How much is water entering the Apalachicola River through Jim Woodruff Dam influenced by climate and how much by reservoir management?

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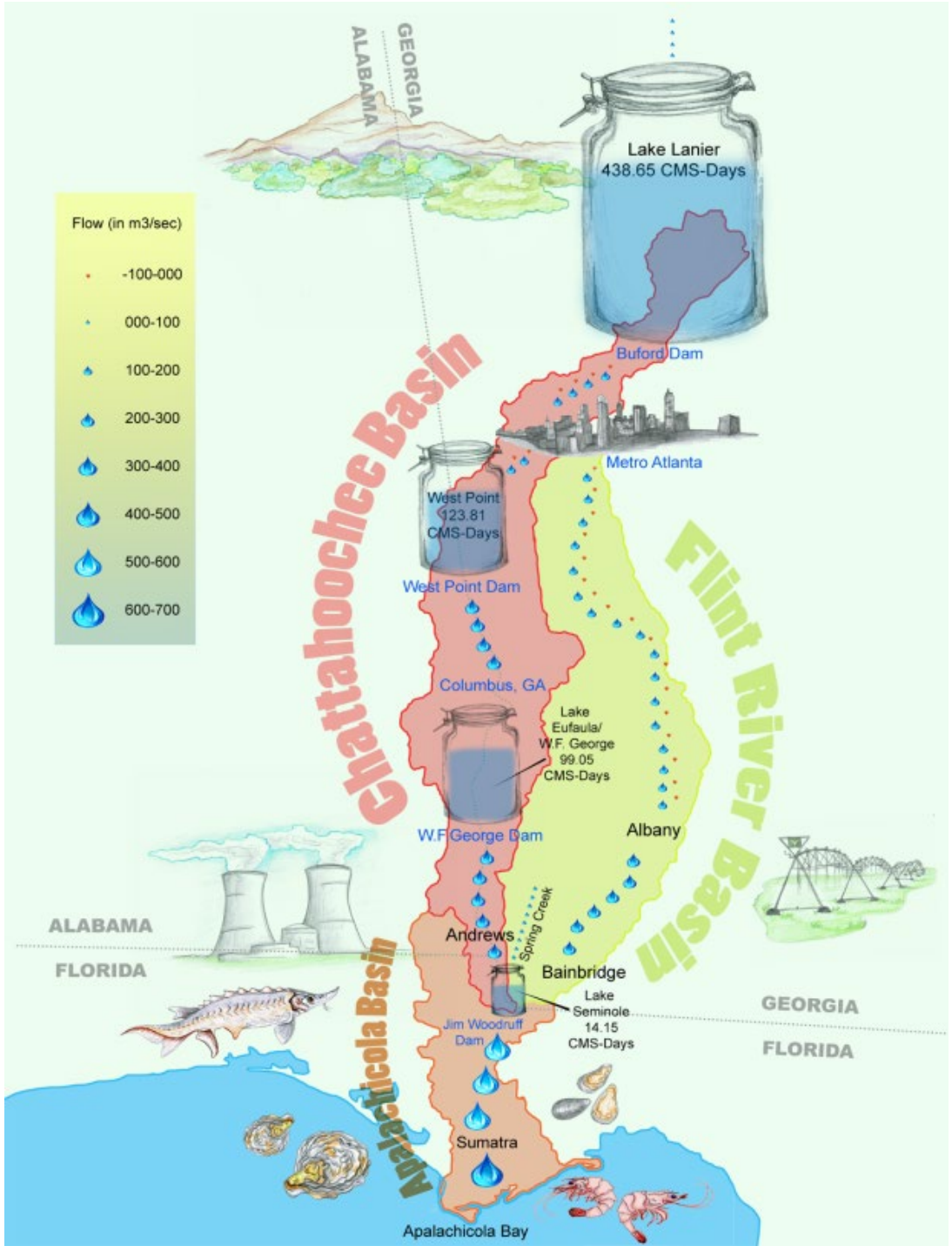
2/25/2020

Introduction

- Management of the Apalachicola-Chattahoochee-Flint watershed has proven to be a controversial issue highlighted by a recent U.S. Supreme Court case between the States of Florida and Georgia over provision of water to the Apalachicola estuary.
- At the root of this controversy is the question of whether the recent problems experienced in the Apalachicola River and estuary could be mitigated by better water supply and water management practices in the watershed.

ACF Basin

Leitman, S. and Kiker, G.A. 2015. Development and comparison of integrated river/reservoir models in the Apalachicola–Chattahoochee–Flint basin, USA. Environment, Systems & Decisions 35(3): pp 410-423.



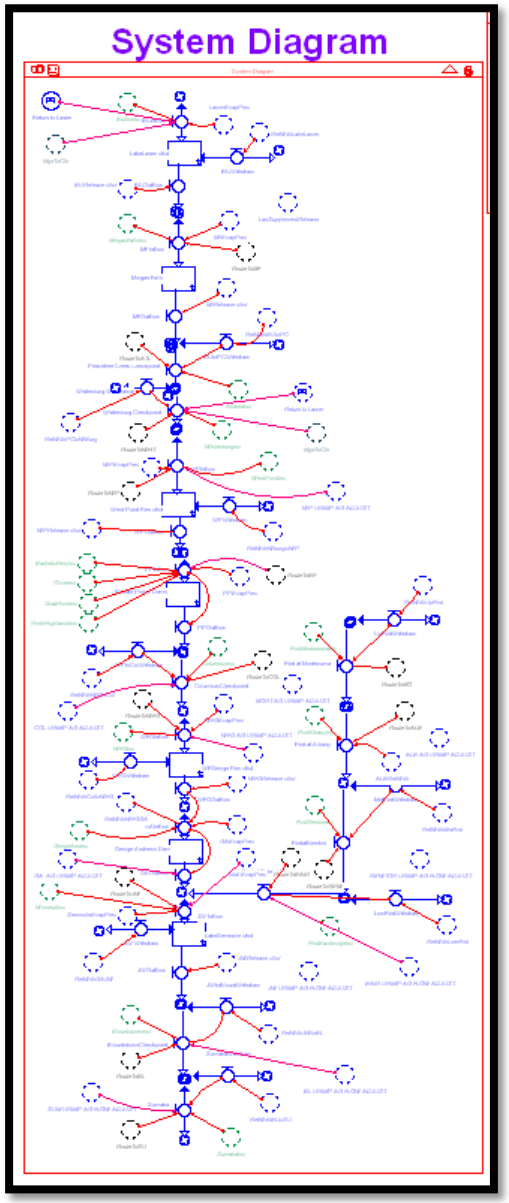
Climate or Reservoir Management?

- physical nature of the watershed
- location of the storage reservoirs

H_0: Flows from Jim Woodruff Dam into the Apalachicola River better defined by climate in the watershed than by reservoir management practices.

Leitman, S., Pine, W.E. and Kiker, G.A. 2016. Management options during the 2011-2012 drought on the Apalachicola River: A systems dynamic model evaluation. Environmental Management (16) 1:15.

ACF-STELLA MODEL



- Simulates reach flow and reservoir levels in the ACF @ daily time step, 73-year simulation period with USACE unimpaired flow inputs
- Developed by USACE, AL, FL, and GA through the Shared Vision Planning Process in the ACF Comprehensive Study (1990s) (Richard Palmer, Univ. of Washington)
- Subsequently changed from monthly to daily execution (by NWFWMD Leitman & Hamlet)
- 2015 - Matched with the USACE HEC RES-SIM model of ACF*
- 2019 – Updated to include WCM operations
- **Advantages**
  - *Configuration flexibility*
  - *Fast run time (73 years < 15 seconds)*
  - *Allows for analysis of multiple climate scenarios*

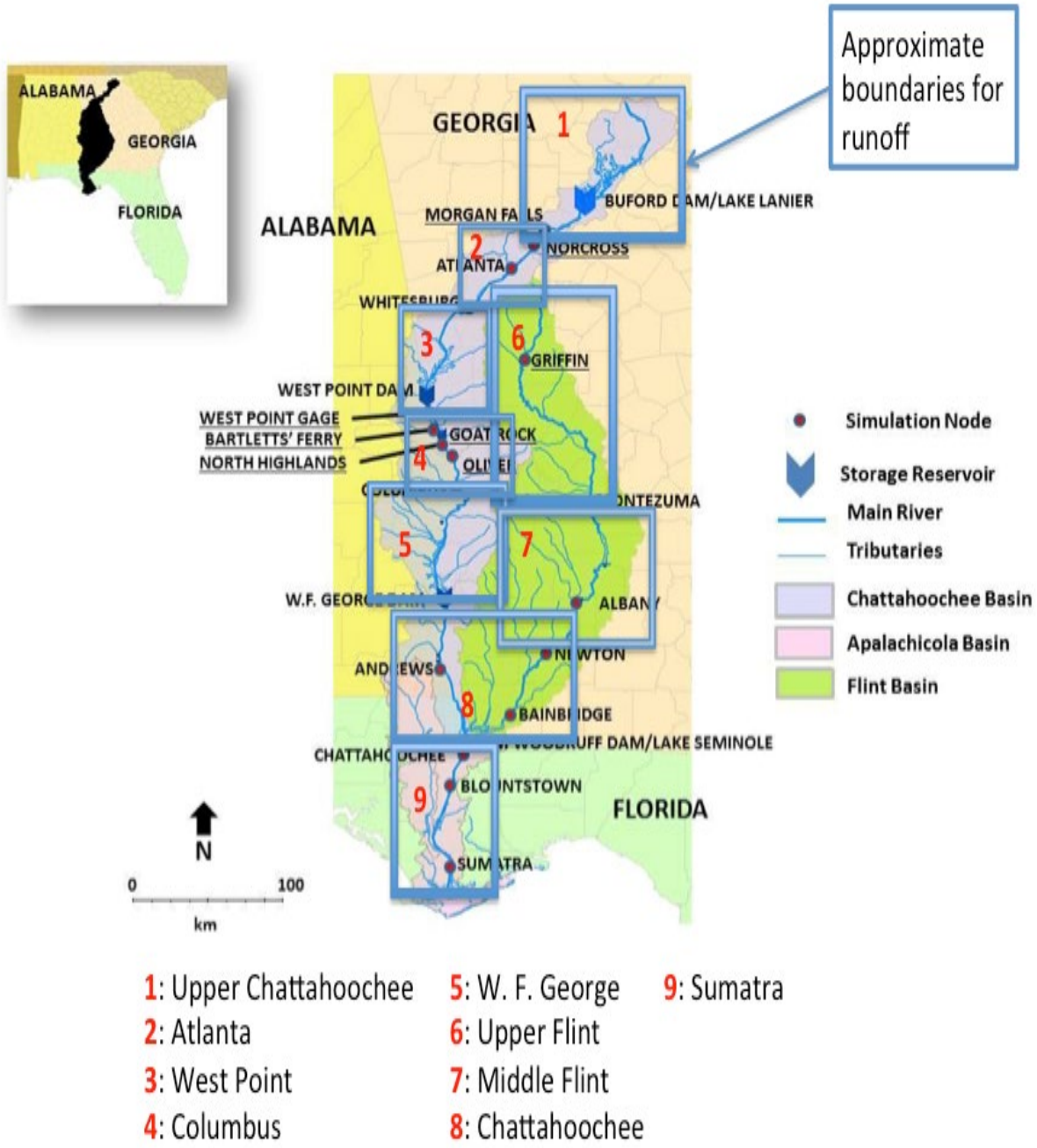
* Leitman, S. and Kiker, G.A. 2015. Development and comparison of integrated river/reservoir models in the Apalachicola–Chattahoochee–Flint basin, USA. Environment, Systems & Decisions 35(3): pp 410-423.

Climate Projection Details

- Climate from international Coupled Model Intercomparison Project 5 (CMIP5) projections for 2020-2079, downscaled to a finer horizontal resolution through bias-correction and spatial disaggregation
- Then fed into a Variable Infiltration Capacity (VIC) hydrologic model to simulate future hydrology (Reclamation 2014).

Climate Projection Details

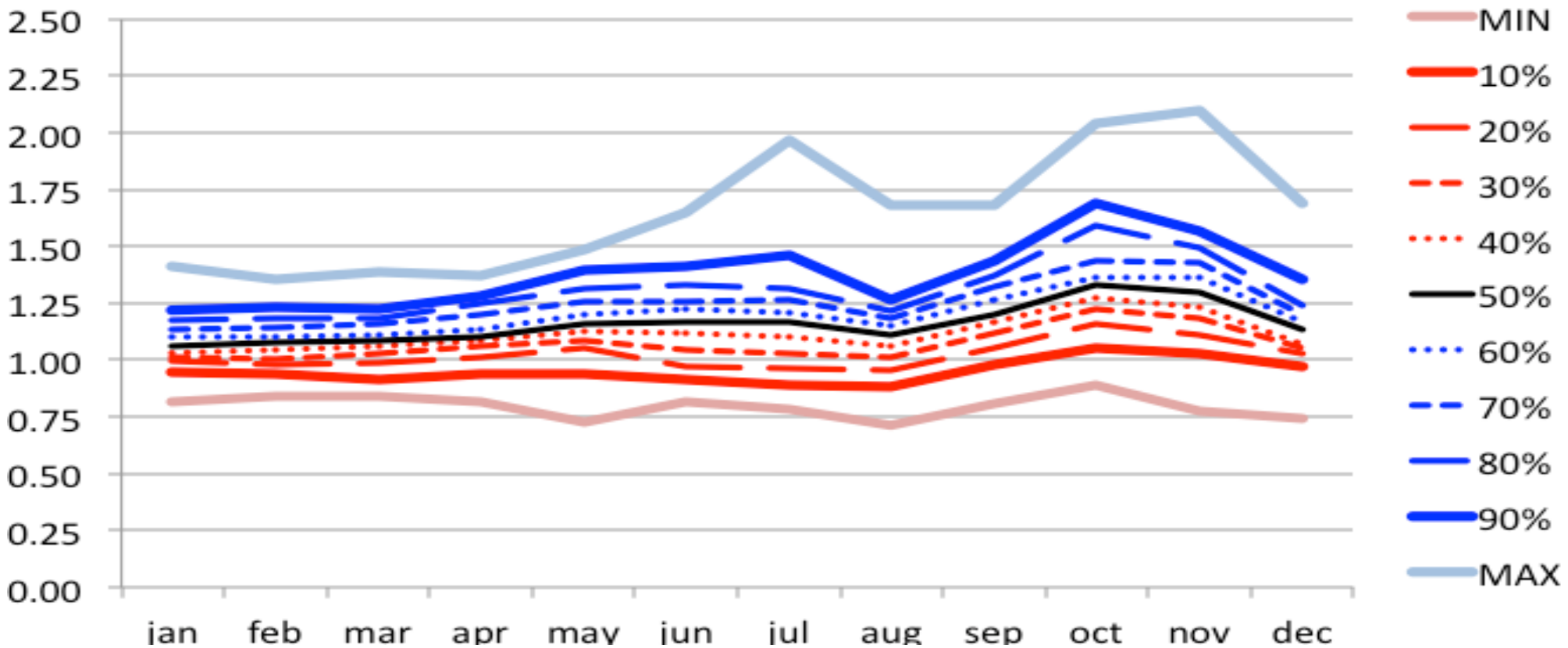
- Examination of the downscaled climate projections for runoff indicates no clear separation between the four green house gas concentration scenarios (RCPs).
- Likely due to the fact that both temperature and precipitation tend to increase with higher RCPs so that the contribution to projected runoff by increase in precipitation is likely partially offset by increased evaporation due to increased projected temperatures.
- As a result, we have chosen to consider the model projections stemming from different RCPs as part of the same envelope.



1: Upper Chattahoochee
2: Atlanta
3: West Point
4: Columbus
5: W. F. George
6: Upper Flint
7: Middle Flint
8: Chattahoochee
9: Sumatra

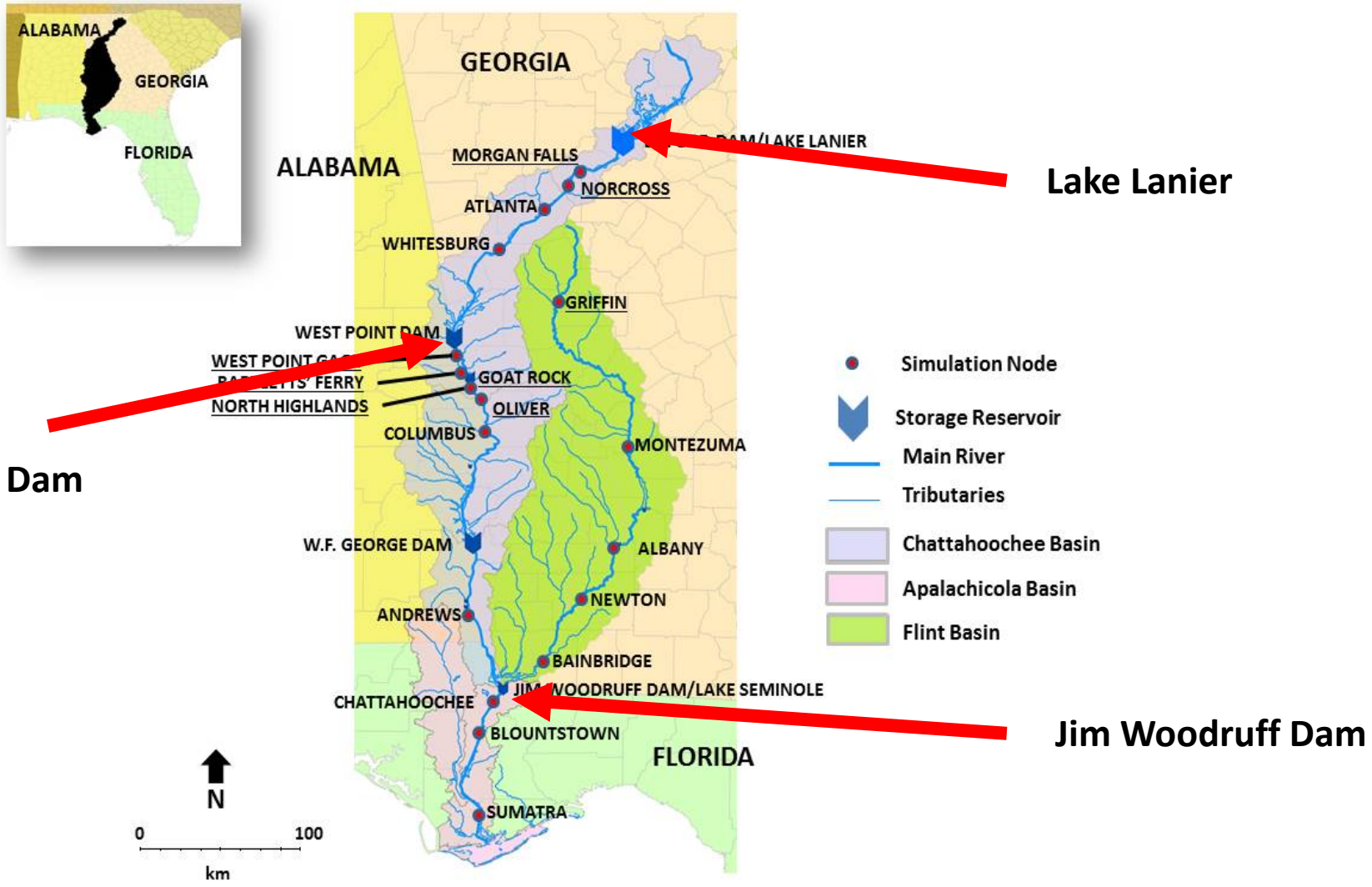
Climate zones used in downscaling climate model forecasts to the ACF Basin

Range of Projected Changes for Monthly Runoff



Example: Monthly change factors based on from model projection percentiles for the Middle Flint reach of the ACF Basin.

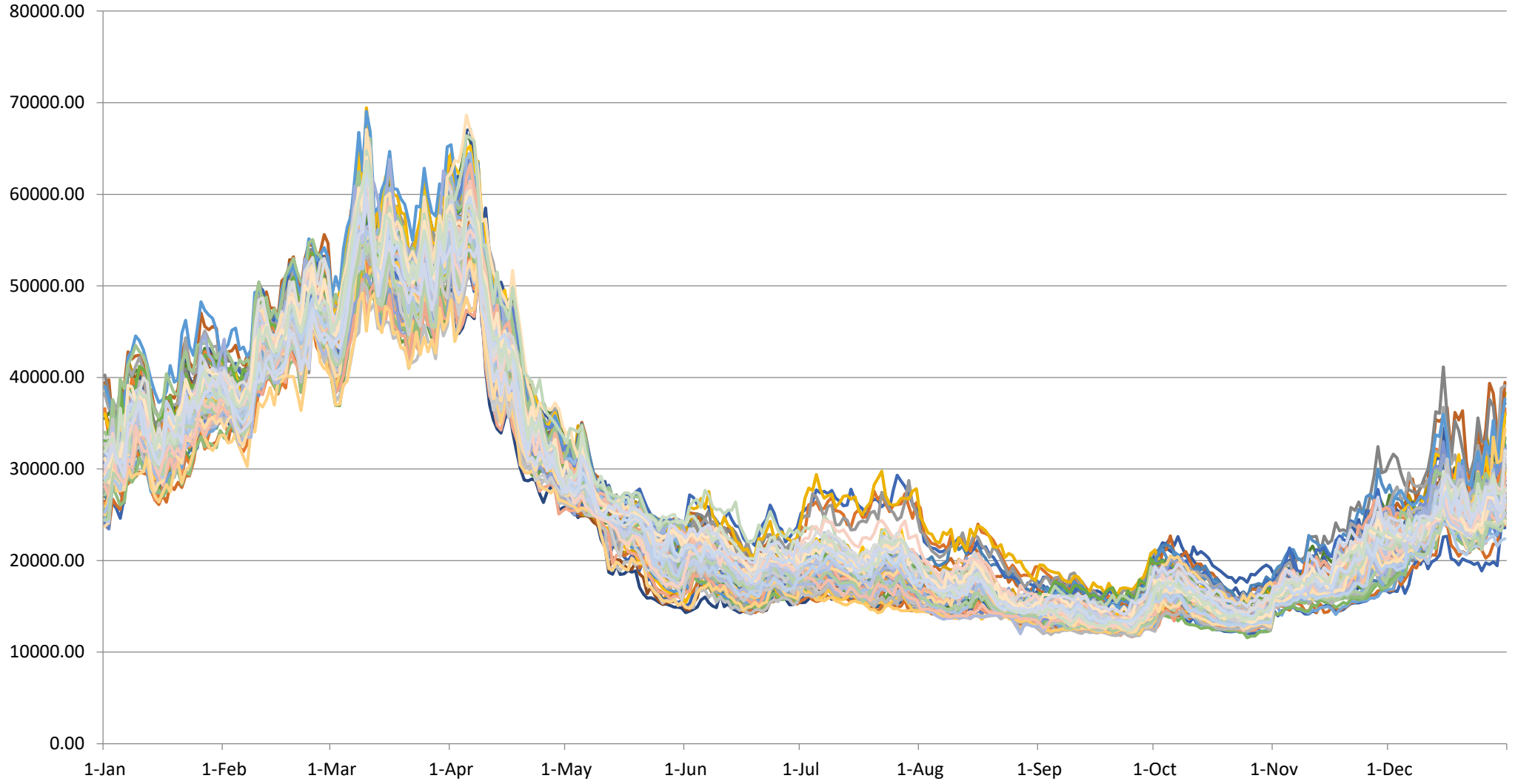
Sites of Flow Analysis Along ACF Basin



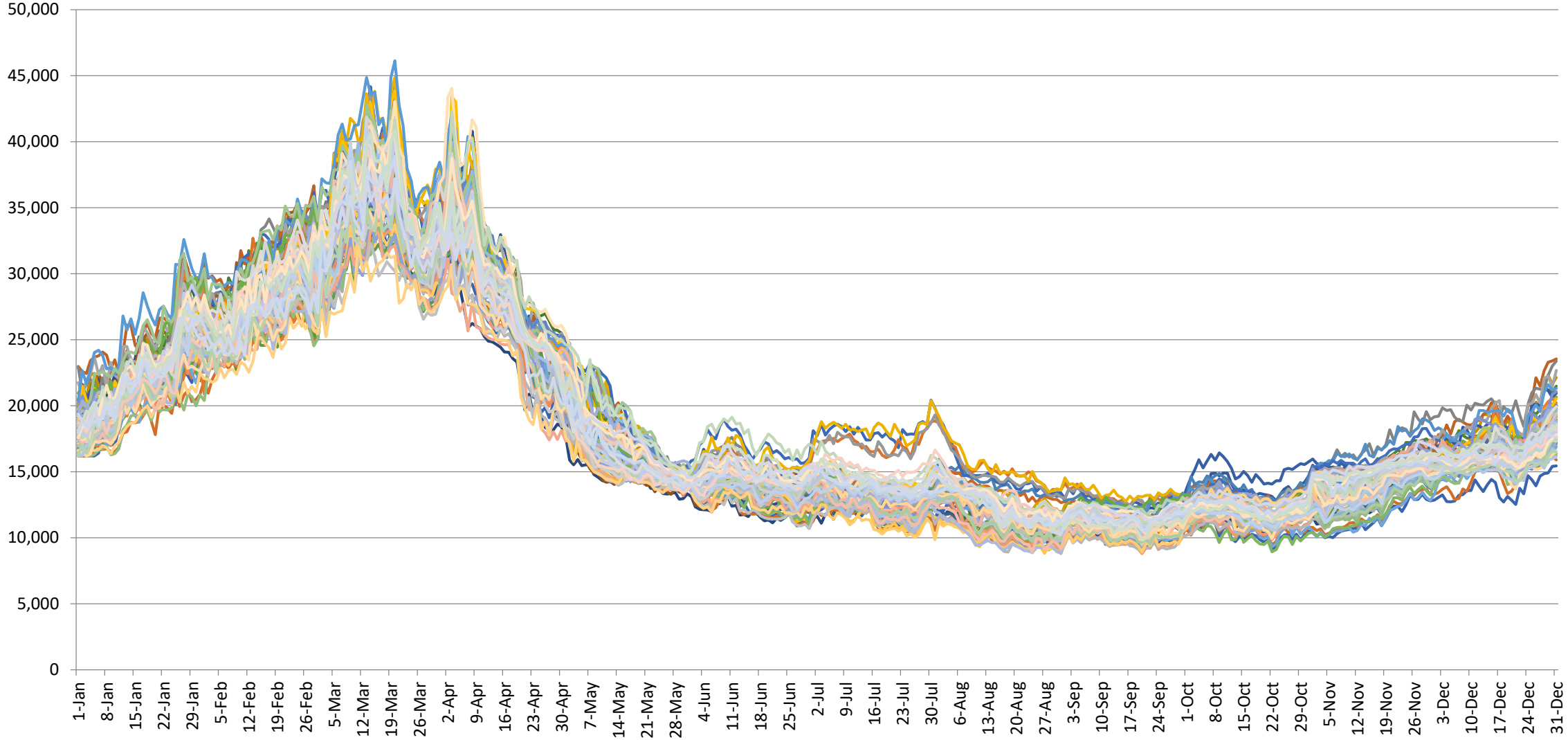
Lake Lanier

West Point Lake and Dam

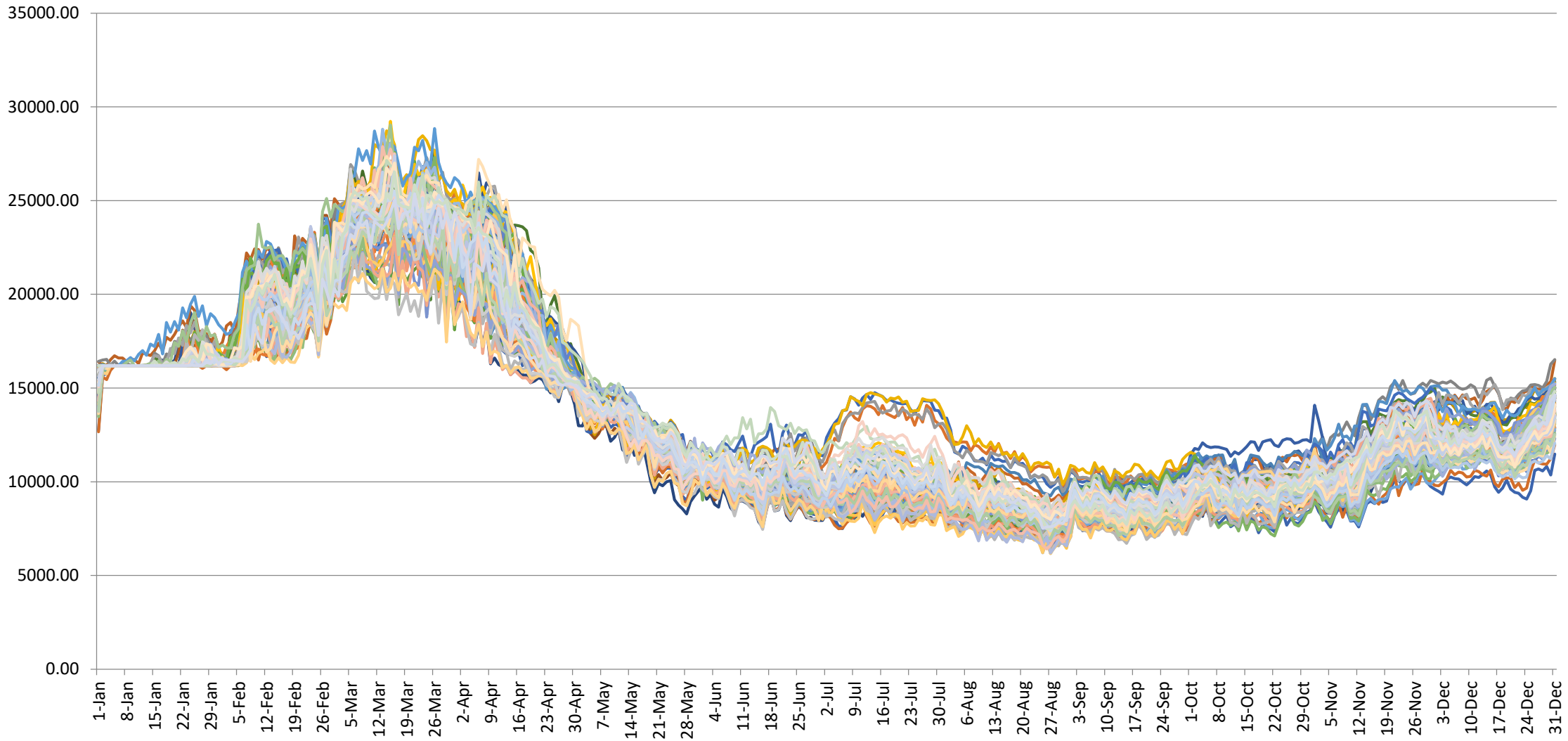
Jim Woodruff Dam



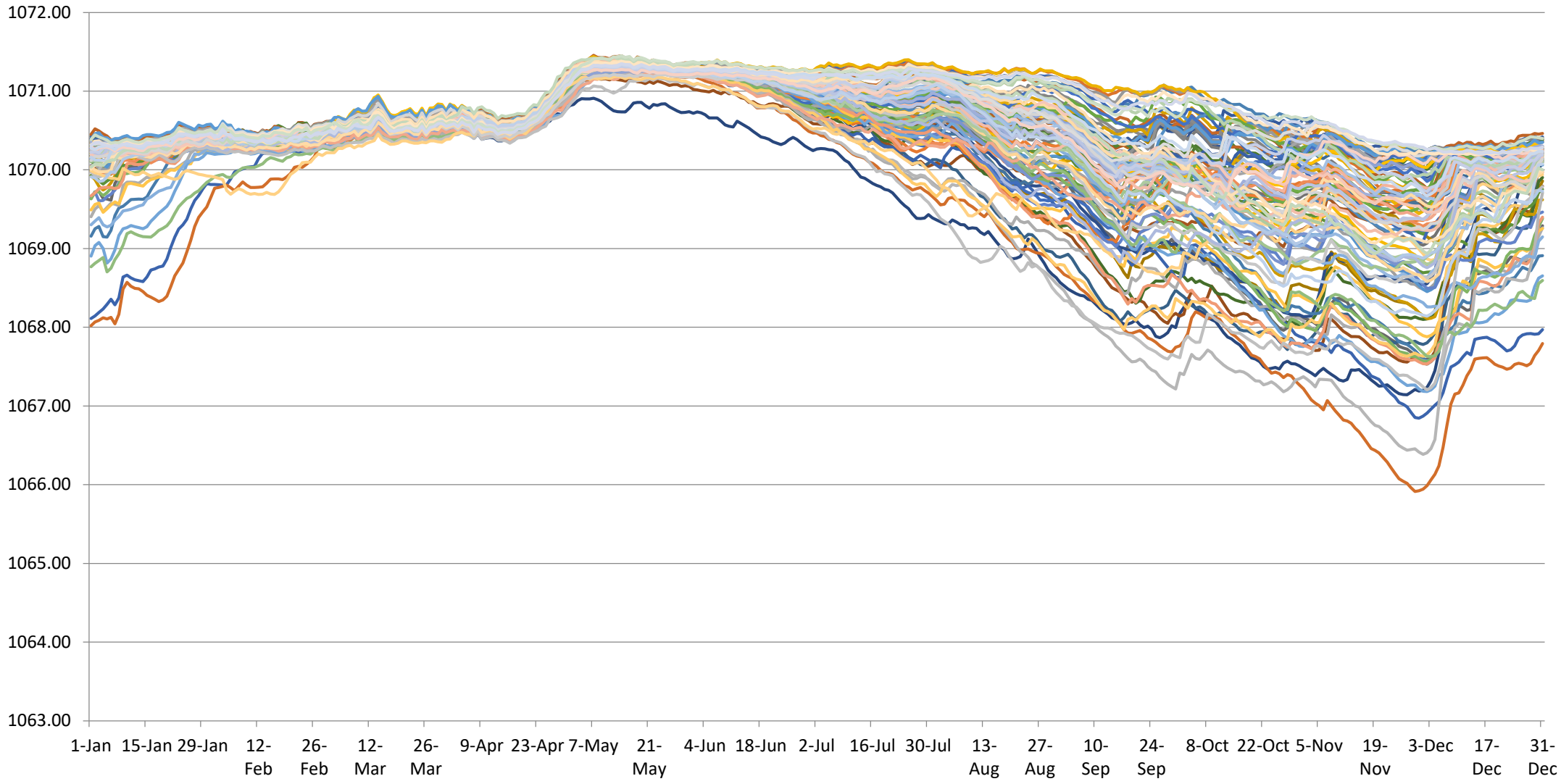
25% EXCEEDED FLOWS AT JIM WOODRUFF OUTFLOW



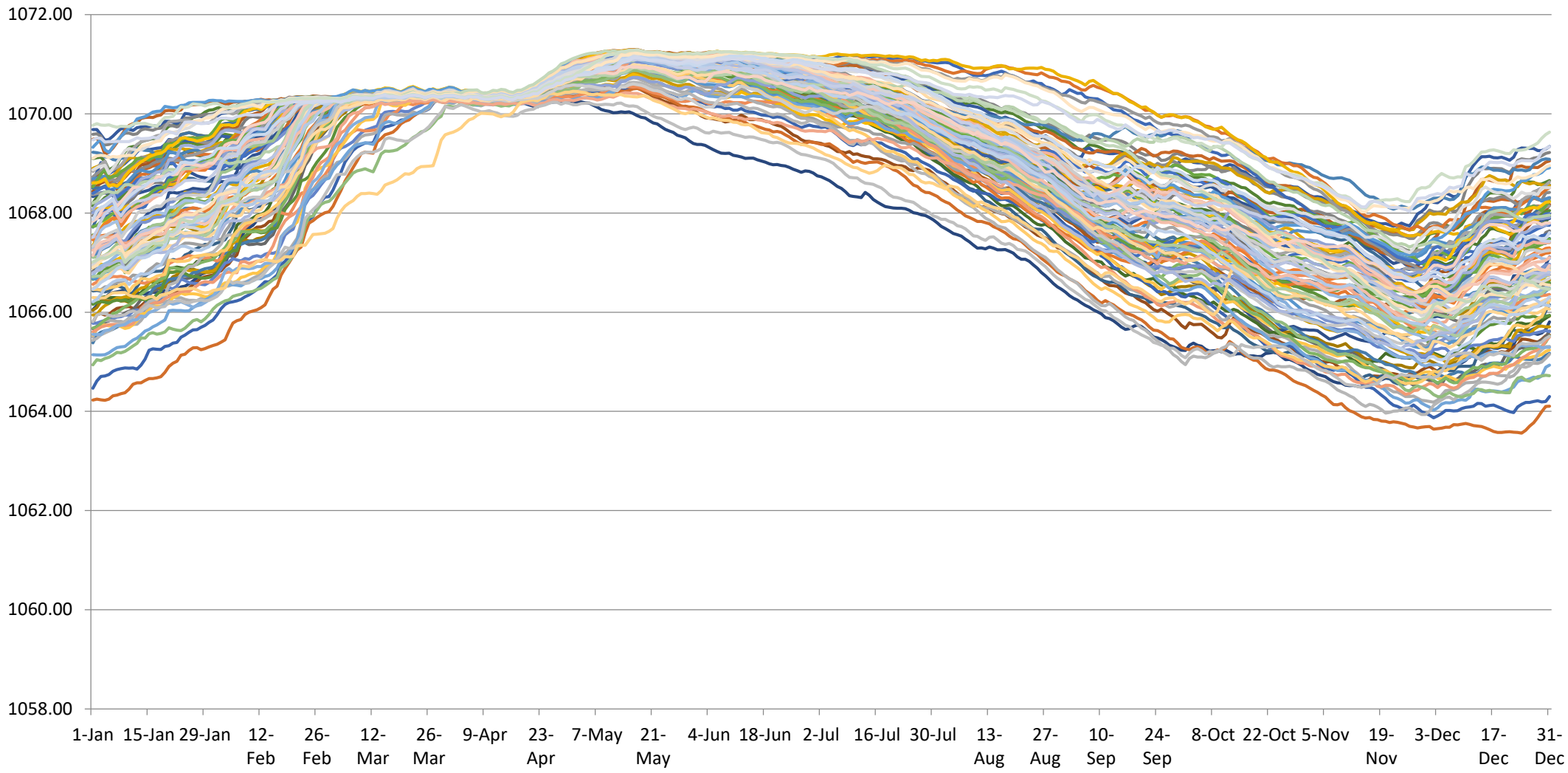
MEDIAN FLOWS AT JIM WOODRUFF OUTFLOW



75% EXCEEDED FLOWS AT JIM WOODRUFF OUTFLOW



25 % EXCEEDED ELEVATIONS AT LAKE LANIER



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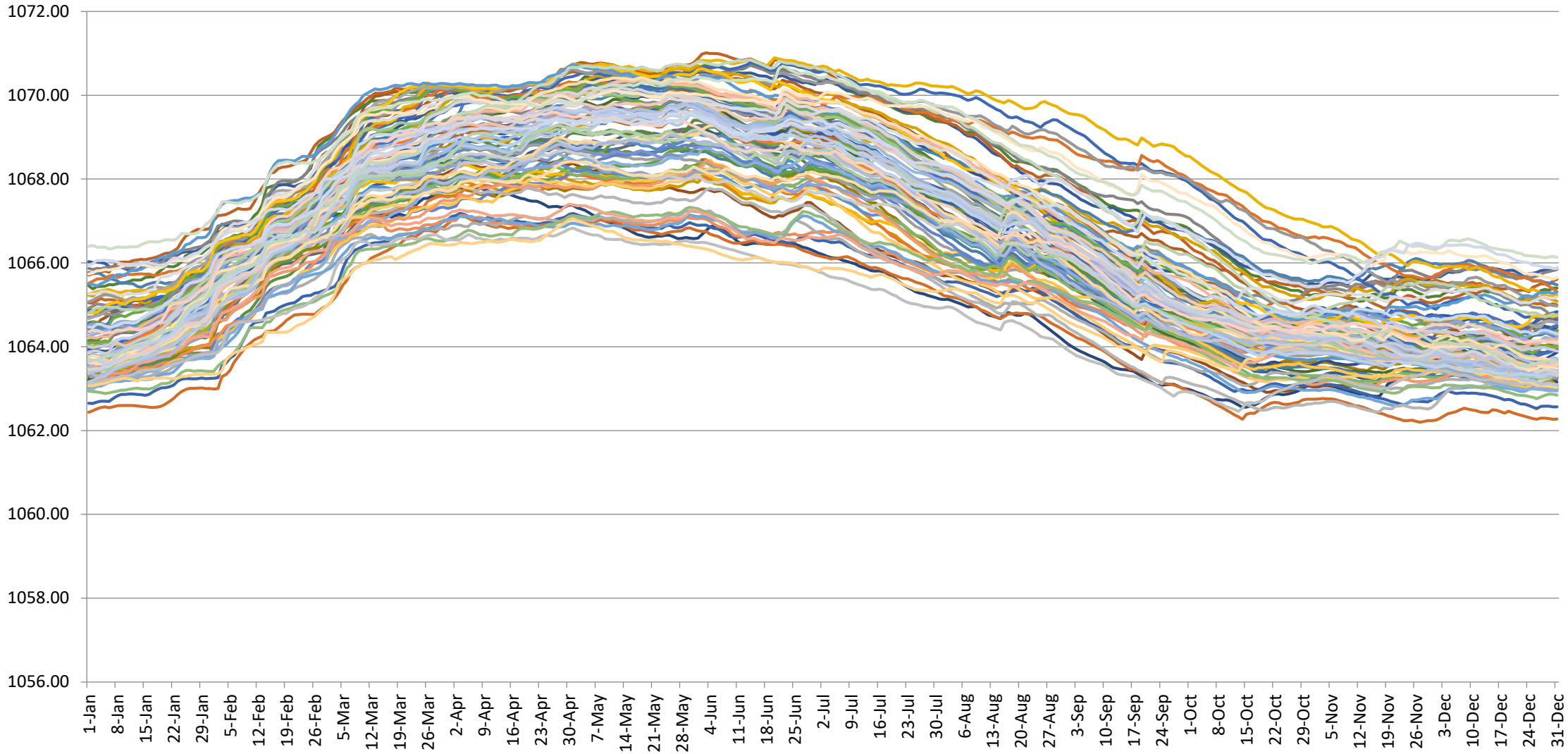

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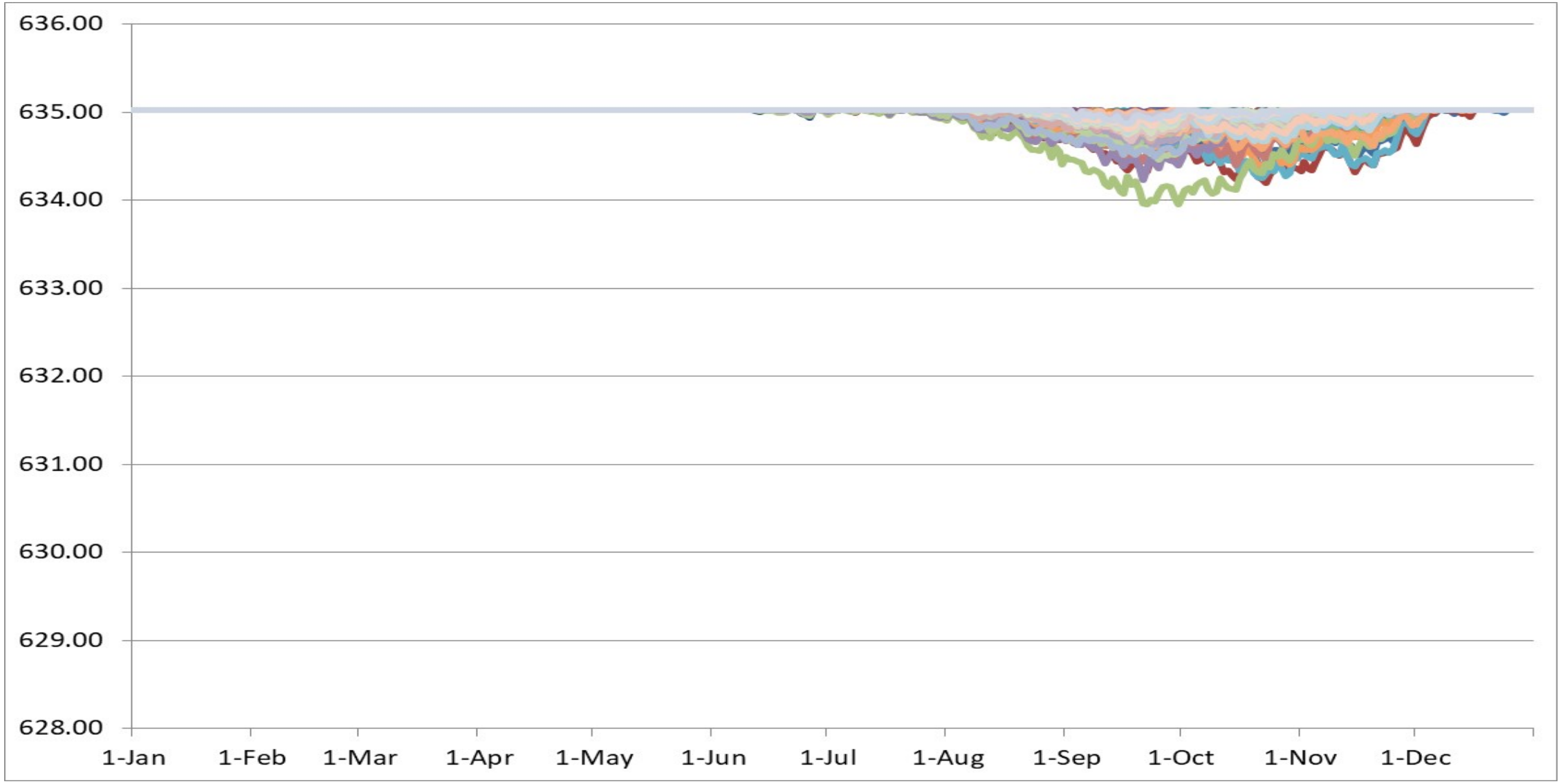
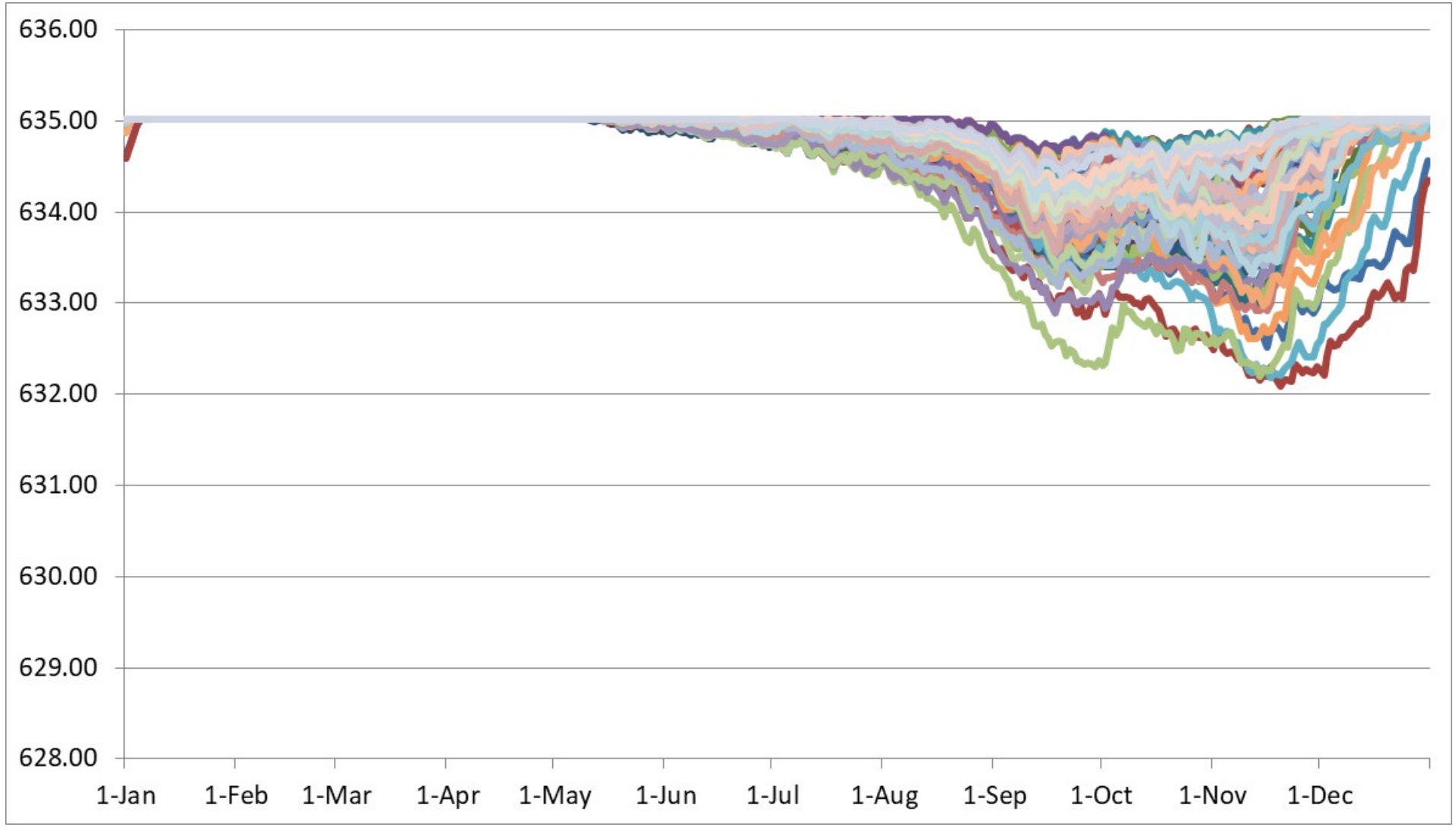
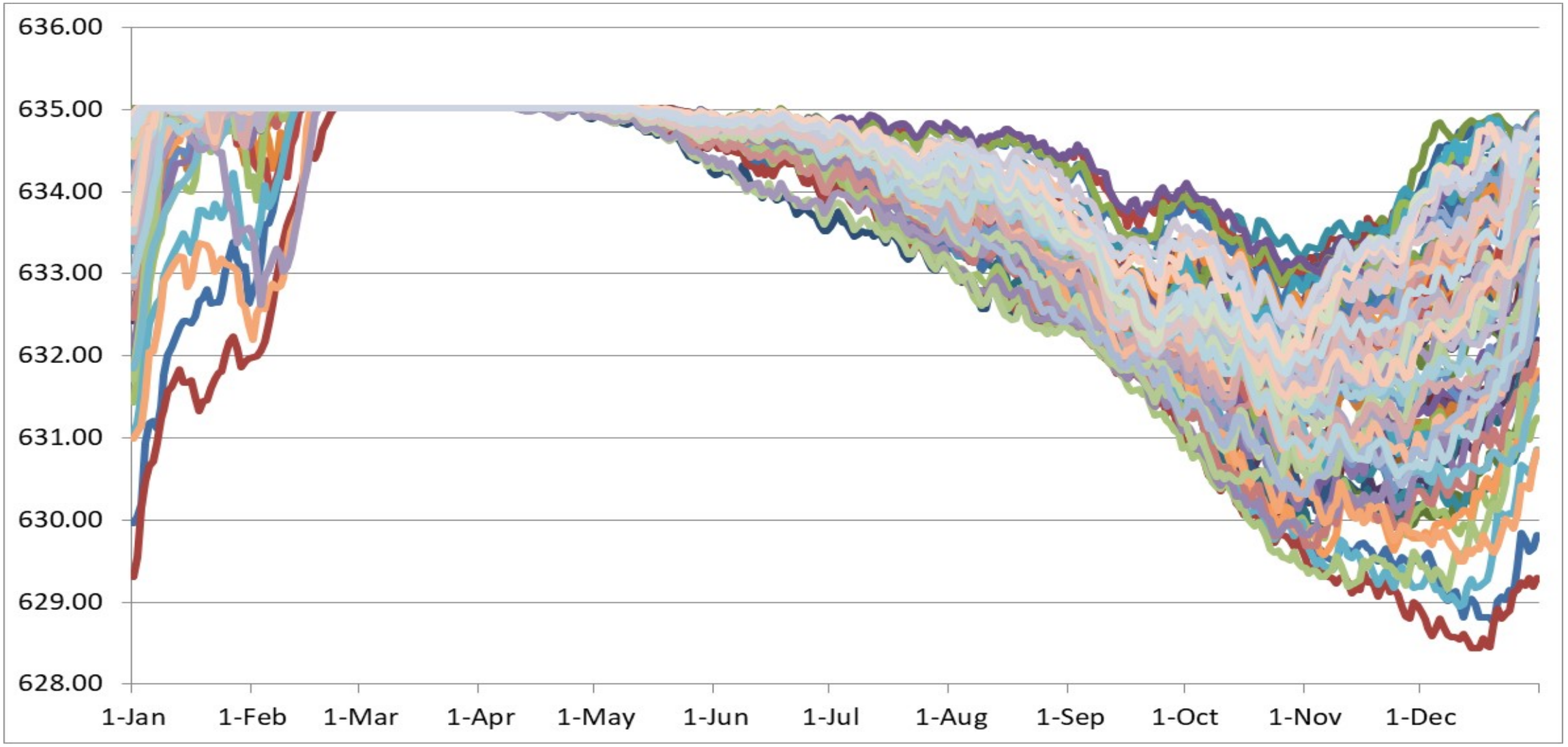


25% exceeded elevations at West Point Lake



Median Elevations at West Point Lake



75% exceeded elevations at West Point Lake

CONCLUSIONS

- Climate plays a major role in defining flow entering the Apalachicola River from the Flint & Chattahoochee basins.
- Reservoir management can still beneficially influence flows entering the Apalachicola River & estuary from the watershed above Jim Woodruff Dam
  - ✓Seasonally relevant delivery times & rates
  - ✓Consumptive demand limitations

CONCLUSIONS

- The amount you can effect flow by supply and/or demand management is confined by the nature of the watershed & capacity of the storage facilities.
- Alternative climate scenarios call for alternative management approaches to meet the same performance metric standards

RELEVANCE OF CONCLUSION

Developing multi-year management plans based on **historical** climate to determine how best to manage the watershed, such as was done in the recent Water Control Manual update, is a short-sighted approach to managing the ACF watershed.

Instead, the management approach for the ACF basin's Federal reservoirs needs to be flexible, adaptive, and short-term to address the non-stationarity of future climate.

RELEVANCE OF CONCLUSION

Florida's paradigm in the recent ACF Compact and Supreme Court case of **seeking historical flows** to protect the Apalachicola estuary is backwards.

Instead (considering the importance of climate in defining the volume of water entering the Apalachicola basin) management of the estuary should be based on **the volume of water anticipated**.