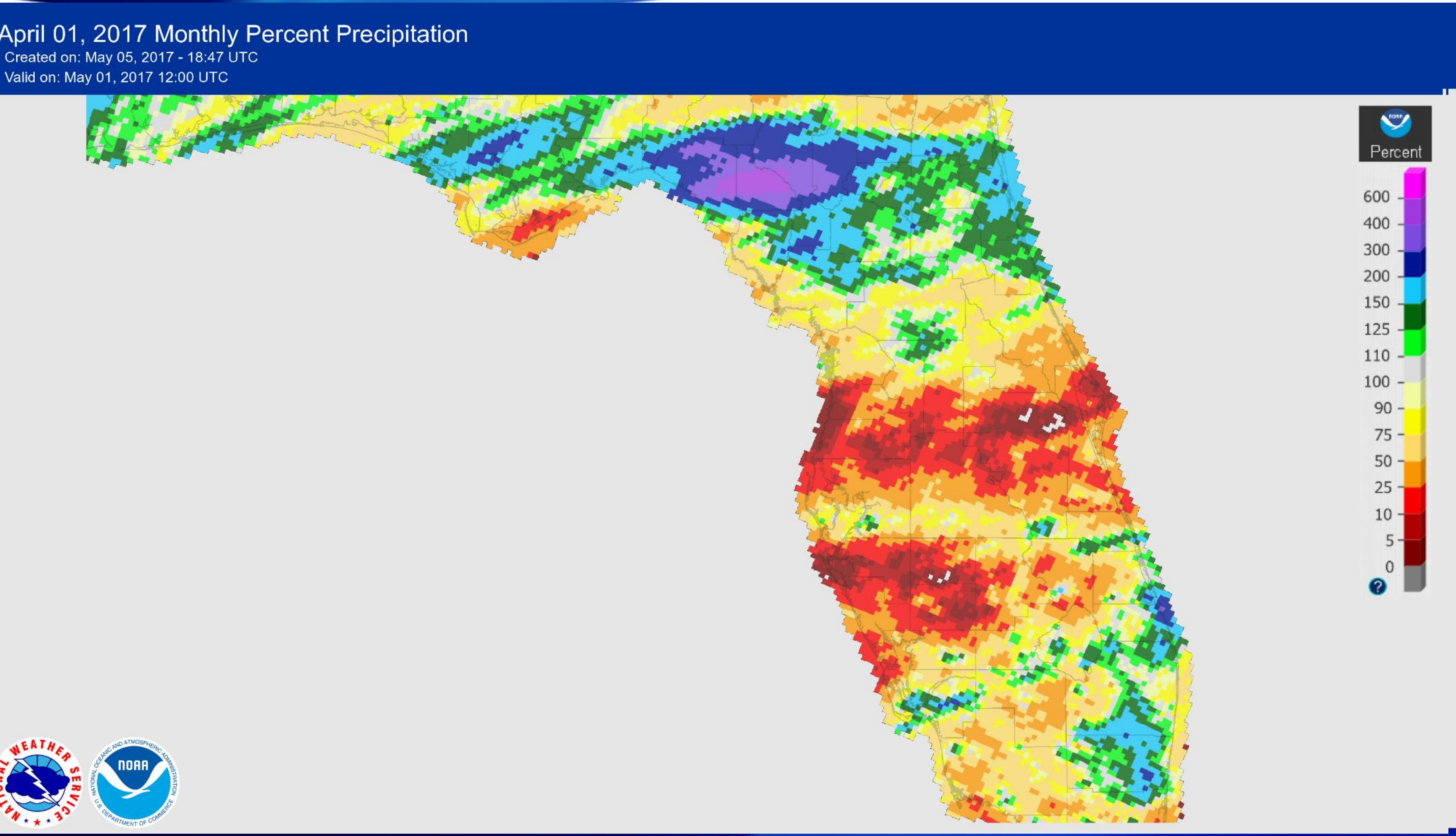
Seasonal Data-informed Decision



2016/2017 La Niña

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2014	-0.5	-0.5	-0.4	-0.2	-0.1	0.0	-0.1	0.0	0.1	0.4	**0.5**	**0.6**
2015	**0.6**	**0.5**	**0.6**	**0.7**	**0.8**	**1.0**	**1.2**	**1.4**	**1.7**	**2.0**	**2.2**	**2.3**
2016	**2.2**	**2.0**	**1.6**	**1.1**	**0.6**	0.1	-0.3	**-0.6**	**-0.8**	**-0.8**	**-0.8**	**-0.7**
2017	-0.4	-0.1	0.1									

Old Reference

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2014	-0.5	-0.6	-0.4	-0.2	0	0	0	0	0.2	0.4	0.6	0.6
2015	0.5	0.4	**0.5**	**0.7**	**0.9**	**1.0**	**1.2**	**1.5**	**1.8**	**2.1**	**2.2**	**2.3**
2016	**2.2**	**1.9**	**1.5**	**1.1**	**0.6**	0.1	-0.3	**-0.5**	**-0.7**	**-0.8**	**-0.8**	**-0.6**
2017	**-0.5**	-0.2	0.1									

Average Sea Surface Temperature

La Niñas We Didn't Know We Had

The change in the way the Climate Prediction Center calculates the Pacific's average temperature has already shaken up a couple of items in the table of historic El Niño and La Niña events. The revisions confirm that it was time to make a change.

In the last version of the table, all the temperature anomalies were based on the 1971-2000 average, which was relatively cool compared to the past three decades. Against that background, some periods of cooler-than-average temperatures (from late 2005 to early 2006 and from late 2008 through early 2009) were not quite cold enough for long enough to qualify as an official La Niña episode.

However, the new strategy calls for the current decade to be compared to the 1981-2010 average—the three warmest decades on record. When NOAA scientists updated the table, the cool periods in 2005/2006 and 2008/2009 emerged as true La Niña episodes.

Seasonal temperature anomalies since 2000

La Niña, El Niño, neutral

relative to 1971-2000

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.6	-1.4	-1.0	-0.8	-0.6	-0.5	-0.4	-0.4	-0.4	-0.5	-0.6	-0.7
2001	-0.6	-0.5	-0.4	-0.2	-0.1	0.1	0.2	0.2	0.1	0.0	-0.1	-0.1
2002	-0.1	0.1	0.2	0.4	0.7	0.8	0.9	1.0	1.1	1.3	1.5	1.4
2003	1.2	0.9	0.5	0.1	-0.1	0.1	0.4	0.5	0.6	0.5	0.6	0.4
2004	0.4	0.3	0.2	0.2	0.3	0.5	0.7	0.8	0.9	0.8	0.8	0.8
2005	0.7	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.2	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.1	0.1	0.2	0.3	0.5	0.6	0.9	1.1	1.1
2007	0.8	0.4	0.1	-0.1	-0.1	-0.1	-0.1	-0.4	-0.7	-1.0	-1.1	-1.3
2008	-1.4	-1.4	-1.1	-0.8	-0.6	-0.4	-0.1	0.0	0.0	0.0	-0.3	-0.6
2009	-0.8	-0.7	-0.5	-0.1	0.2	0.6	0.7	0.8	0.9	1.2	1.5	1.8
2010	1.7	1.5	1.2	0.8	0.3	-0.2	-0.6	-1.0	-1.3	-1.4	-1.4	-1.4
2011	-1.3	-1.2	-0.9	-0.6	-0.2	0.0	0.0	-0.2	-0.4	-0.7	-0.8	-0.9
2012	-0.8	-0.6										

relative to 1981-2010

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2000	-1.7	-1.5	-1.2	-0.9	-0.8	-0.7	-0.6	-0.5	-0.6	-0.6	-0.8	-0.8

Hydrologic & Systems Model

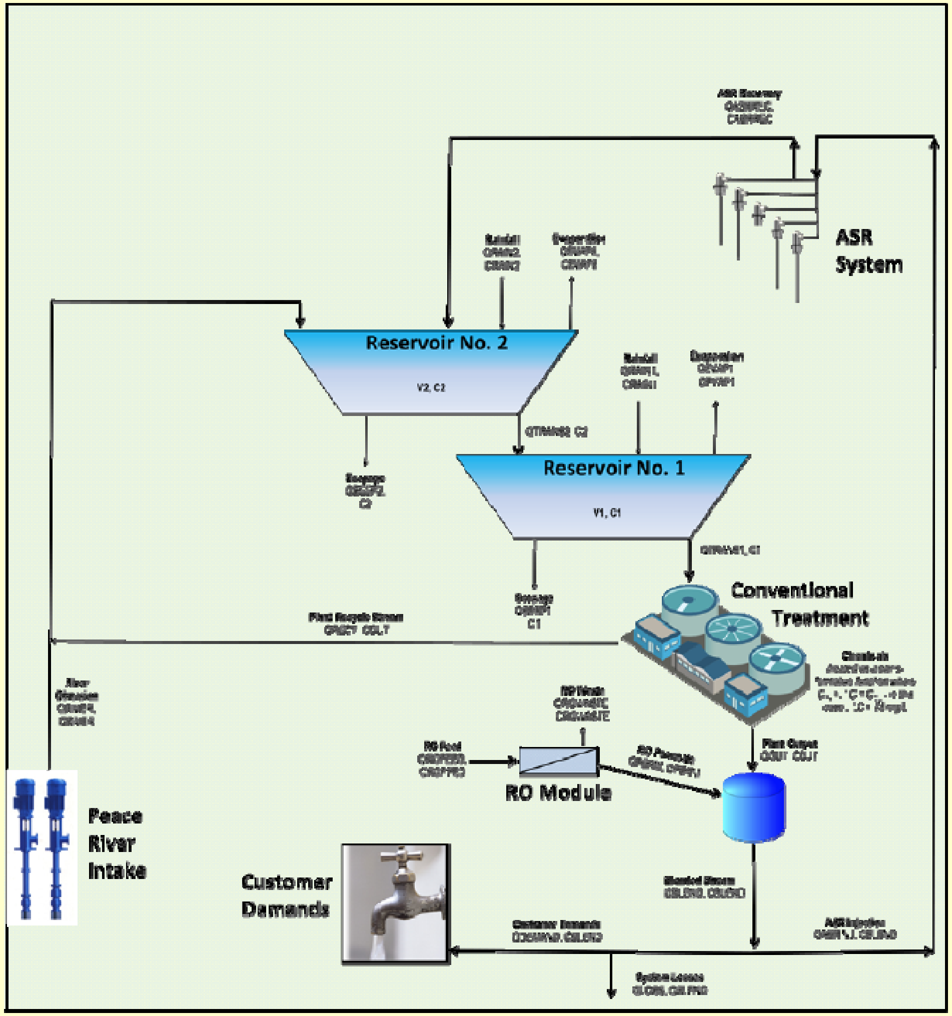
"If you don't have a hydrologic model, you don't have jack"

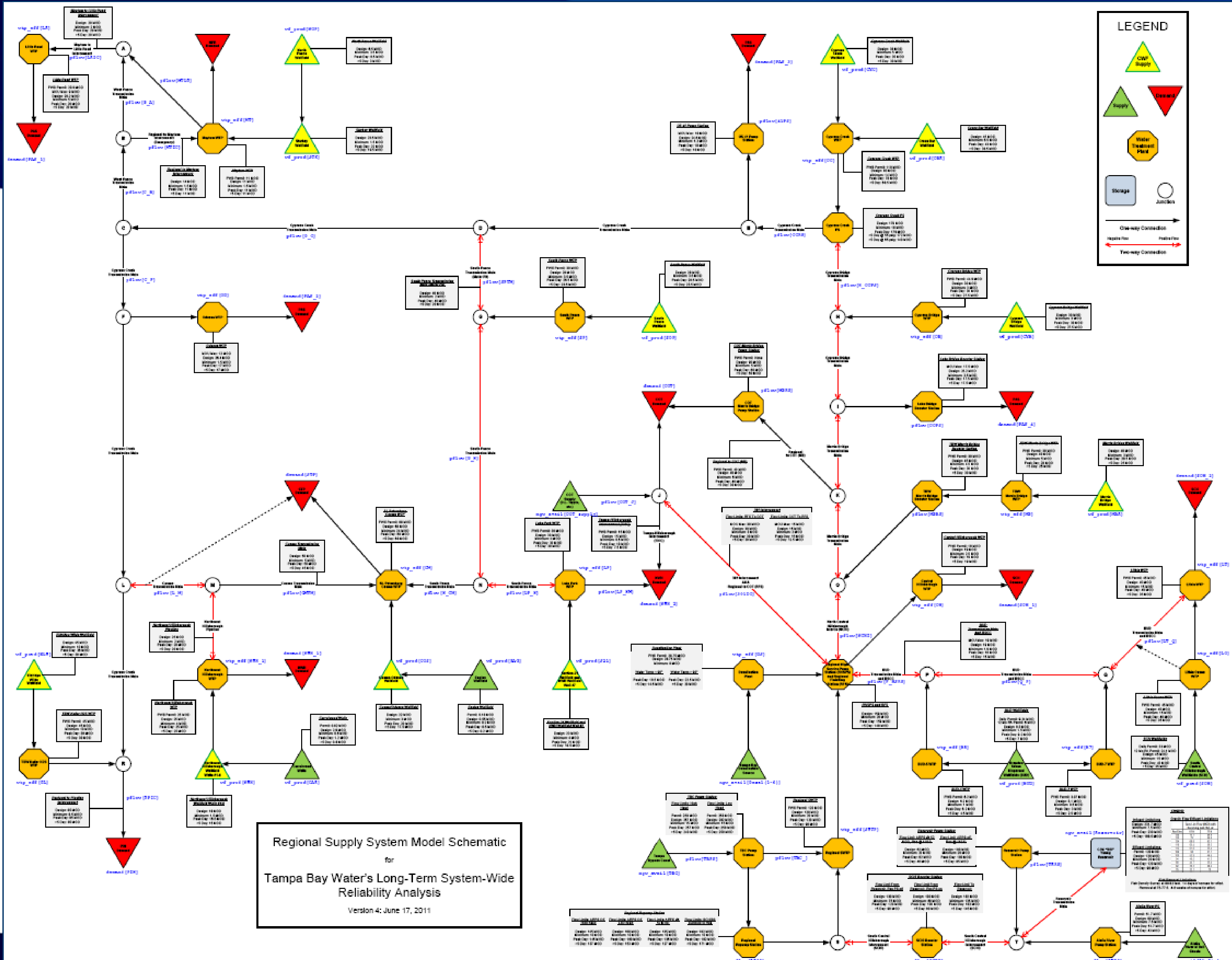
Dr. Alison Adams

Hydrologic & Systems Models

System Reliability Modeling Starts by Defining Fundamental Solvent & Solute Mass Balance Relationships

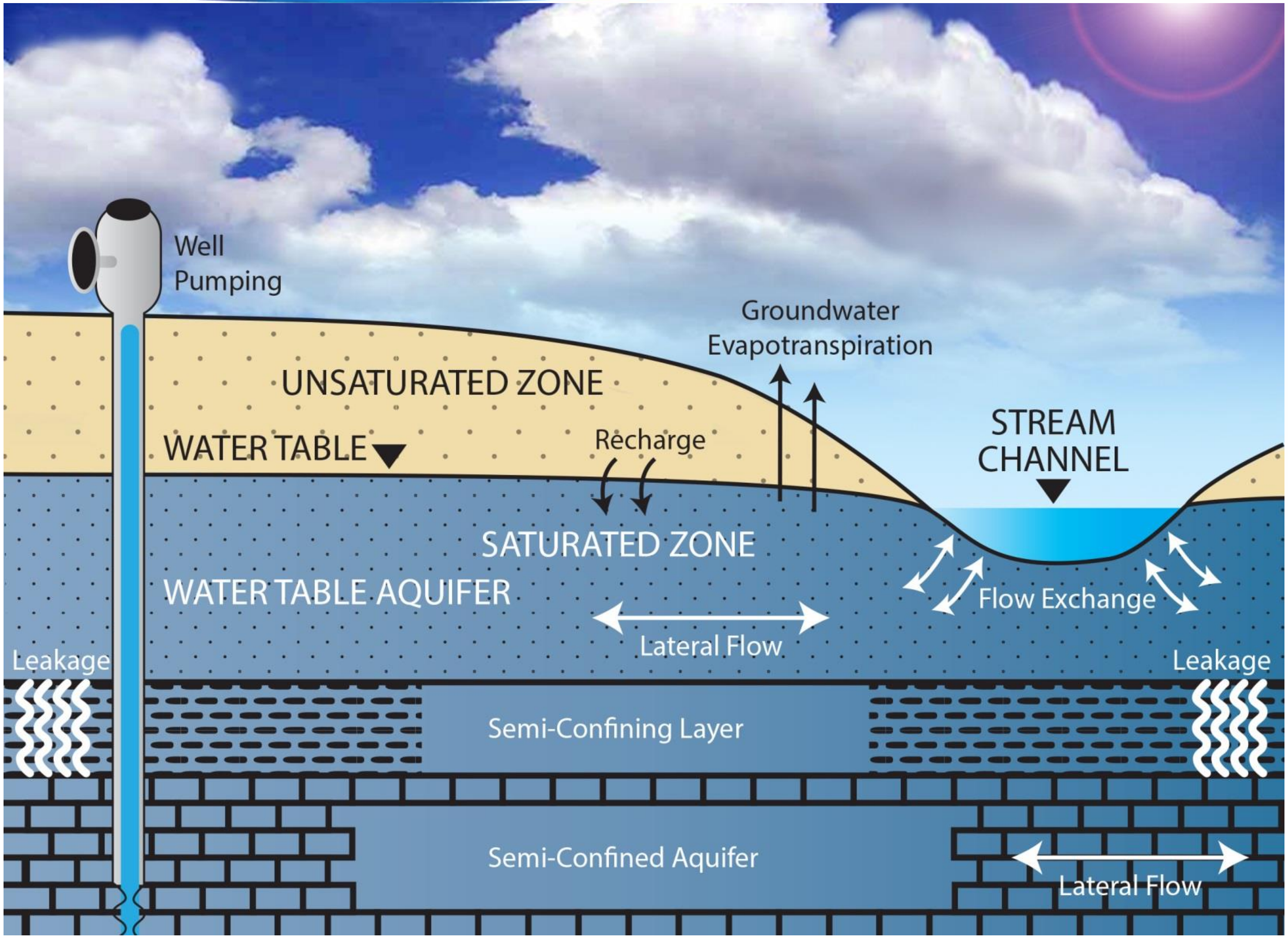
(Solute in this case is TDS)





LEGEND
CWF Supply
Supply
Demand
Water Treatment Plant
Storage
Junction
One-way Connection
Two-way Connection
Regional Supply System Model Schematic
for
Tampa Bay Water's Long-Term System-Wide Reliability Analysis
Version 4: June 17, 2011

Integrated Hydrologic Model



Surficial Aquifer System (SAS)

Intermediate Aquifer System (IAS)

Upper Floridan Aquifer System (UFAS)

Models Used to Manage Diverse Source

Ground Water

Desal Water

Surface Water

15 BG Reservoir

TAMPA BAY WATER

Tampa Bay Times

Cooperation got us ready for drought

Friday, April 21, 2017 5:18pm

Getting to this point was an ugly, expensive slog. But in the face of a statewide drought, the Tampa Bay region stands well-positioned to cope with the dry conditions without harming the environment. That's thanks to the existence of a regional water authority, a 15-billion-gallon reservoir and a massive desalination plant that reduces the need to pump extra groundwater when the rains aren't falling.

Thirty years ago, Tampa Bay was at war with itself over water, with counties battling over who was drawing too much from the aquifer and damaging lakes and rivers. That eventually led to the creation of Tampa Bay Water, a regional utility uniting the interests of Pinellas, Hillsborough and Pasco counties. The agency led the charge to construct a desal plant and reservoir for droughts just like the current one. Both projects became mired in multimillion-dollar cost overruns, breakdowns and mismanagement. But it has ultimately reflected the wisdom of regional co-operation. Both facilities are now running and serving their purpose, and no region in Florida is as well-equipped to endure the drought as this one.

Conclusion

- Need to have hydrologic ad Systems model to understand your own local situation

- Climate variability and change simulation need to incorporate local context

- Short-term adaptive management strategies should be tied to long-term planning and vice versa

Questions & Comments