

Lake Okeechobee System Operating Manual

**Iteration 2 Modeling -
Evaluation Technical workshop
Climate perspective**

Sanibel-Captiva Conservation Foundation

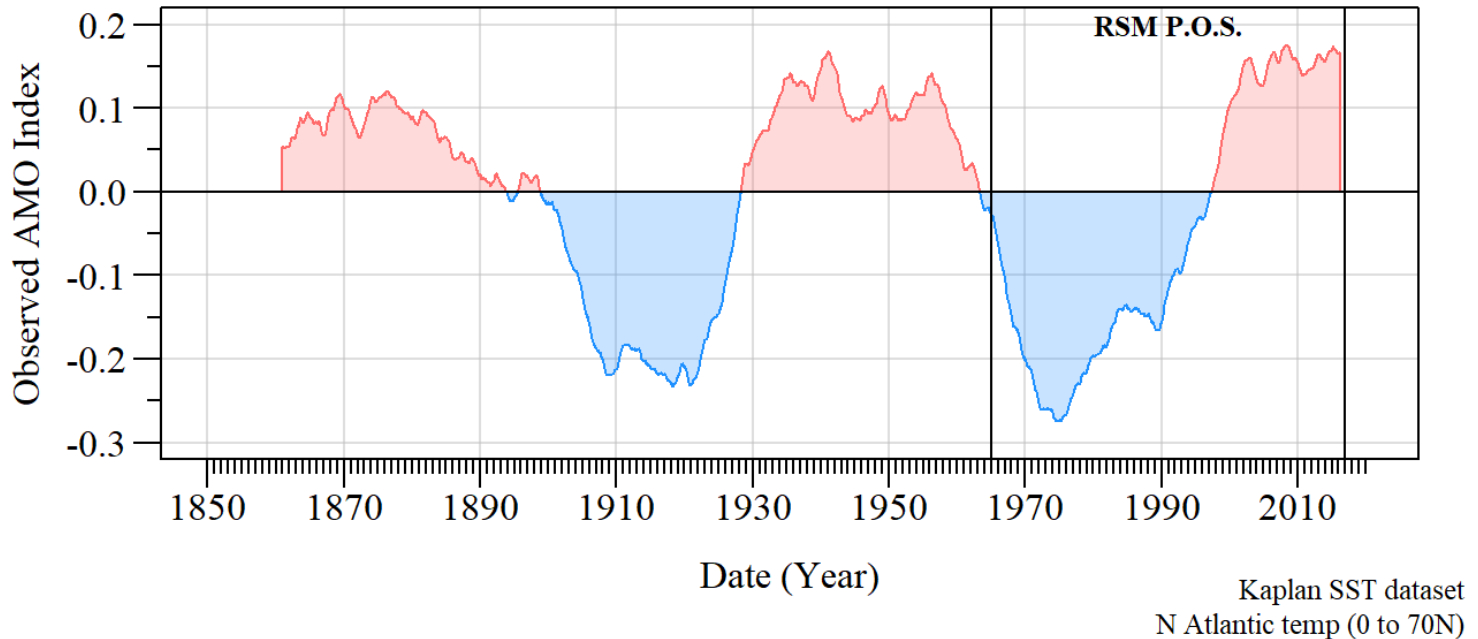
Conservancy of Southwest Florida

June 29, 2021

(Updated: June 30, 2021)



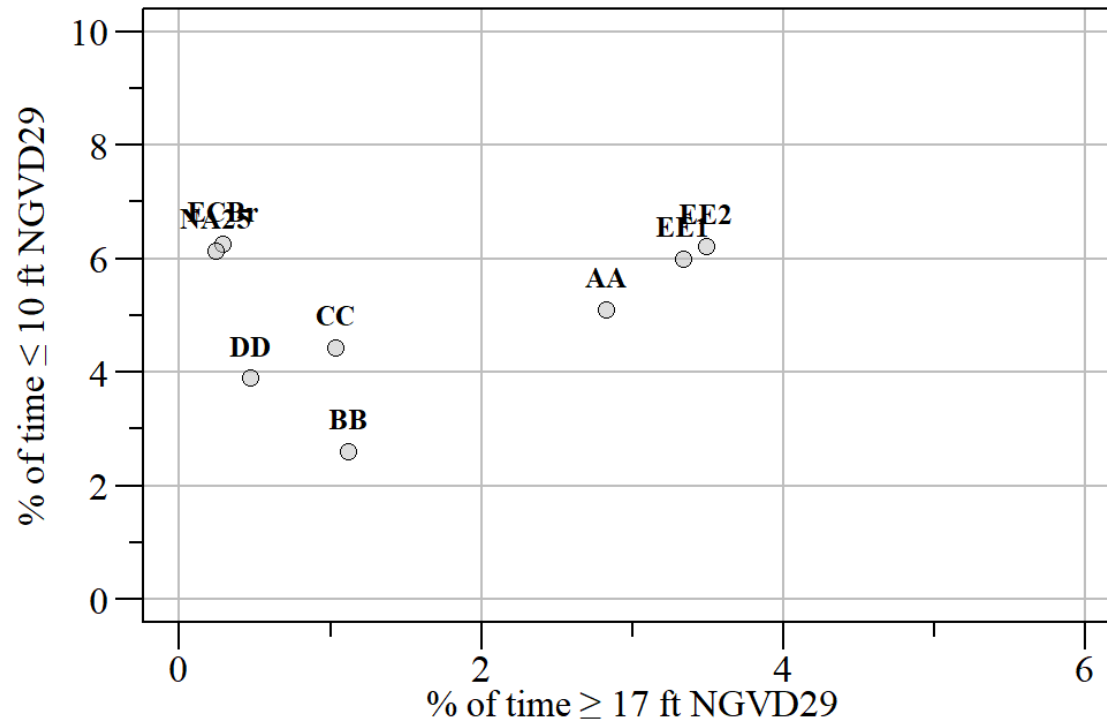
Paul Julian PhD 



Monthly observed Atlantic Multidecadal Oscillation (AMO) Index from 1856 to 2021 for the northern Atlantic (Enfield et al. 2001).

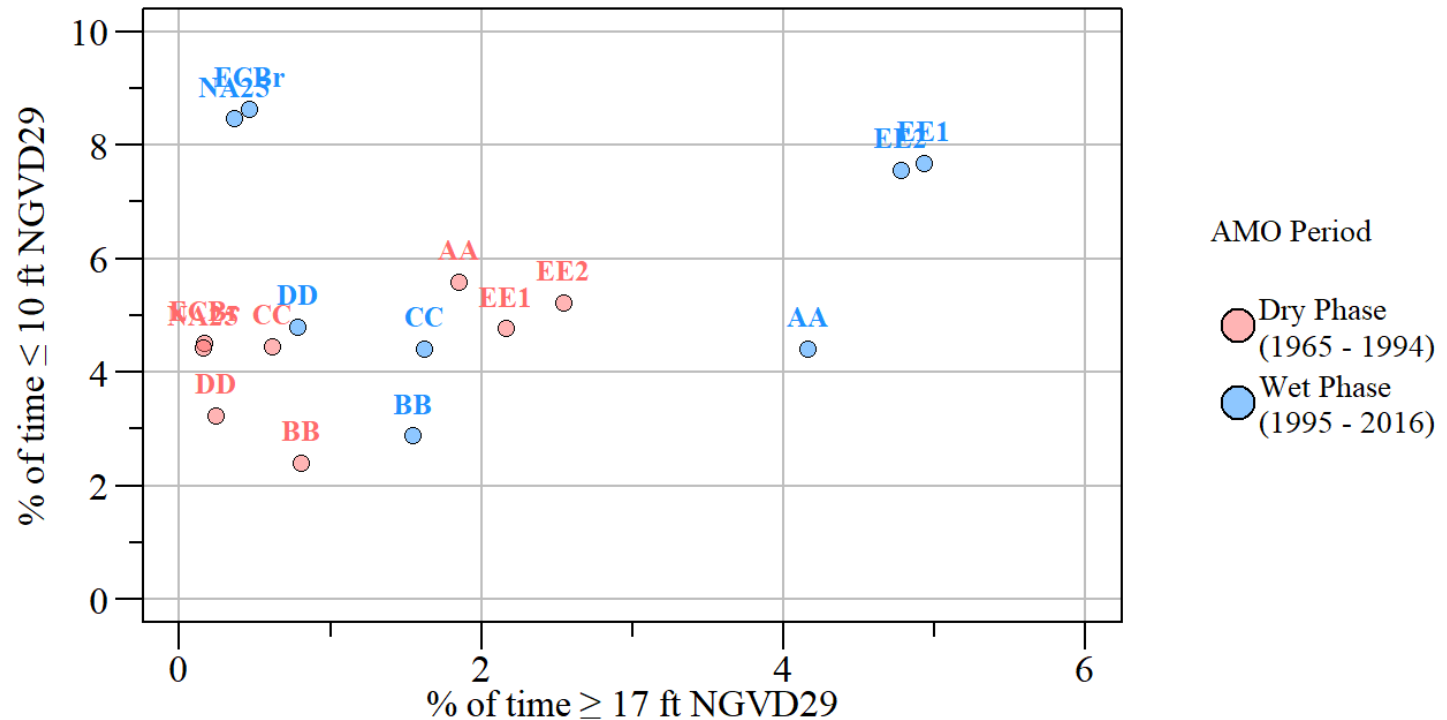
- Recent debate on AMO index suggest decadal or longer-term internal oscillatory signals that are distinguishable from climatic noise (see Steinman et al 2015; Mann et al 2020; Mann et al 2021).
- Only variability in the interannual range associated with the El Niño/Southern Oscillation is found to be distinguishable from the noise background.
 - Still an indicator of warm/cool phase shift.

Extreme High/Low



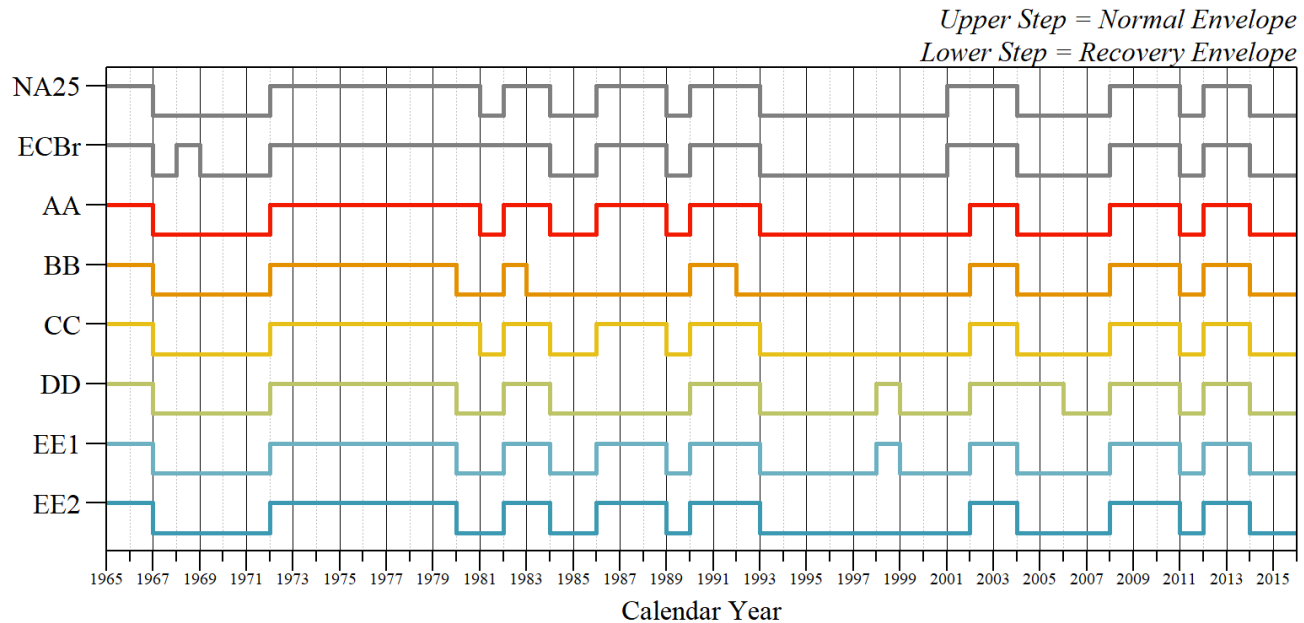
Percent of time where stages ≤ 10 or ≥ 17 Ft NGVD29 during the period of simulation (1965 - 2016).

Extreme High/Low



Percent of time where stages ≤ 10 or ≥ 17 Ft NGVD29 during the period of simulation (1965 - 2016) broken down into dry (1965-1994) and wet (1995-2016) phases.

Normal/Recovery Envelope



Transition between normal and recovery stage envelopes for each alternative during the entire simulation period.

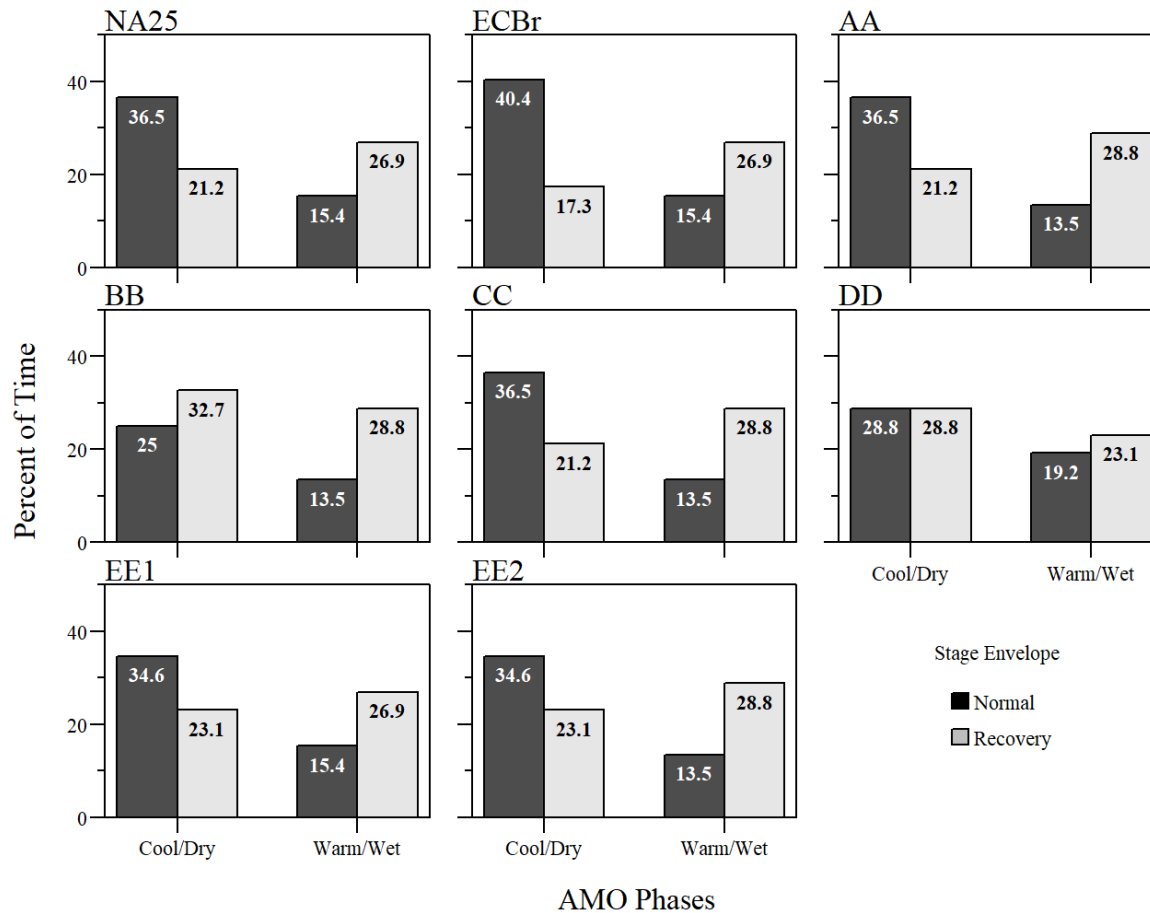
Shift from normal to recovery:

- Stages >17 Ft any time of the year *or*
- Stage in the June1 – July31 window is ≤ 13.0 ft for < 30 days

Shift from recovery to normal:

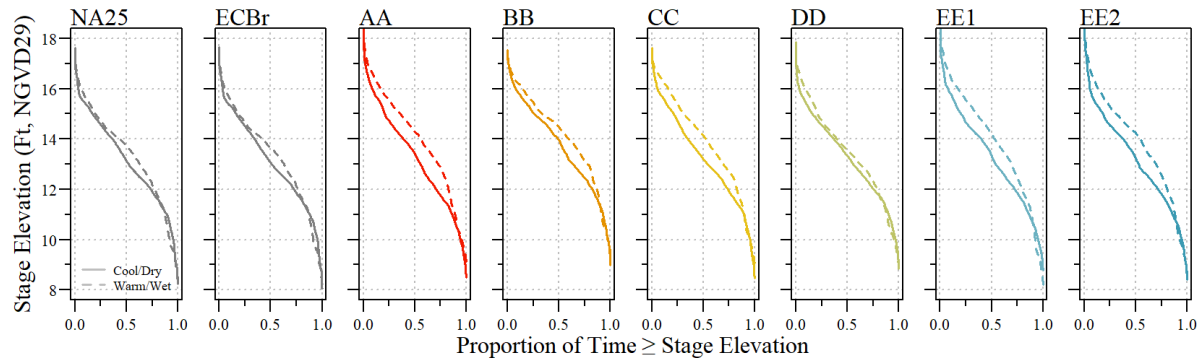
- Stage ≤ 16.0 ft from Aug1 – Dec31 *and*
- Stage during May1 - Aug1 falls below 11.5 Ft for 60 or more days *or*
- Stage during Apr15 - Sep15 falls below 12.0 Ft for 90 or more days

Lake Stage Envelope

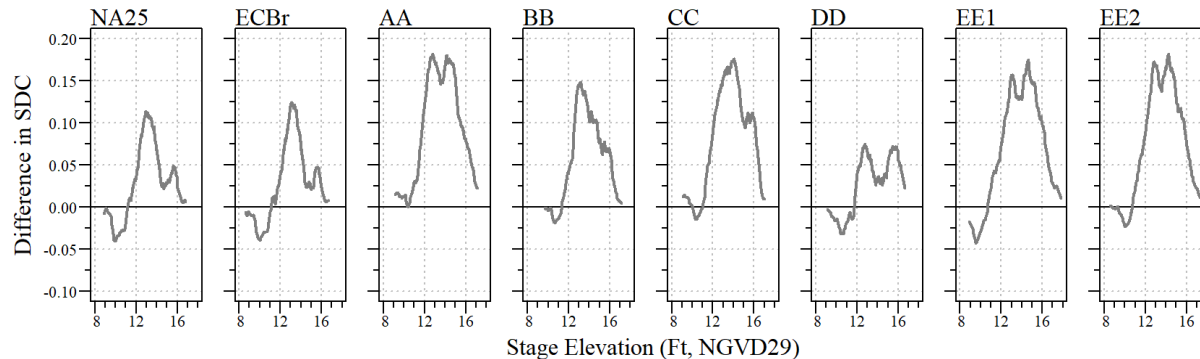


Percent of time within normal and recovery stage envelope during dry (1965-1994) and wet (1995-2016) phases for each alternative across the simulation period of record (52-years).

Lake Stage Duration Curves



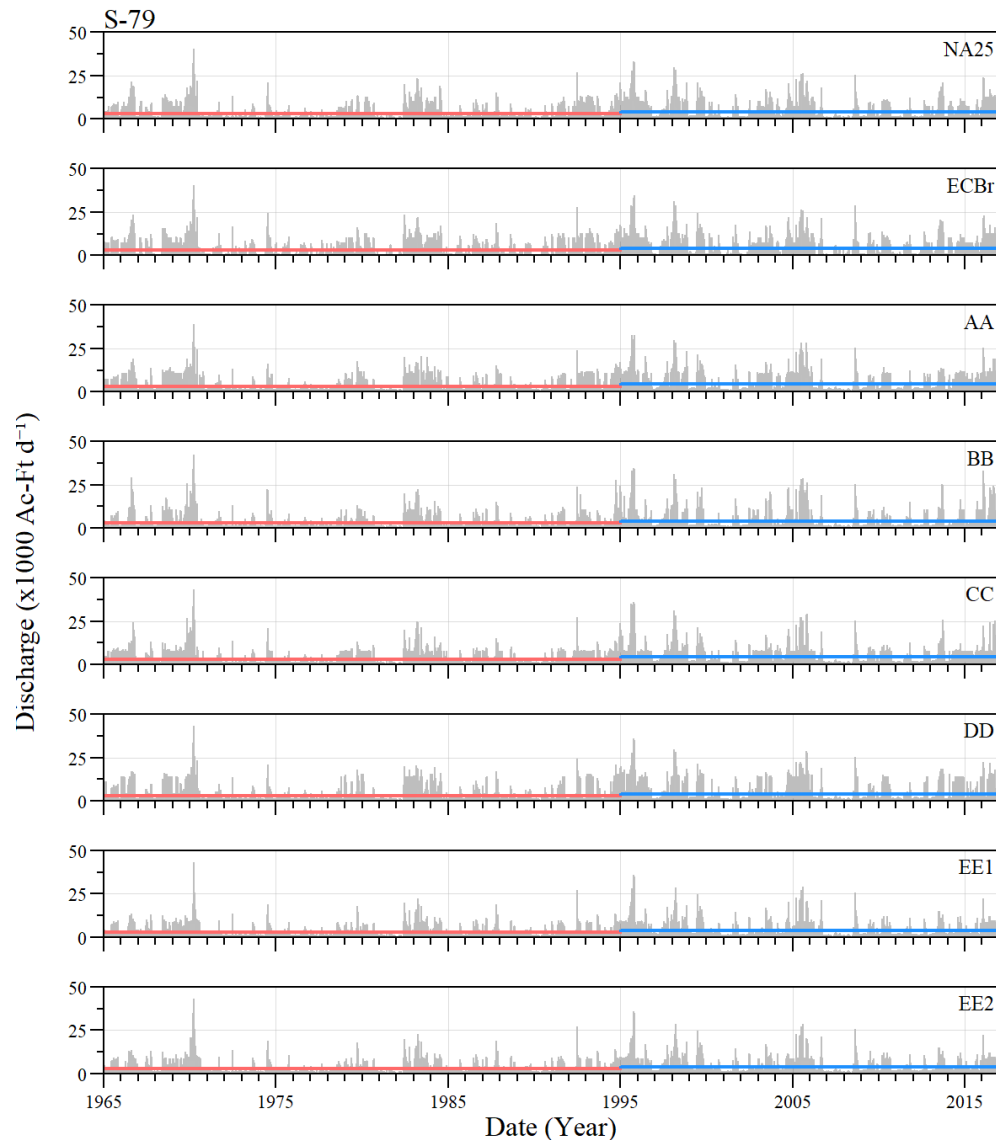
Stage duration curves for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016) within each phase for each alternative compared to FWO (NA25) and ECB (ECBr).

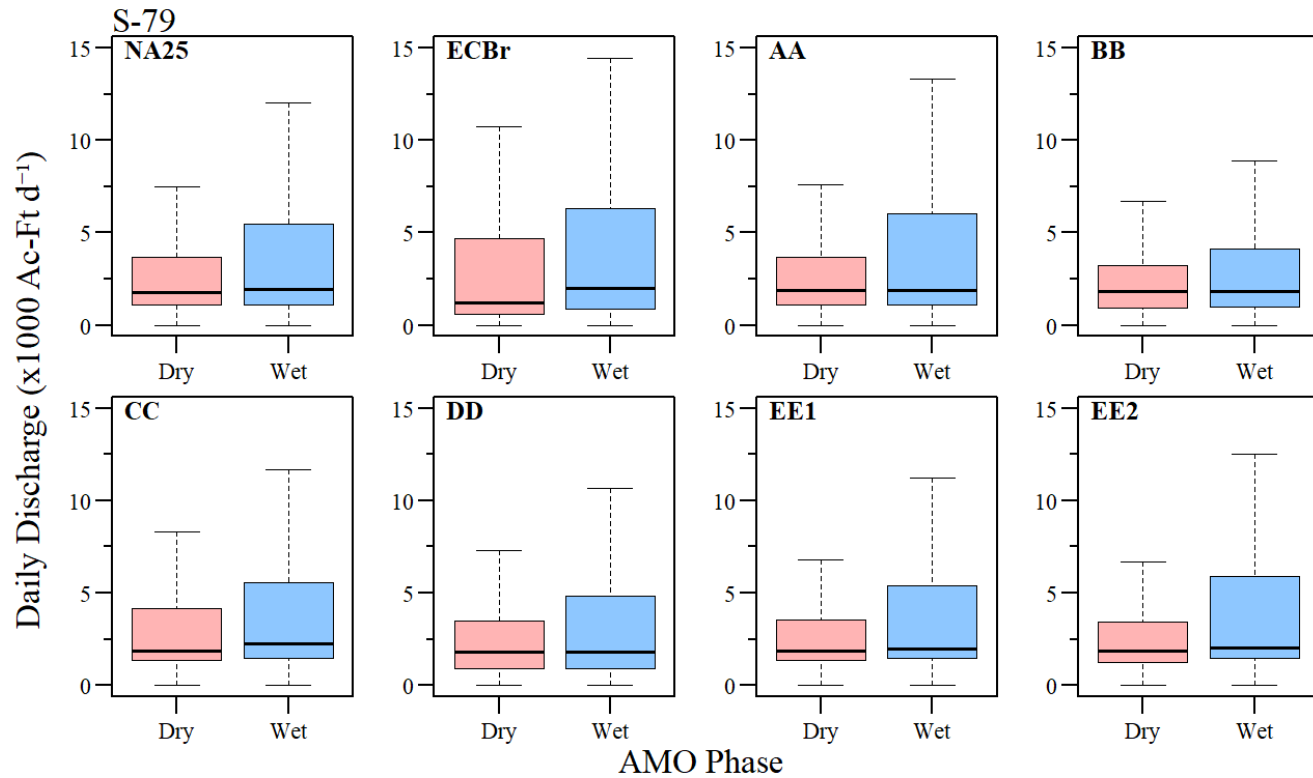


Difference in stage duration curves (SDC; Cool - Wet) between climate phases for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016) for each alternative includes FWO and ECB.

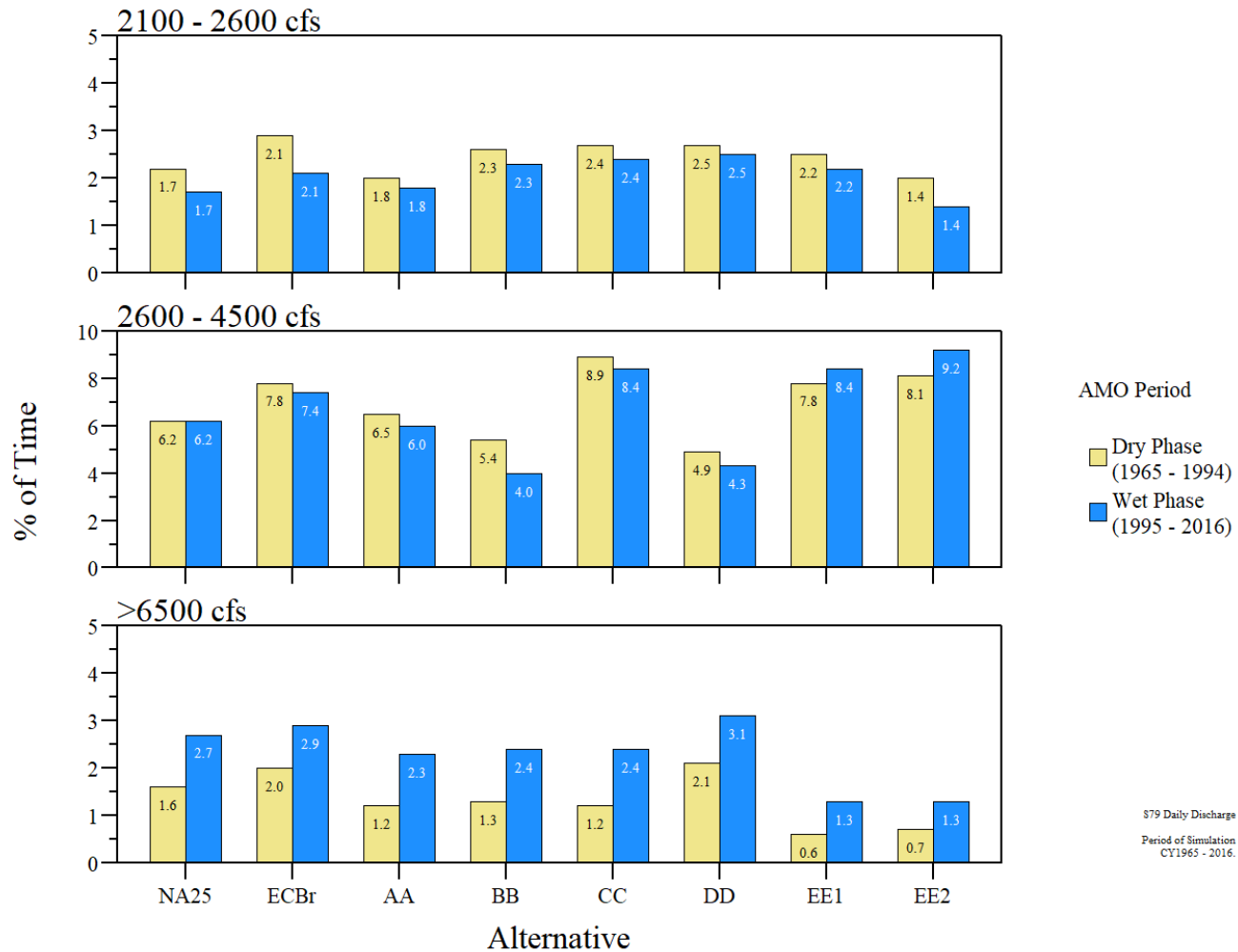
Daily time-series of S79 discharges for each alternative with mean discharge for dry/cool (1965 – 1994) and wet/warm (1995 – 2016) AMO phase depicted (red and blue, respectively).

- More extreme and longer duration discharges during warm/wet phase.

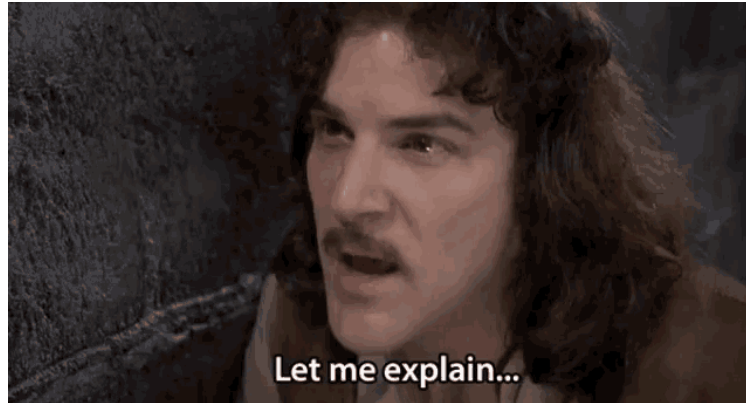




Boxplot of daily discharge comparing dry/cold (1965 – 1994) and wet/warm (1995 – 2016) AMO phase for each alternative for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016).



Percent of time within each respective flow category for S-79 comparing dry/cold (1965 – 1994) and wet/warm (1995 – 2016) AMO phase for each alternative for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016; 18993 days).



- During the simulation period of record the climate shifts from a dry/cool phase to a wet/warm phase.
- Lake stage extremes are exacerbated in the wet/warm phase
 - AA and EEs extreme high (>17 ft NGVD29) are much more dramatic in the wet/warm phase.
- For all plans we are in a recovery lake envelope more frequently in the wet/warm phase.
- While S79/CRE stress events are less frequent in the warm/wet phase, extreme high (>6500 cfs) events increase for all plans.
- **It is recommended to consider climate shifts in the simulation period of record and what that means for the systems within the project area.**

Acknowledgments



South Florida Water Management District ([DBHYDRO](#))



US Army Corps of Engineers ([USACE LOSOM](#))

- Interagency Modeling Center

[HTML Slide deck](#) | [PDF Slide deck](#) | [RMarkdown Source](#) © Julian (2021)



[Analysis Script](#)

[Additional Supplemental Slides](#); [Workshop #1 Presentation](#)



References

- Enfield DB, Mestas-Nuñez AM, Trimble PJ (2001) The Atlantic Multidecadal Oscillation and its relation to rainfall and river flows in the continental U.S. *Geophysical Research Letters* 28:2077–2080. doi: 10.1029/2000GL012745
- Mann ME, Steinman BA, Brouillette DJ, Miller SK (2021) Multidecadal climate oscillations during the past millennium driven by volcanic forcing. *Science* 371:1014–1019. doi: 10.1126/science.abc5810
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- Steinman BA, Mann ME, Miller SK (2015) Atlantic and Pacific multidecadal oscillations and Northern Hemisphere temperatures. 347:5.