Lake Okeechobee System Operating Manual

Iteration 2 Modeling -
Evaluation Technical workshop
Climate perspective

Sanibel-Captiva Conservation Foundation

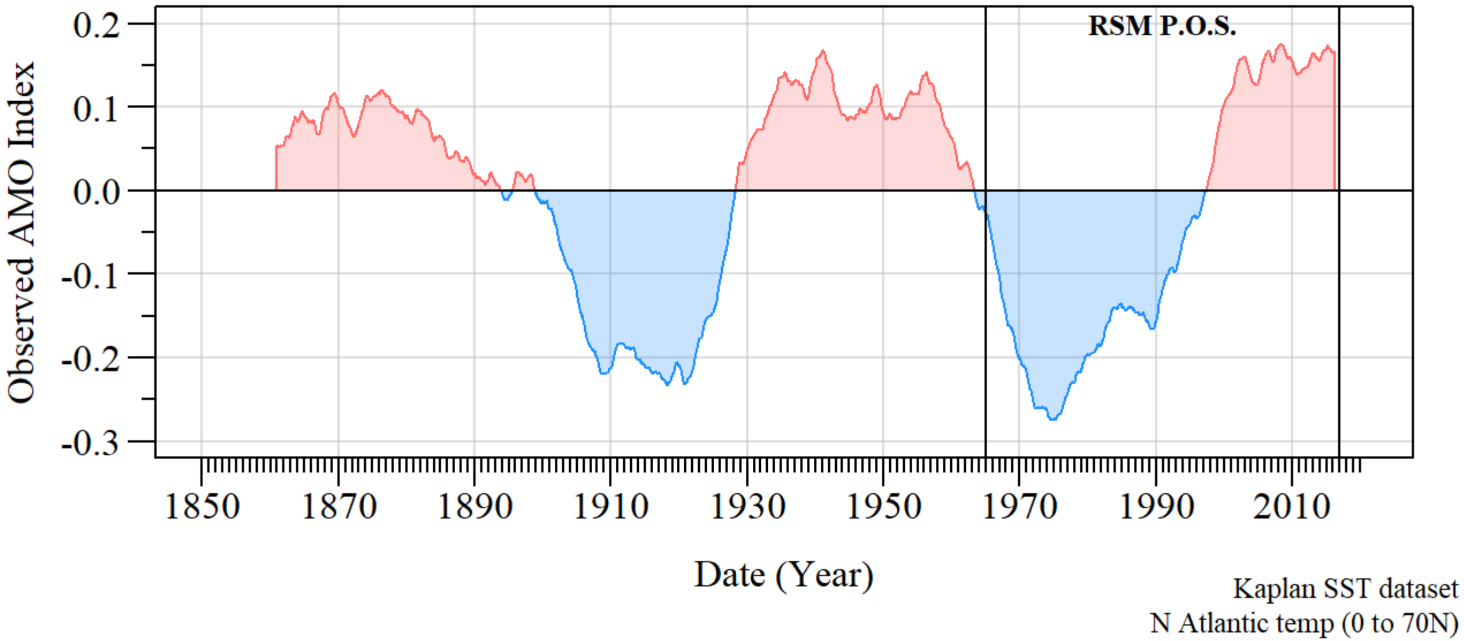
Conservancy of Southwest Florida

June 29, 2021
(Updated: June 30, 2021)

SCCF

CONSERVANCY of Southwest Florida
OUR WATER, LAND, WILDLIFE, FUTURE.

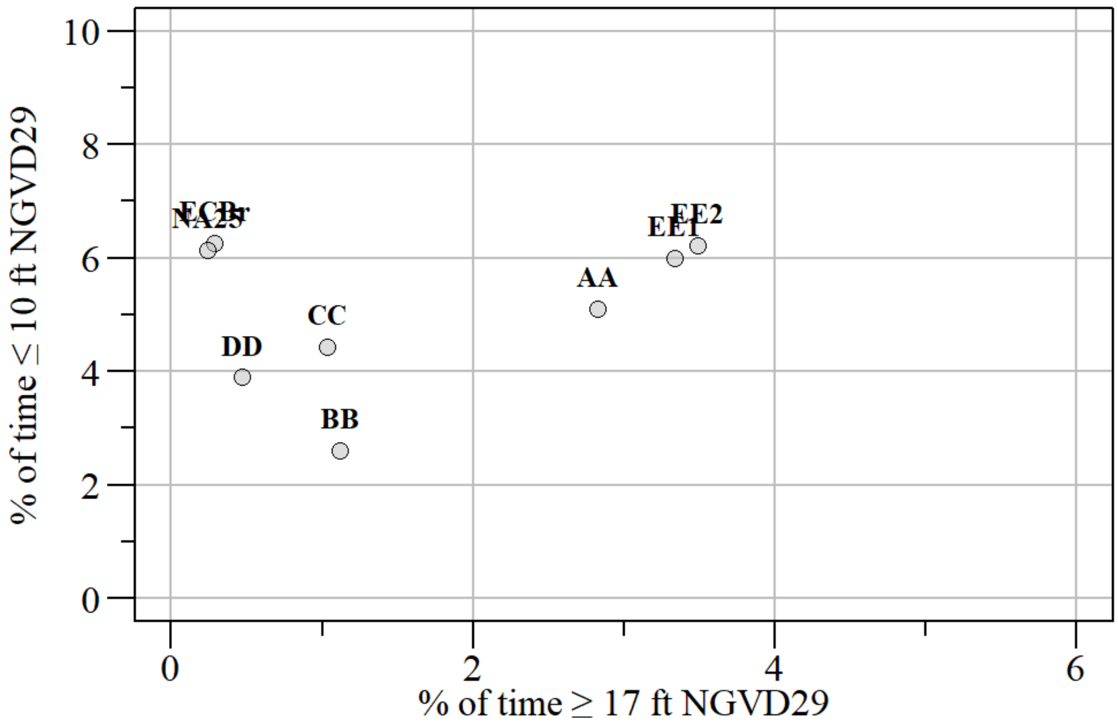
Paul Julian PhD



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

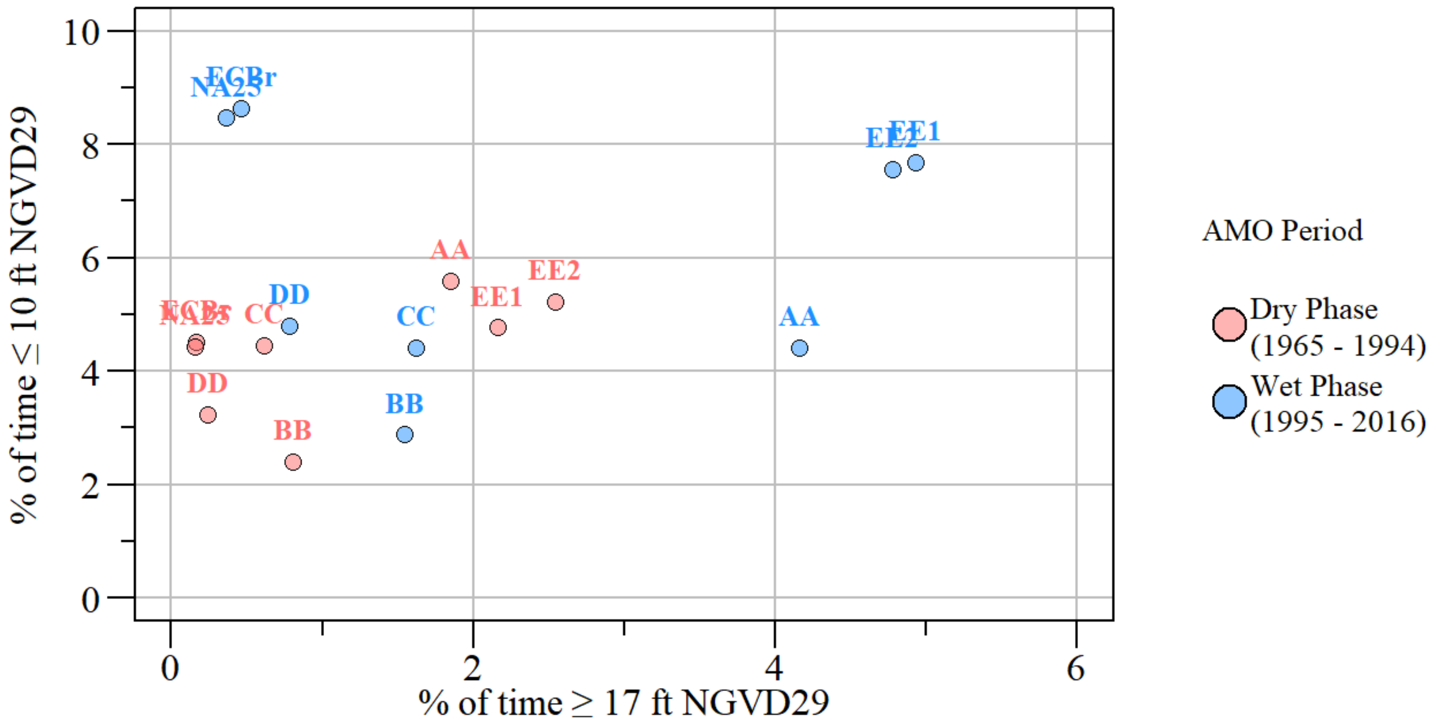
- Recent debate on AMO index suggest decadal or longer-term internal oscillatory signals that are distinguishable from climatic noise (see Steinman et al 2015; Mann et al 2020; Mann et al 2021).
- Only variability in the interannual range associated with the El Niño/Southern Oscillation is found to be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

Extreme High/Low

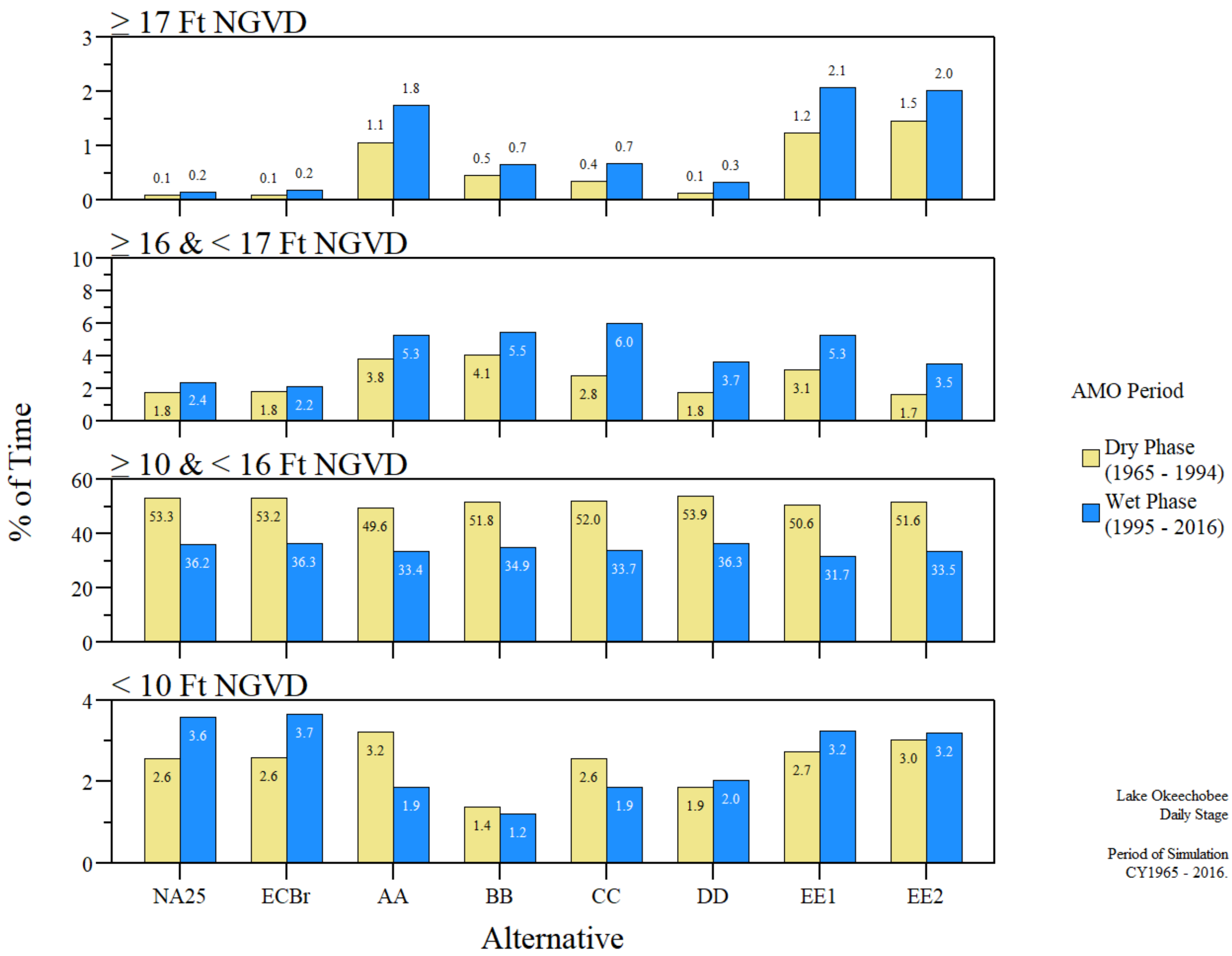


Percent of time where stages ≤ 10 or ≥ 17 Ft NGVD29 during the period of simulation (1965 - 2016).

Extreme High/Low

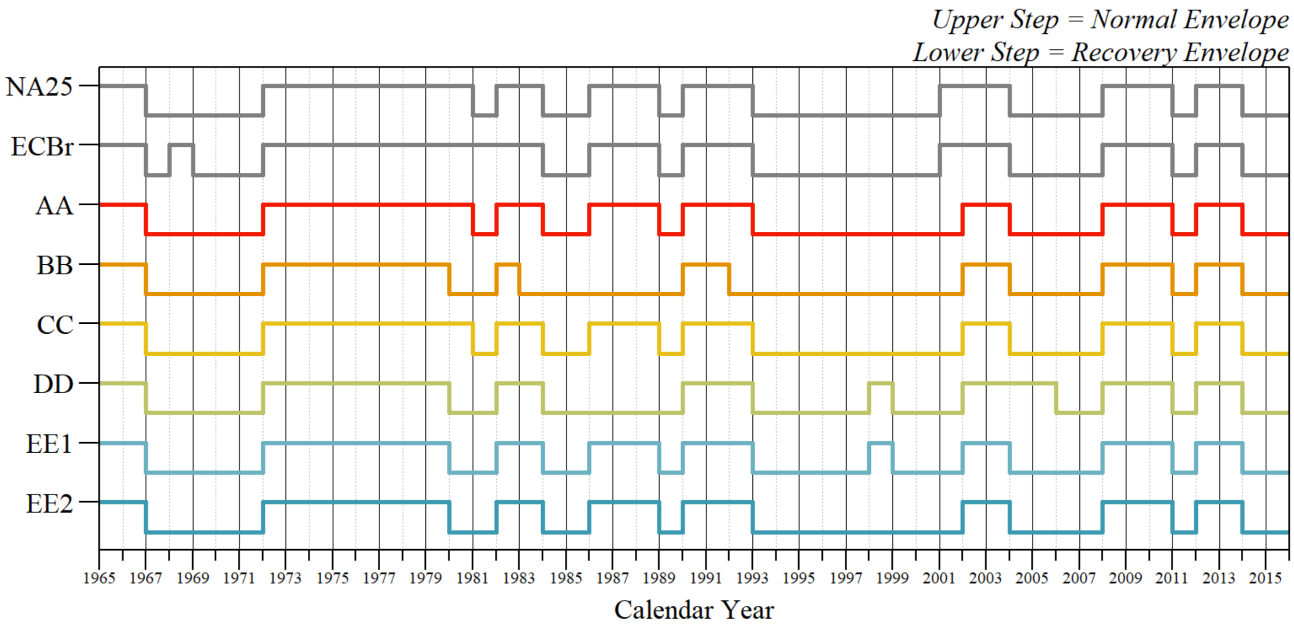


Percent of time where stages ≤ 10 or ≥ 17 Ft NGVD29 during the period of simulation (1965 - 2016) broken down into dry (1965-1994) and wet (1995-2016) phases.



Percent of time within each respective stage elevation category for Lake Okeechobee 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).

Normal/Recovery Envelope



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

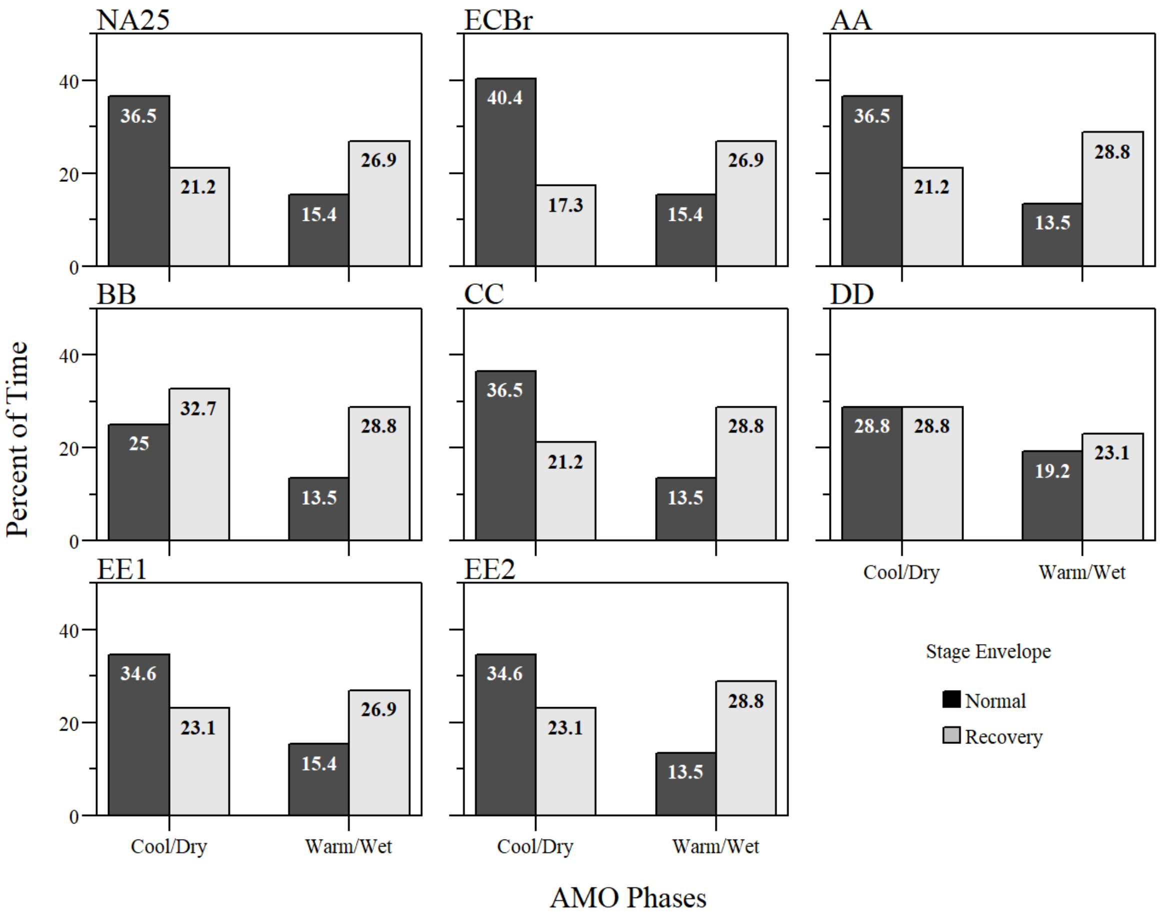
Shift from normal to recovery:

- 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:

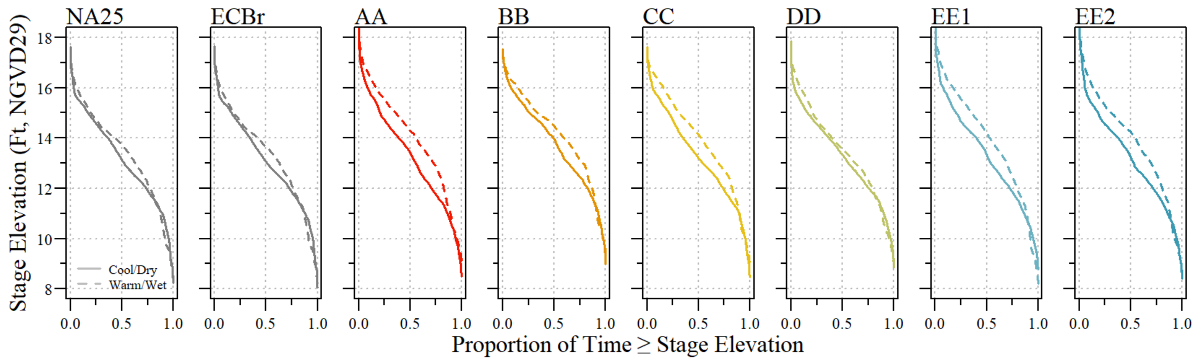
- Stage ≤16.0 ft from Aug1 – Dec31 *and*
- Stage during May1 - Aug1 falls below 11.5 Ft for 60 or more days *or*
- Stage during Apr15 - Sep15 falls below 12.0 Ft for 90 or more days

Lake Stage Envelope

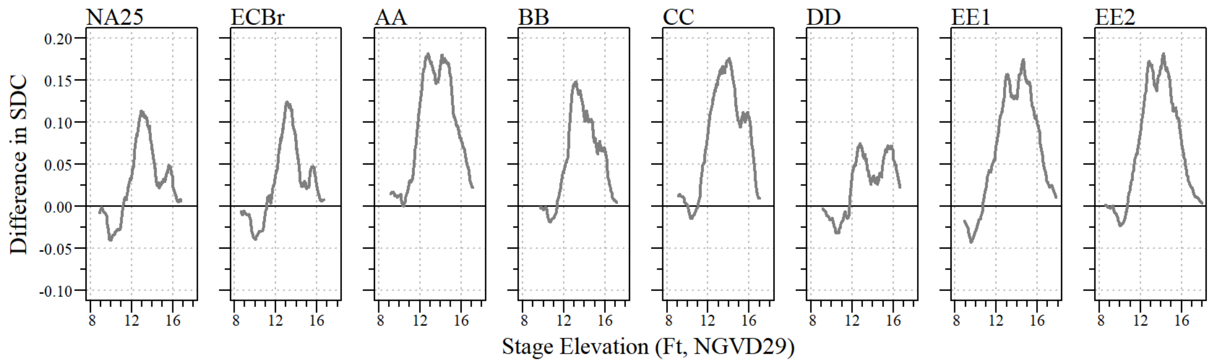


Percent of time within normal and recovery stage envelope during dry (1965-1994) and wet (1995-2016) phases for each alternative across the simulation period of record (52-years).

Lake Stage Duration Curves



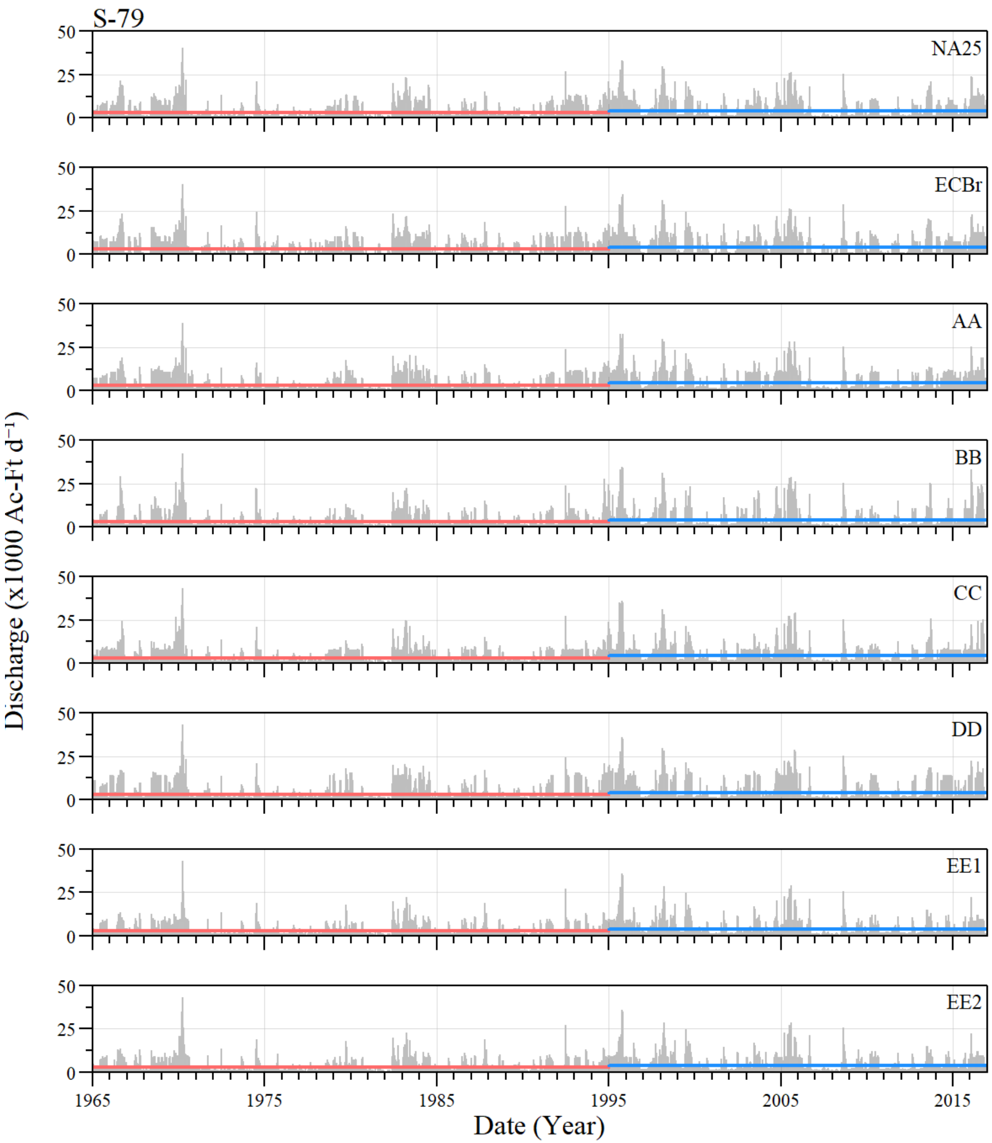
Stage duration curves for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016) within each phase for each alternative compared to FWO (NA25) and ECB (ECBr).

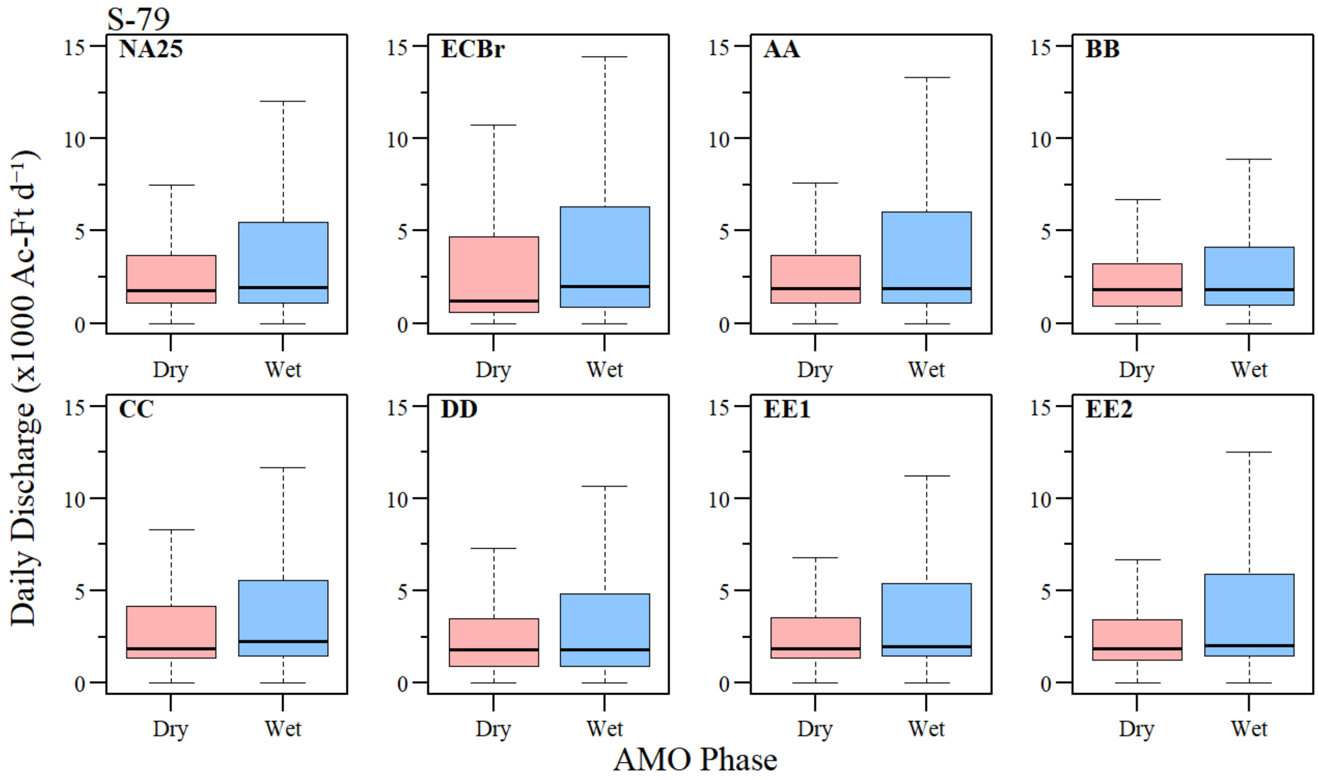


Difference in stage duration curves (SDC;Cool - Wet) between climate phases for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016) for each alternative includes FWO and ECB.

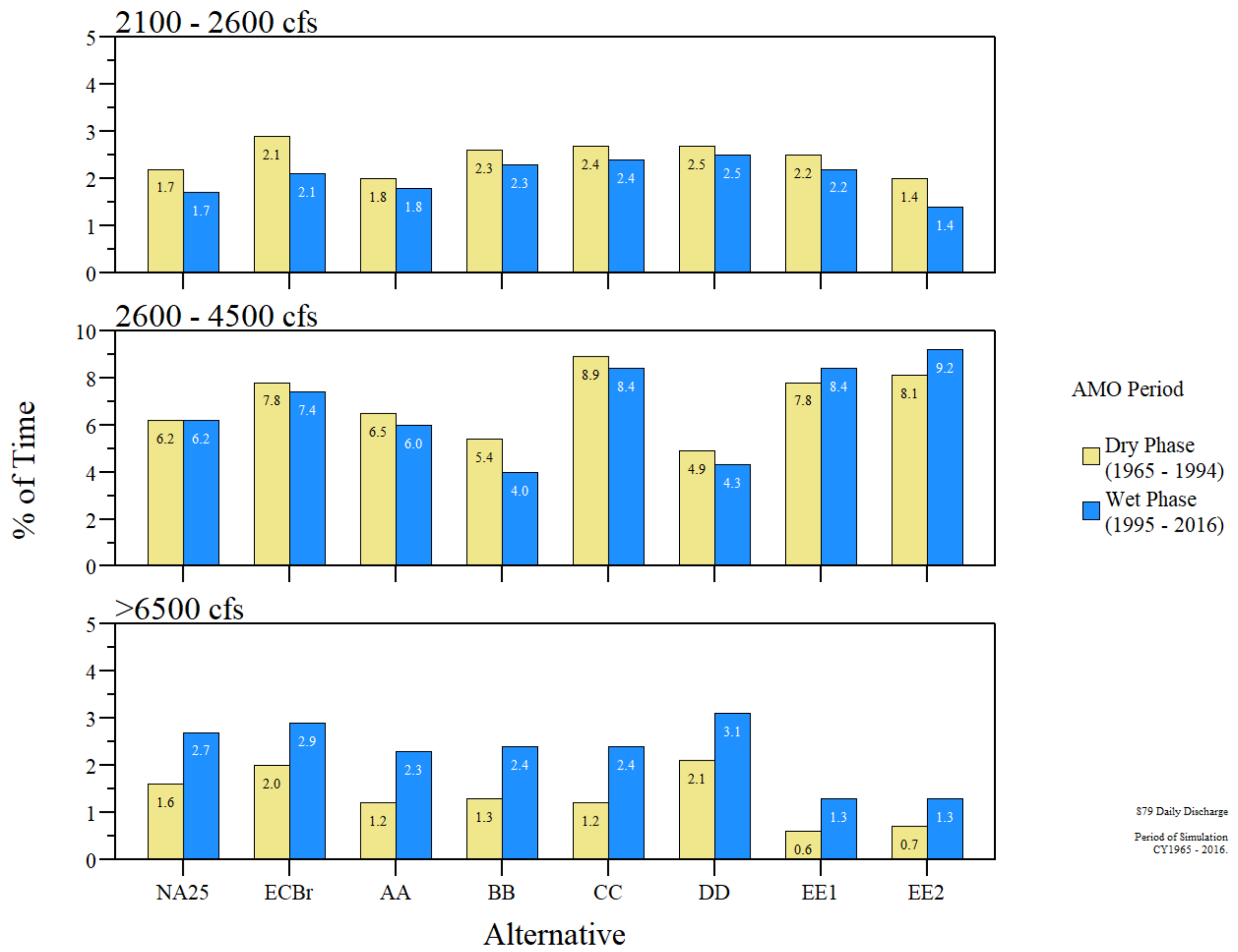
Daily time-series of S79 discharges for each alternative with mean discharge for dry/cool (1965 – 1994) and wet/warm (1995 – 2016) AMO phase depicted (red and blue, respectively).

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

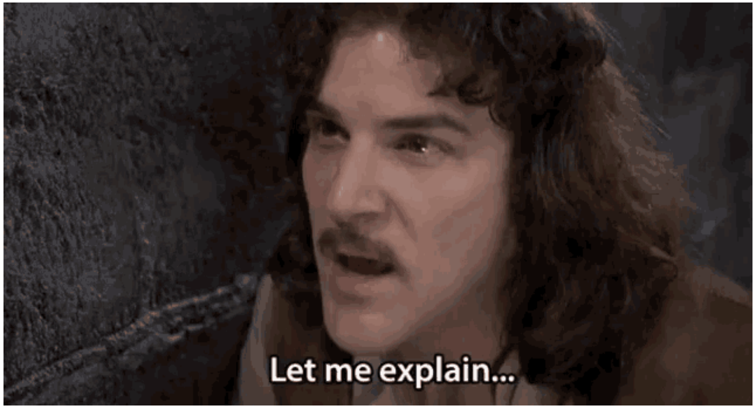




Boxplot of daily discharge comparing dry/cold (1965 – 1994) and wet/warm (1995 – 2016) AMO phase for each alternative for the entire period of simulation (Jan 1, 1965 - Dec 31, 2016).



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

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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