Assessing Best Predictors of Hypoxic Volume

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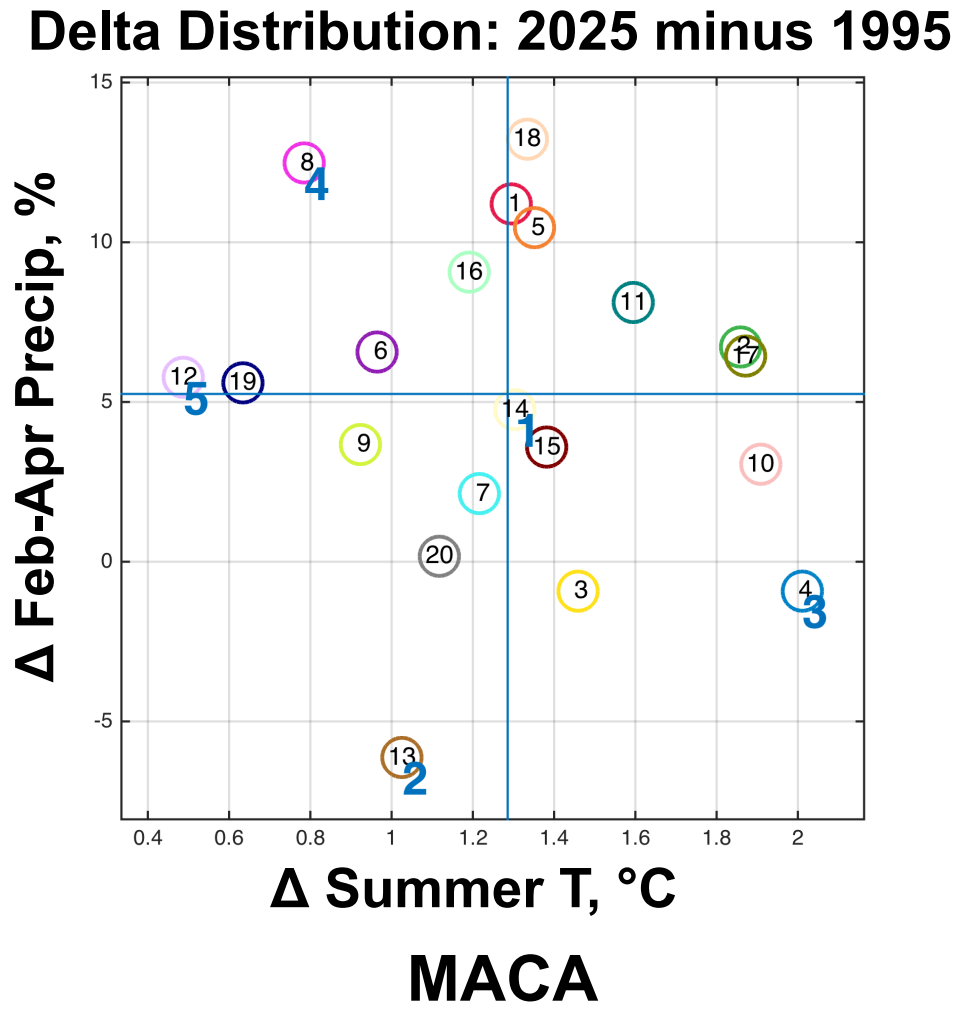
Predictors of Annual Hypoxic Volume

- Is the change in FMA precipitation the best choice when assessing the sensitivity of hypoxia to future climate scenarios?



Limnol. Oceanogr., 59(2), 2014, 373–384

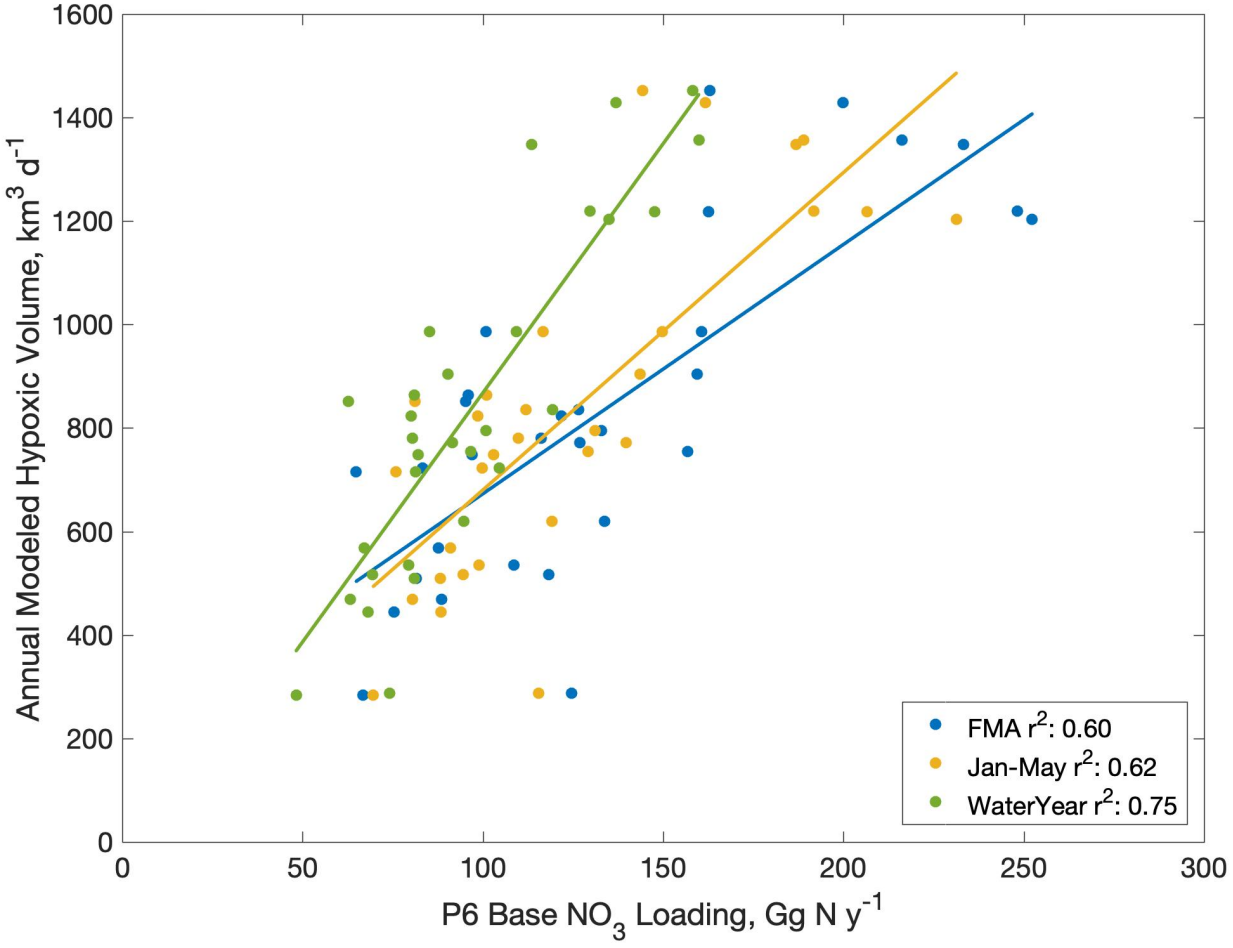
doi:10.4319/lo.2014.59.2.0373

Nutrient loading and meteorological conditions explain interannual variability of hypoxia in Chesapeake Bay

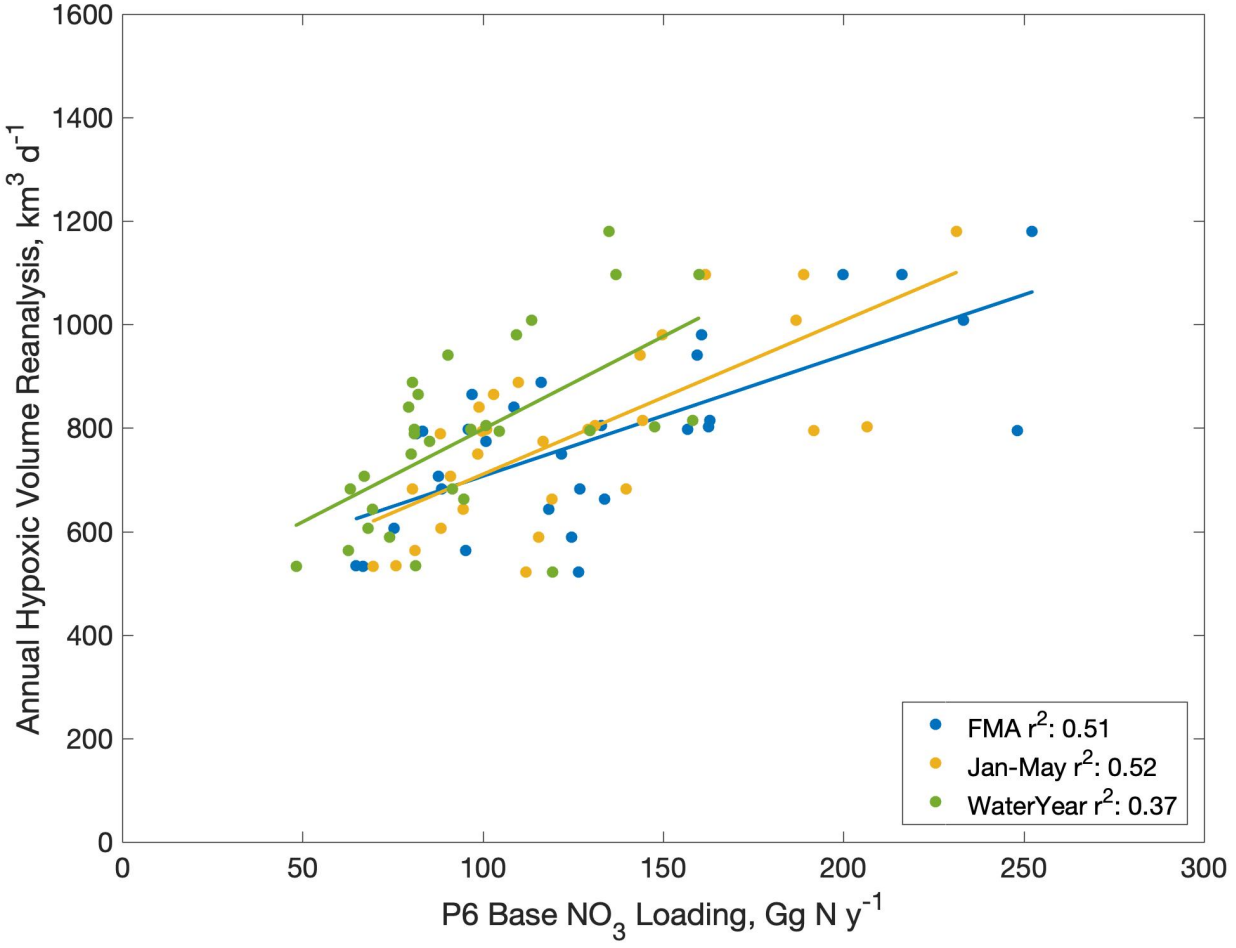
Yuntao Zhou,[1,2,*] Donald Scavia,[2,3,4] and Anna M. Michalak [1]

- "Overall, total April–May precipitation (P, mm), cumulative January–May TN loading (N, 106 kg) from the Susquehanna, Potomac, and Rappahannock, and the April–August dominant wind effect (W, i.e., SW wind duration/NE wind duration) were selected by BIC for the final model, and together explained 85% of the variability in the mean hypoxic volume…"
- **Approach Taken**
  - Compute Correlations between reanalysis/modeled HV and:
    - NO_3 Loading, Total Nitrogen, Discharge, and Precipitation
    - TN Results similar to NO_3 Loading, not shown
  - Examine these correlations over different spatial regions
    - Whole Bay, Zhou & Scavia's three rivers
    - Three river results similar to Whole Bay, not shown
    - Examine different temporal periods (Feb-Apr, Jan-May, etc.)

Modeled HV

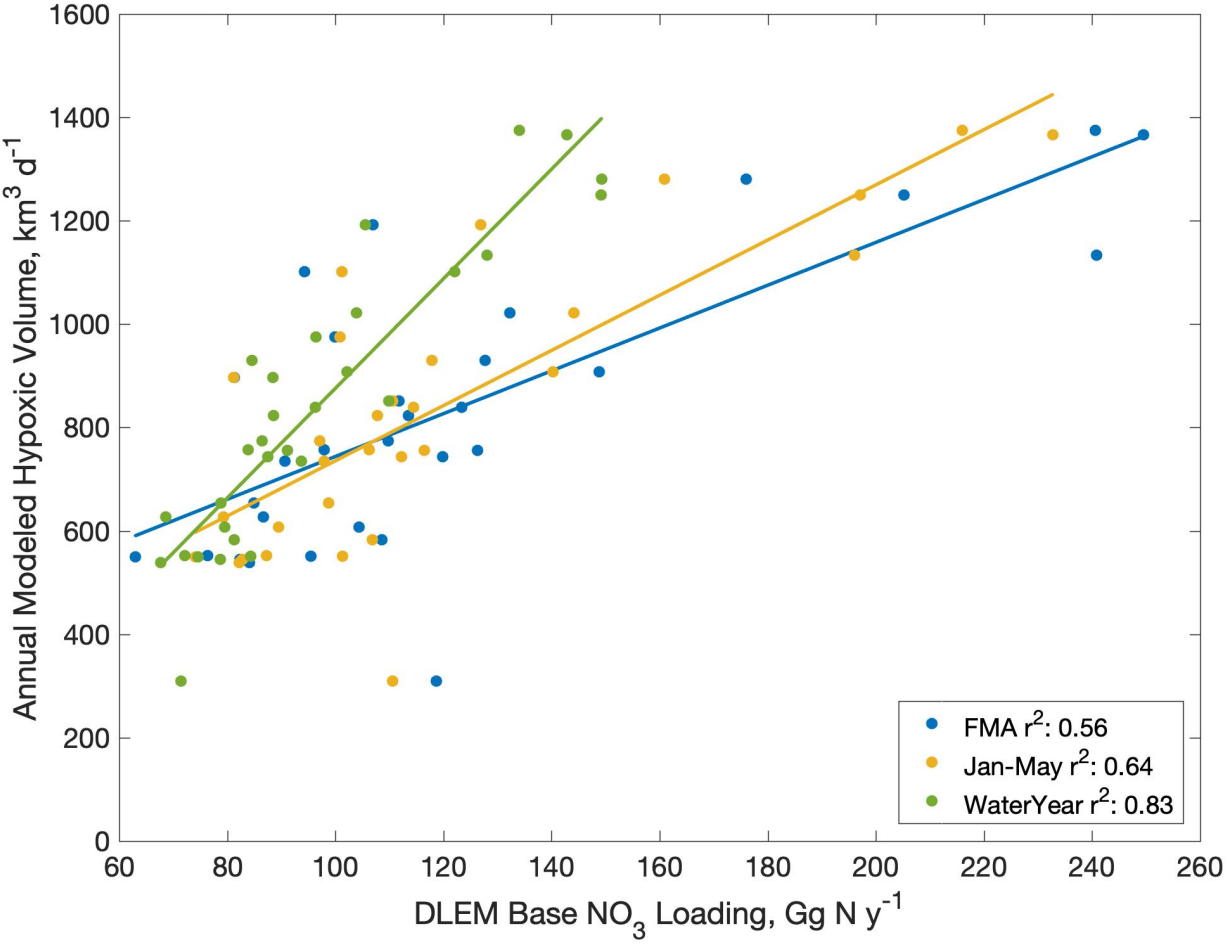


HV Reanalysis

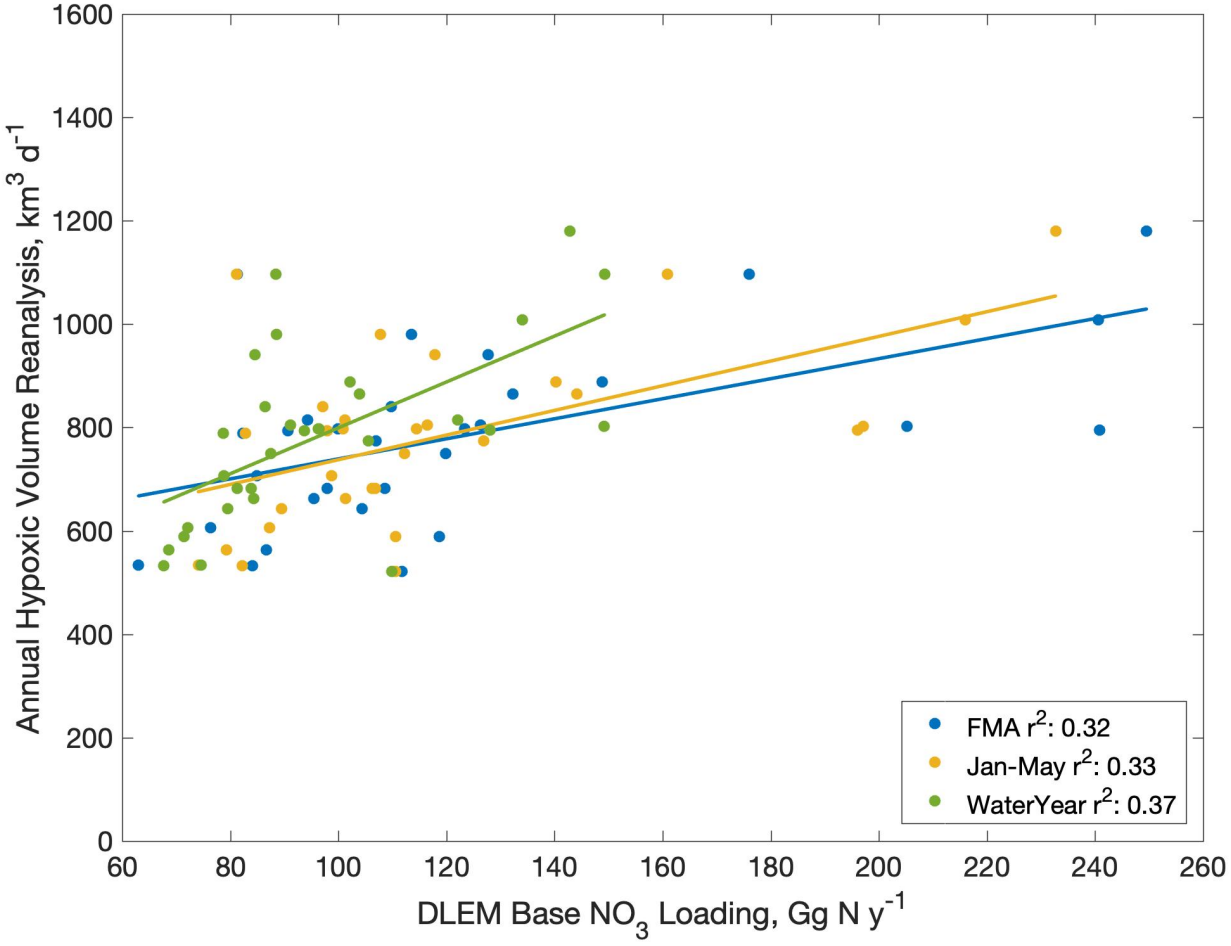


- Higher correlation to modeled hypoxic volume than reanalysis of annual hypoxic volume

Modeled HV

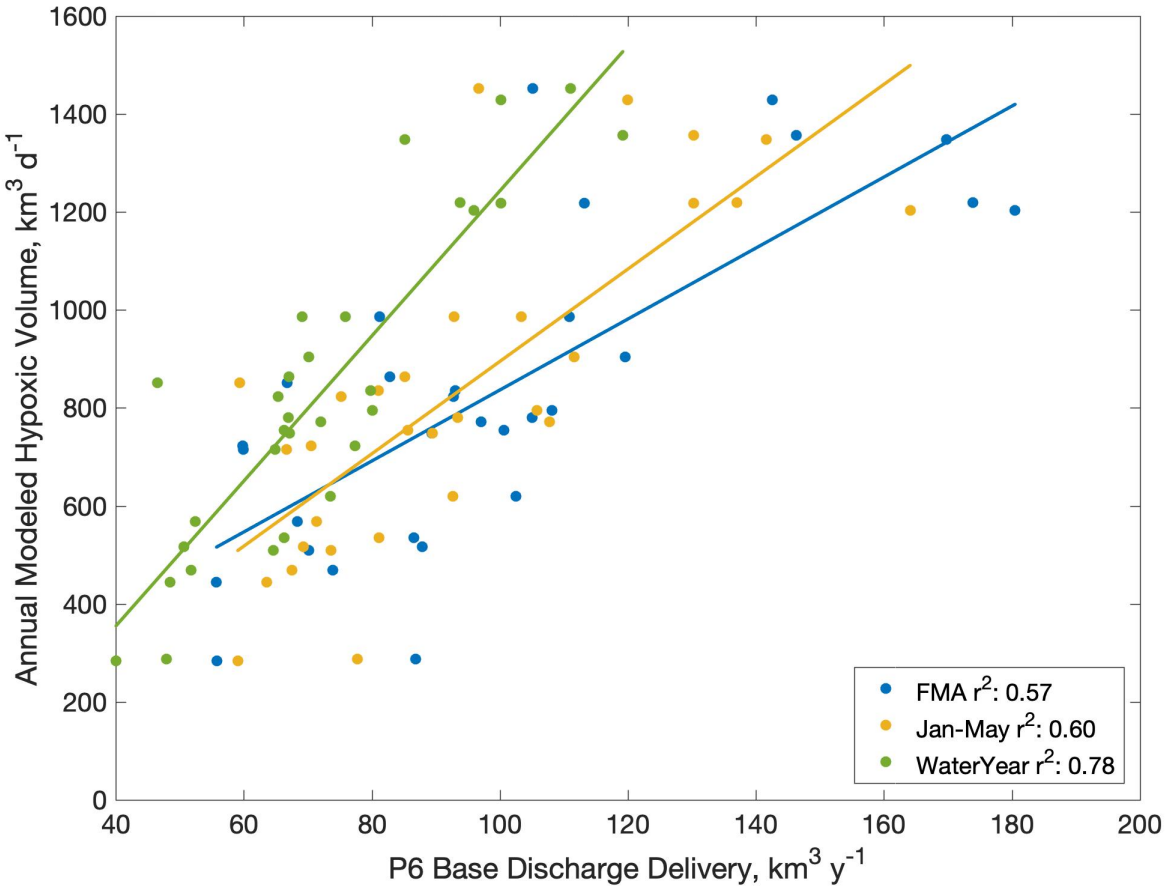


HV Reanalysis

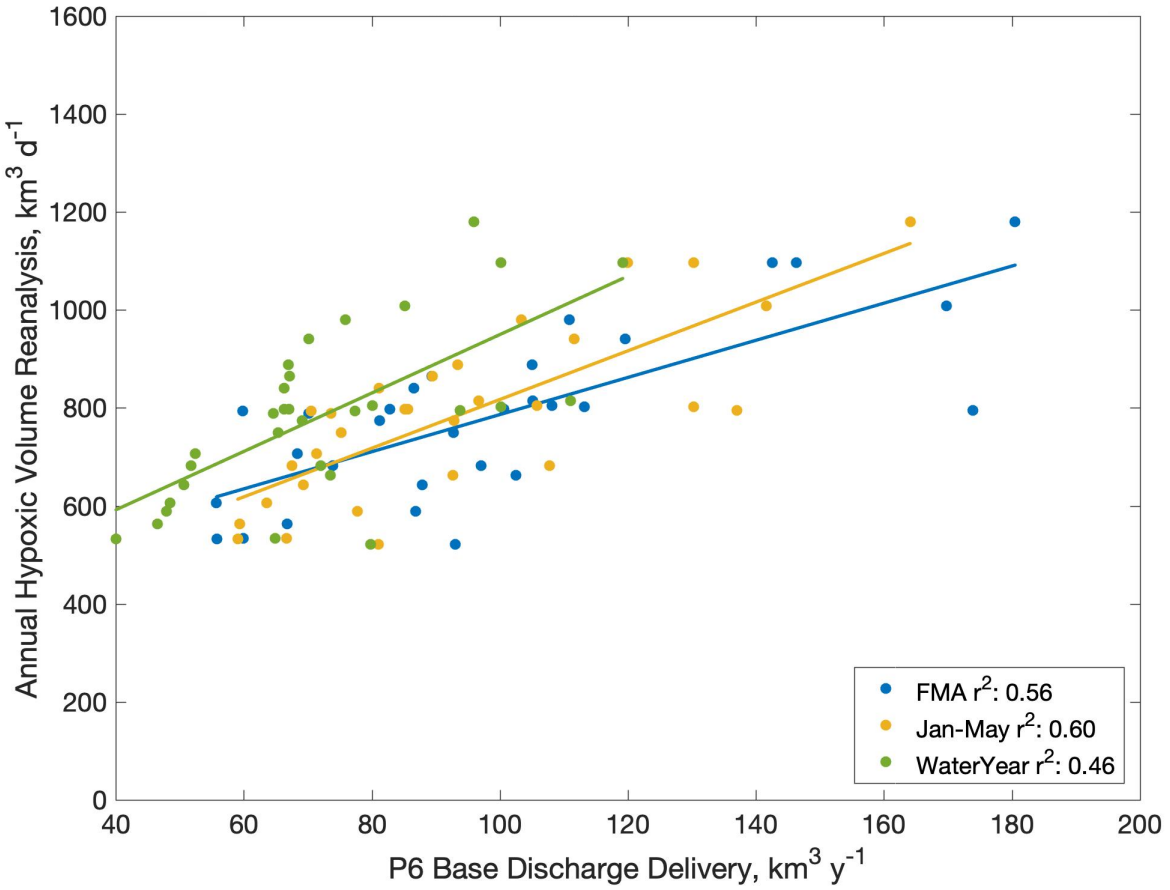


- Higher correlation to modeled hypoxic volume than reanalysis of annual hypoxic volume
- Correlations are less similar for DLEM NO_3 Loading than P6 NO_3 Loading

Modeled HV



HV Reanalysis



- Correlations for both relationships are more similar for discharge than they were for NO_3 Loading

Predictor	NO3 - Modeled HV			NO3 - HV Reanalysis		
Correlation Period	FMA	Jan-May	Water Year	FMA	Jan-May	Water Year
P6 HV	0.60	0.62	0.75	0.51	0.52	0.37
DLEM HV	0.56	0.64	0.83	0.32	0.33	0.37
Predictor	**Discharge - Modeled HV**			**Discharge - HV Reanalysis**		
Correlation Period	FMA	Jan-May	Water Year	FMA	Jan-May	Water Year
P6 HV	0.57	0.60	0.78	0.56	0.60	0.46
DLEM HV	0.48	0.58	0.58	0.44	0.45	0.37
Predictor	**Precipitation - Modeled HV**			**Precipitation - HV Reanalysis**		
Correlation Period	FMA	Jan-May	Water Year	FMA	Jan-May	Water Year
P6 HV	0.47	0.49	0.63	0.48	0.54	0.39
DLEM HV	0.45	0.56	0.48			

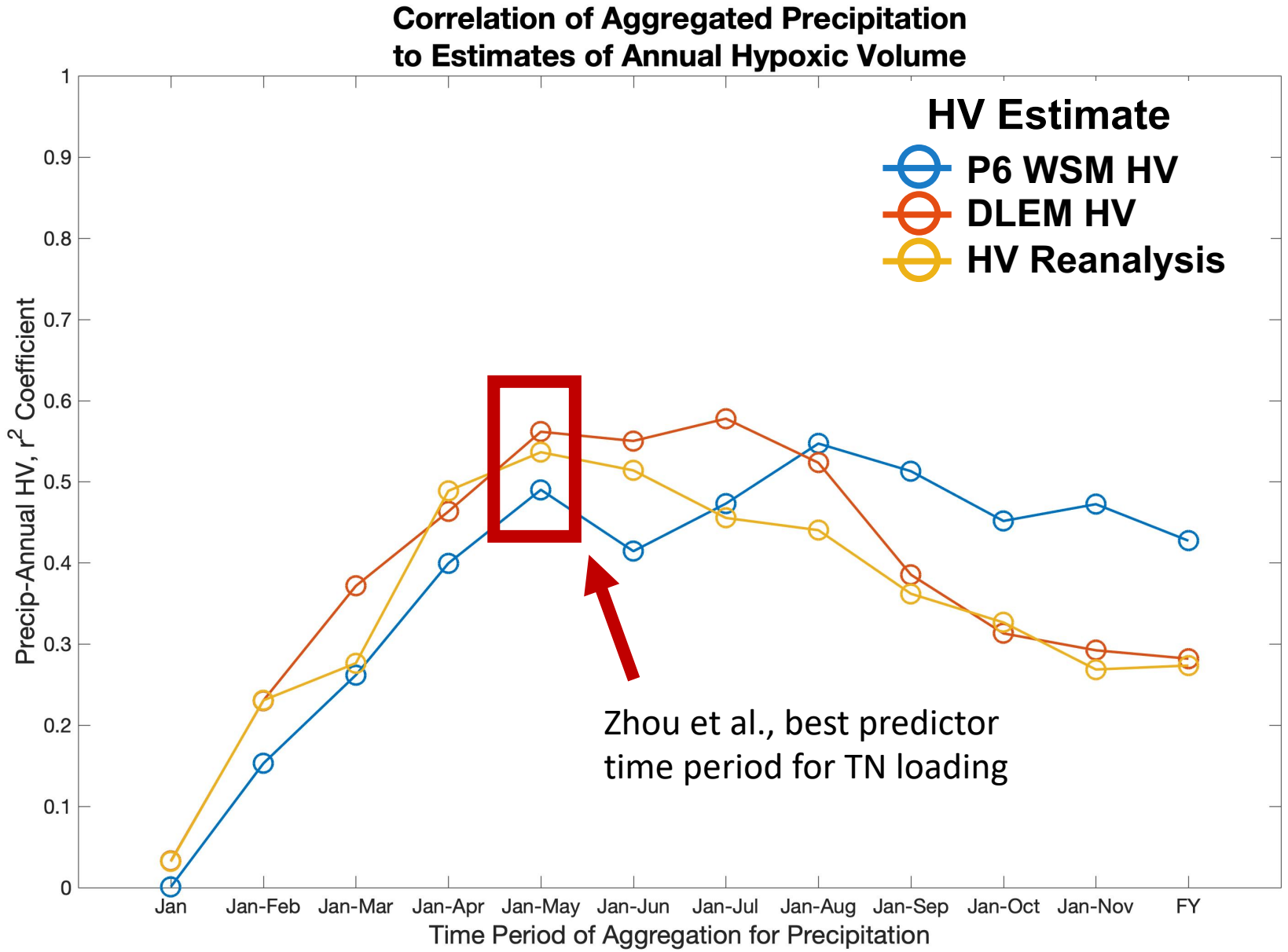
- **Annual HV is more correlated to Jan-May Precipitation than Feb-April precipitation**

How many ways can you skin a ~~cat~~ precipitation dataset?

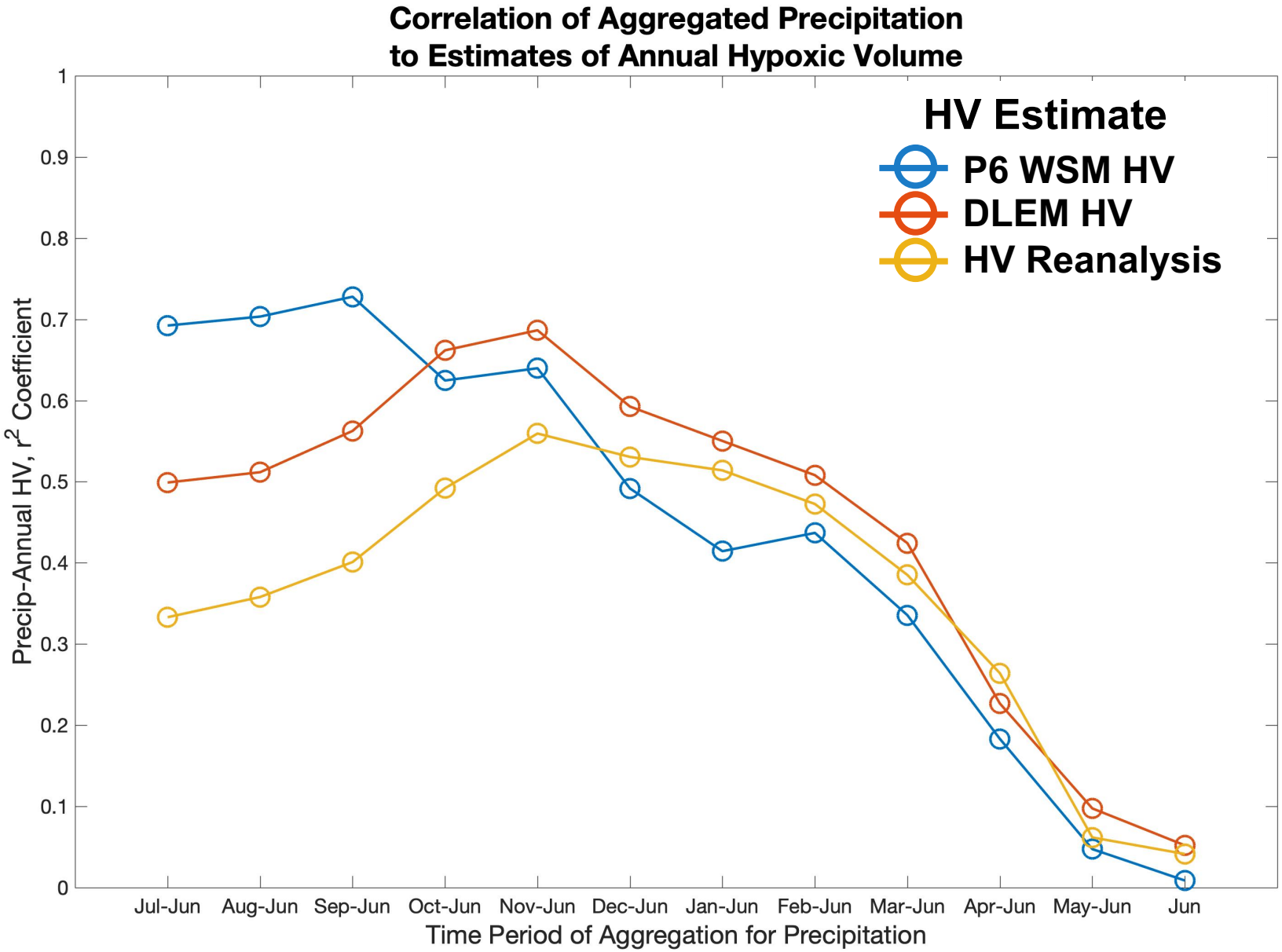
- Better estimates of fit can be found for time periods different from current “FMA” selection

Time Period	P6 HV	DLEM HV	HV Reanalysis
Feb-Apr	0.47	0.45	0.48
Feb-May	0.51	0.50	0.47
Mar-May	0.41	0.42	0.39
Jan-Apr	0.40	0.46	0.49
Jan-May	0.49	0.56	0.54
Jan-Jun	0.41	0.55	0.51
Jan-Jul	0.47	0.58	0.46
Jan-Aug	0.55	0.52	0.44
Full Year	0.43	0.28	0.27
Water Year	0.63	0.48	0.39

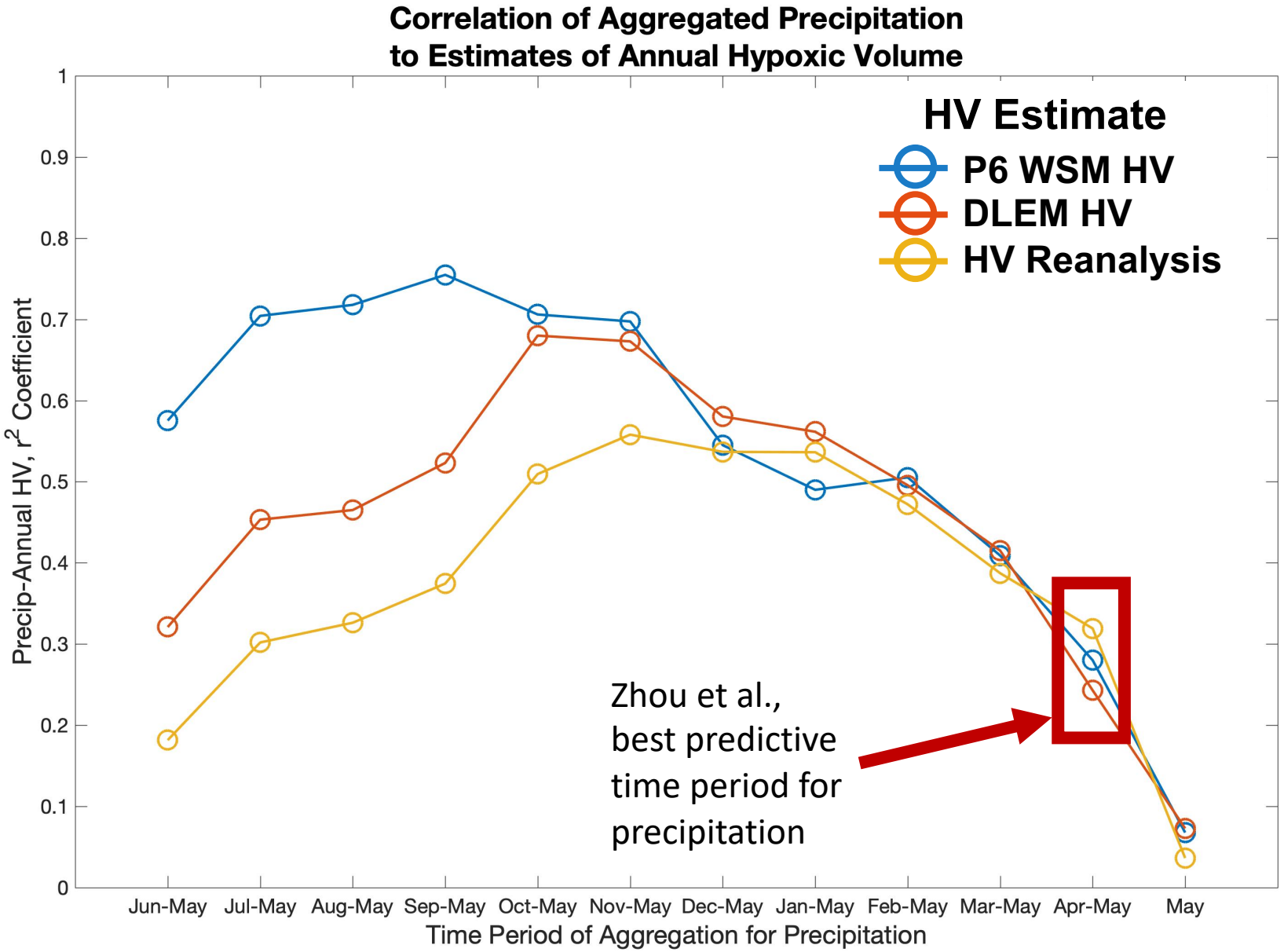
} Currently being used



- Best time period for aggregated precipitation and <u>all</u> estimates of hypoxic volume is Jan-May



- Peak in goodness of fit for Nov to June, diminishing returns as more months are added (moving left)



- Peak in goodness of fit for late fall to May, diminishing returns as more months are added (moving left)

Conclusions

- In selecting a downscaled GCM representing the center of a distribution for precipitation, the time period of Feb-Apr may not be the best choice

- ***Switch from using Feb-April precipitation to Nov-June precipitation when selecting downscaled GCMs***