# Corsica River Shallow Water Simulation Progress

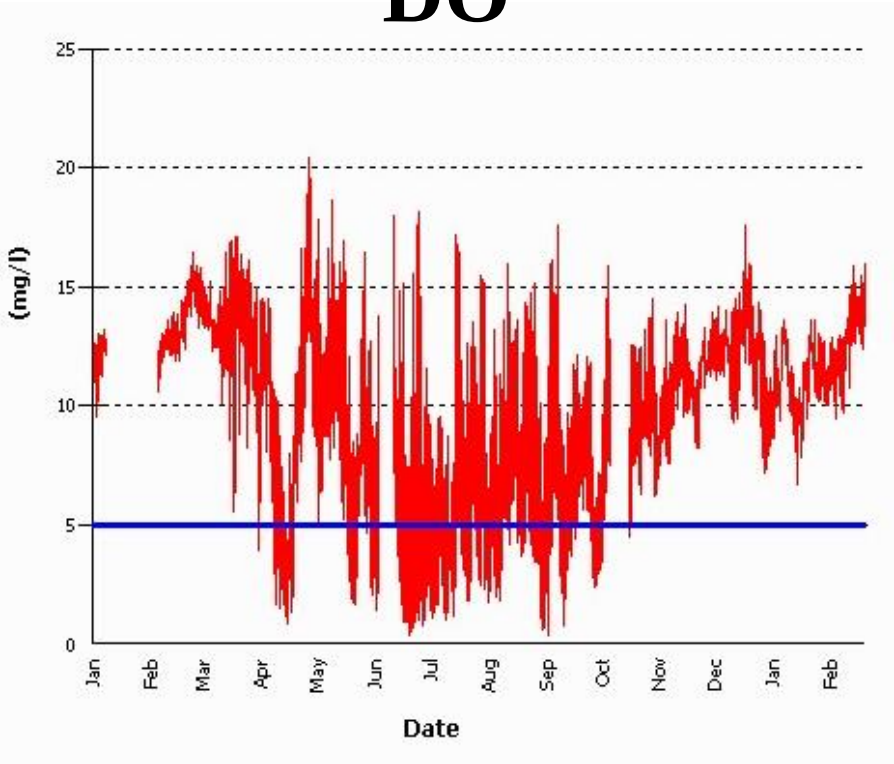
**Richard Tian, Nicole Cai, Jeremy Testa, Damian Brady,**
**Carl Cerco and Lewis Link**

**Modeling Quarterly Review Meeting**
**04/06/2022**
**Annapolis**

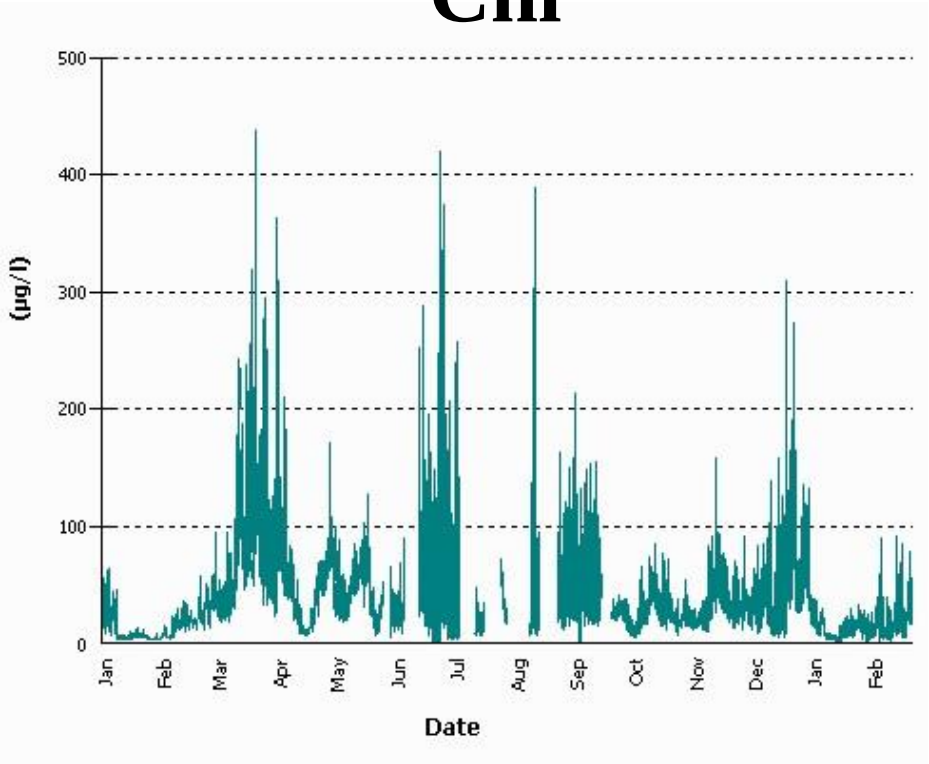
# DO and Chlorophyll CMON Data 2013 at Station 3851

## (Data from MD DNR)

### DO




### Chl



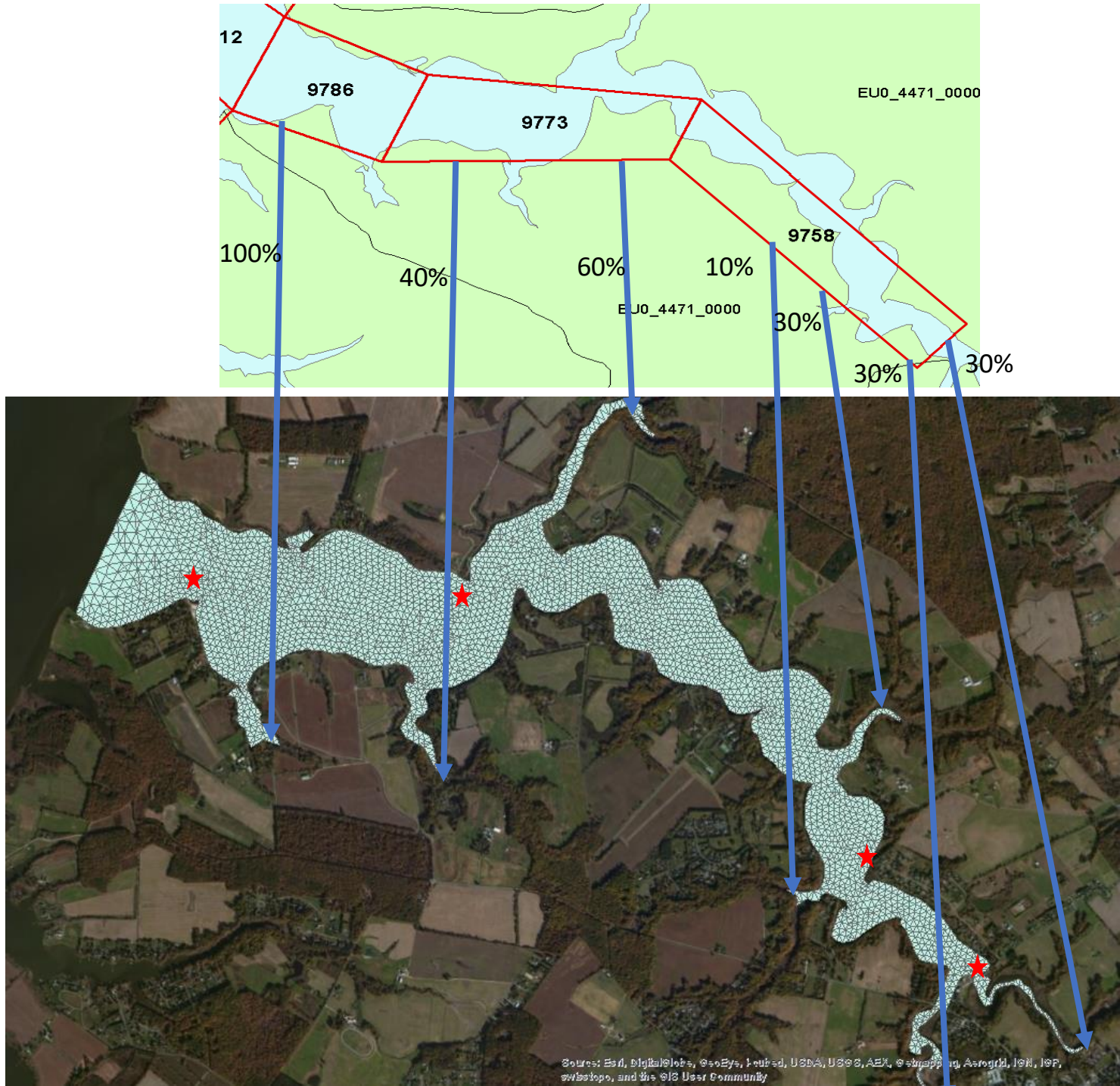

**Can any model reproduce this?**

**Quote from Carl Cerco: "You can't grab a bottle of water and ask me: Model it!"**

**But we tried**

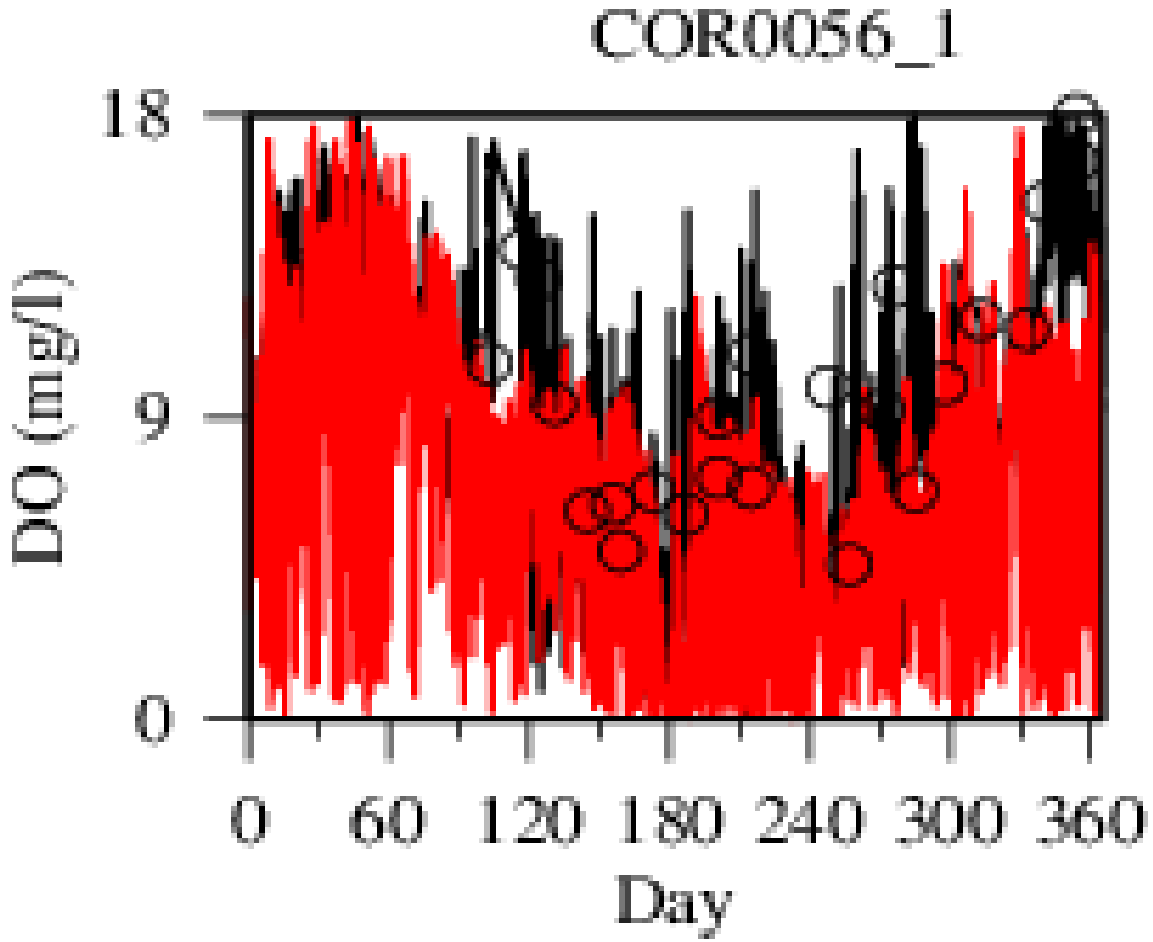
# Model grid and Watershed loading

- SCHISM
- 5029 cells with up to 20 m resolution and 5 sigma layers
- 3 CH3D runoffs partitioned into 7
- Arbitrary
- Is further partitioning needed?



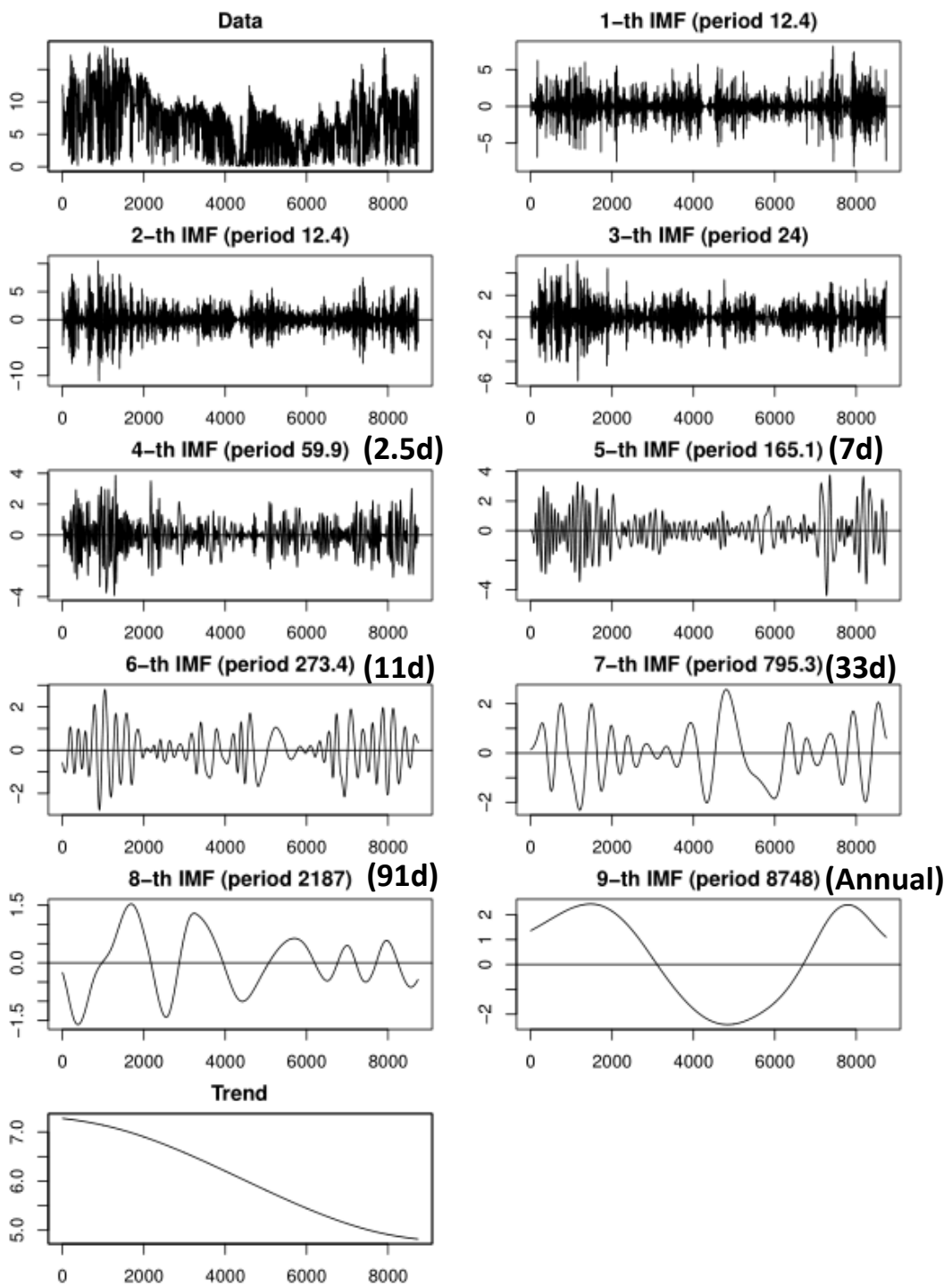
# Modeling solution versus CMON data at the upper estuary

- **Is this real or model instability?**
- **Are there interpretable signals embedded in the high-frequency variability?**
- **Are there relationships with forcing data that can predict the variations?**

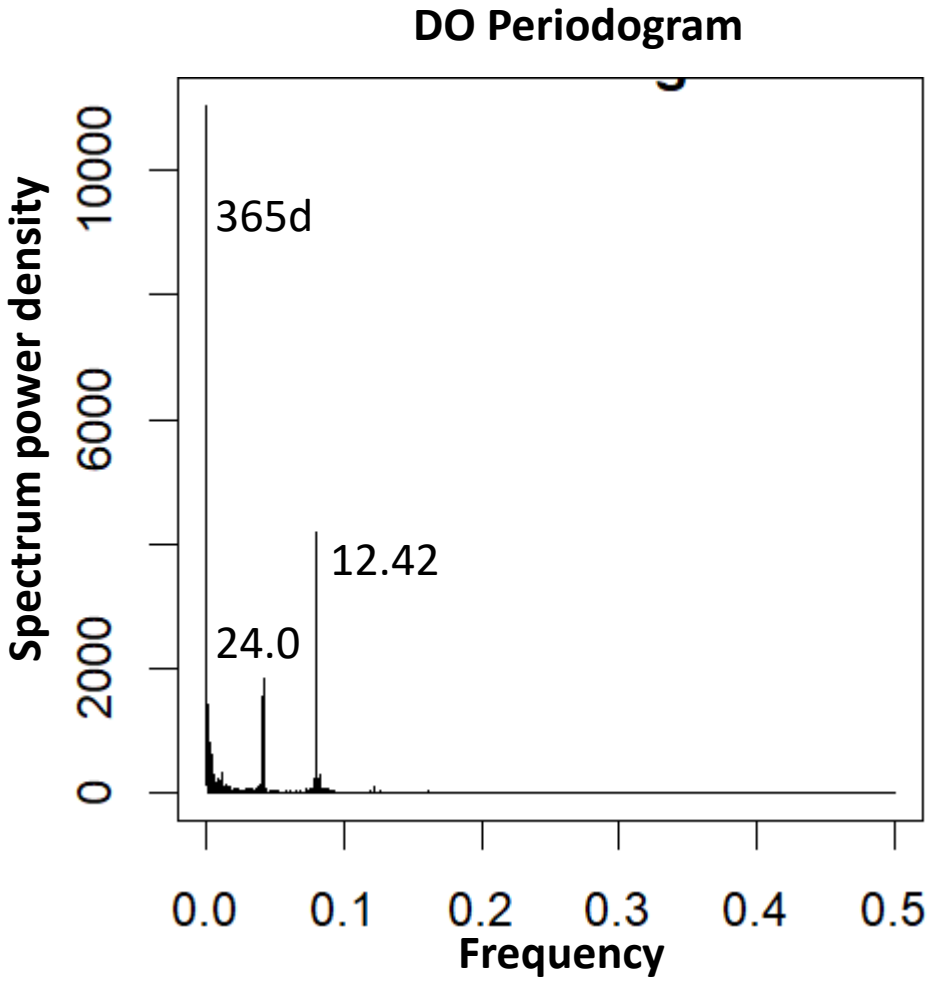


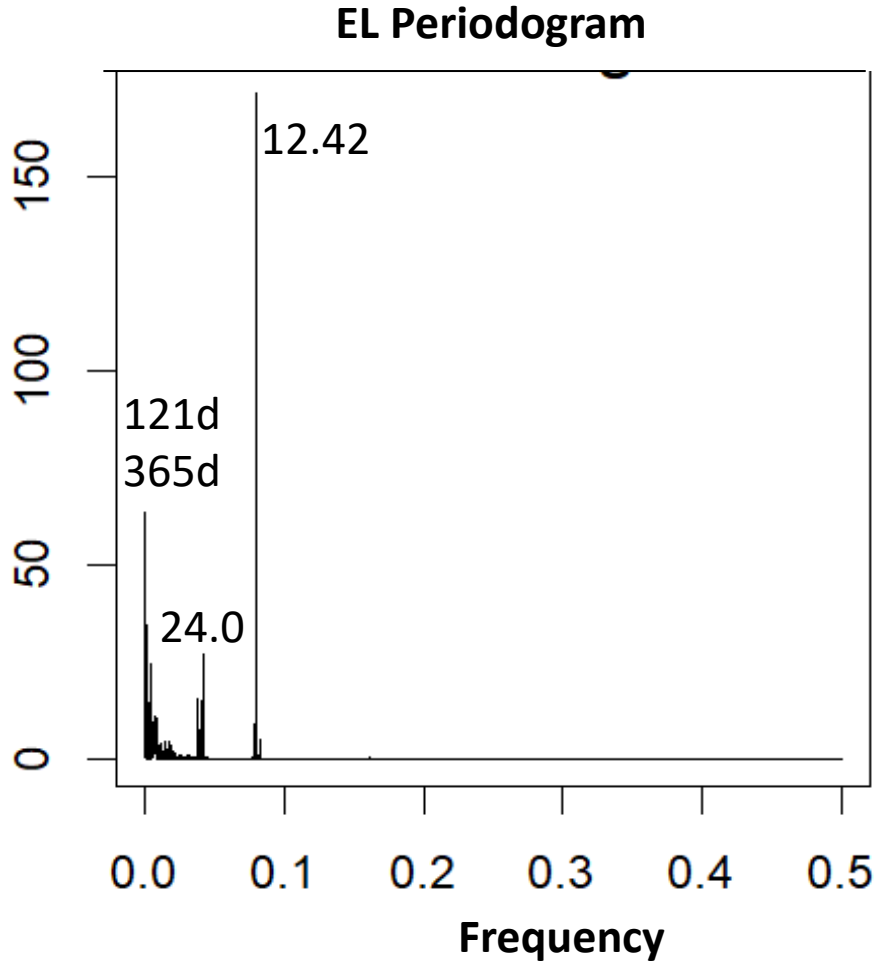
# DO EMD (Empirical Mode Decomposition)

- Frequency in hours.
- The first two modes have M2 tide frequency.
- The third mode is diurnal.
- The nineth mode is the seasonal cycle.
- Trend is the residual.



# DO and Sea surface elevation spectral analysis

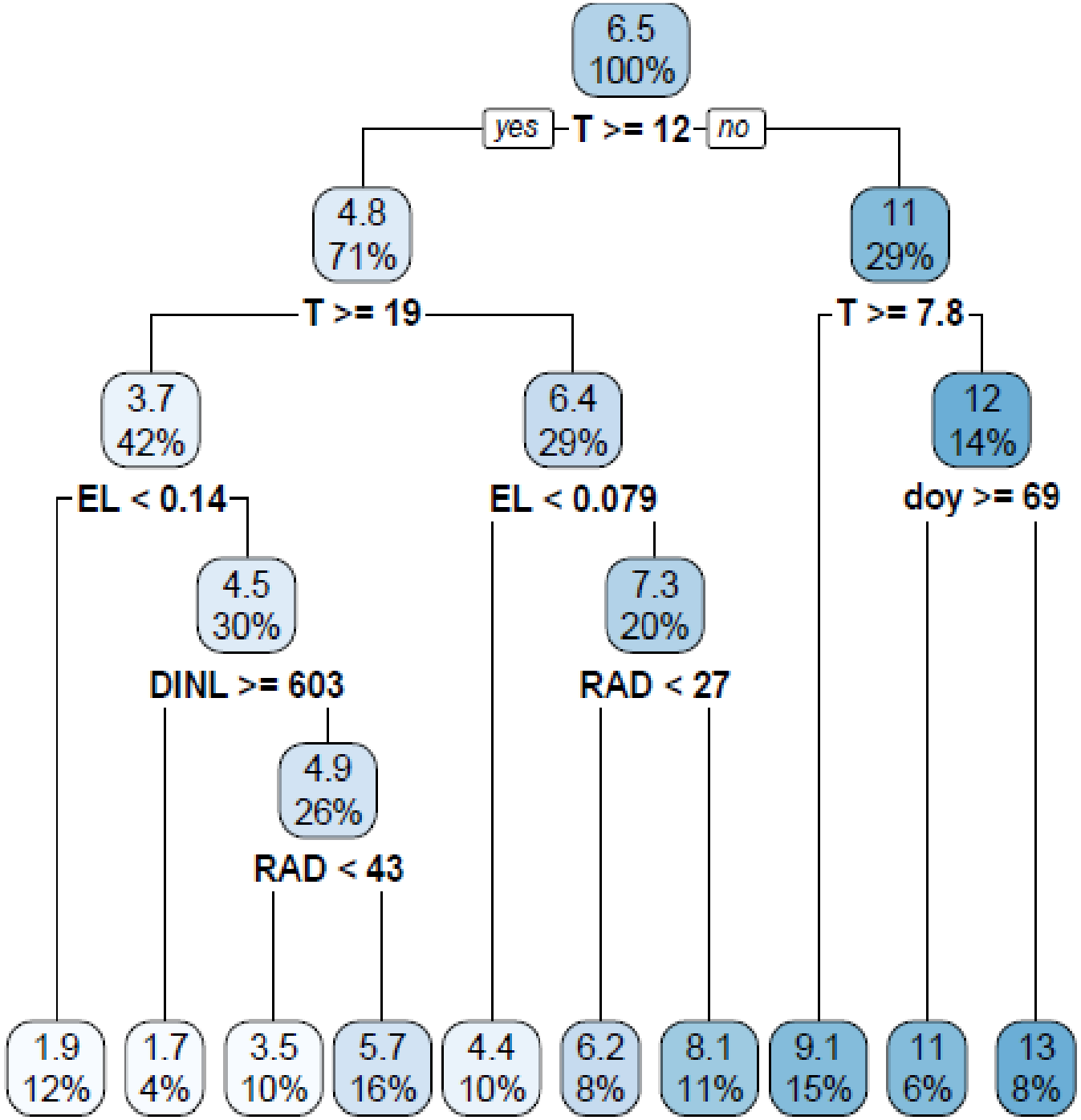


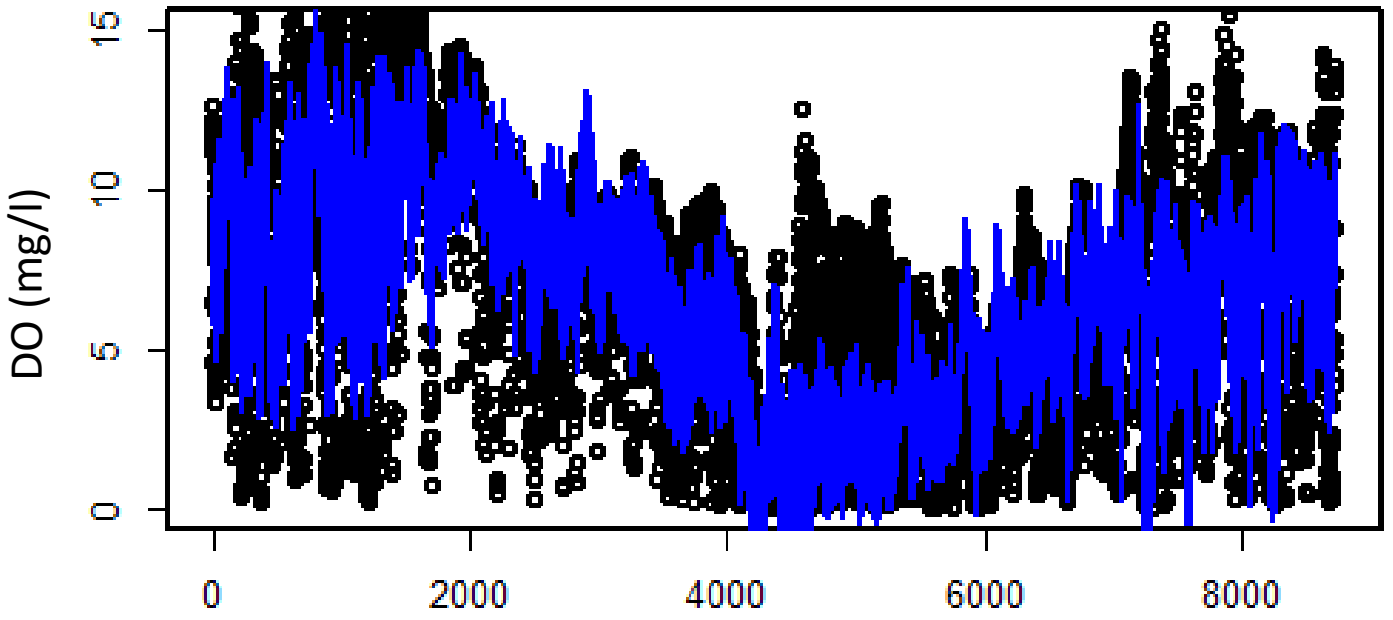

**Seasonal cycle dominant overall, M2 frequency prevailing for high-frequency variability. There are interpretable signals.**

# DO CART analysis

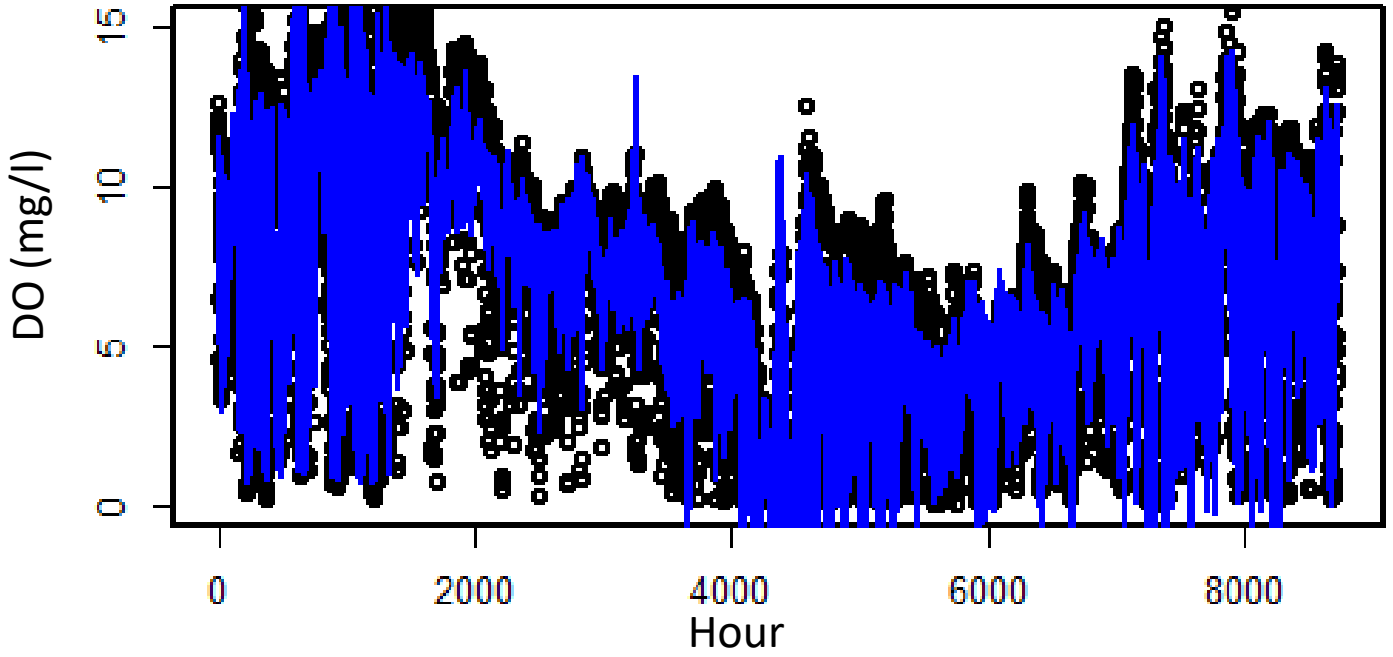
- **Model: cart <- rpart(DO ~ EL + DINL + RAD + hod + doy + T + WS)**
- **Temperature is the dominant predictor, followed by tide, day of the year (doy), nutrient loads (DINL) and solar radiation (RAD).**
- **Limitation: Linear model approach.**



**GAM prediction, same equation as CART:**
**$R^2$=0.70**

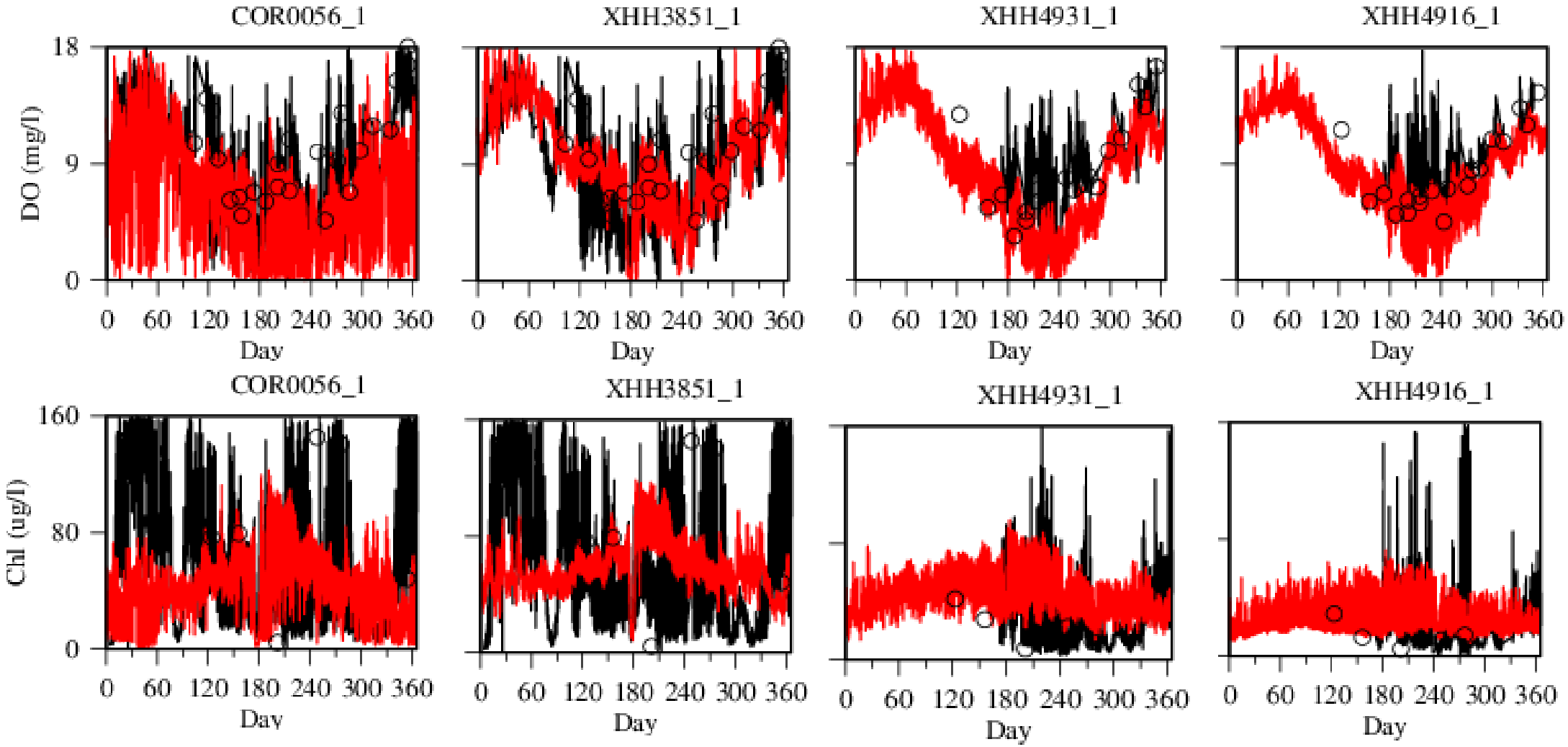



**GAM prediction with chlorophyll added:**
**$R^2$=0.86**




**The model worked and the results are predictable.**

# Simulation of DO and chlorophyll at 4 stations from the upper to the lower estuary

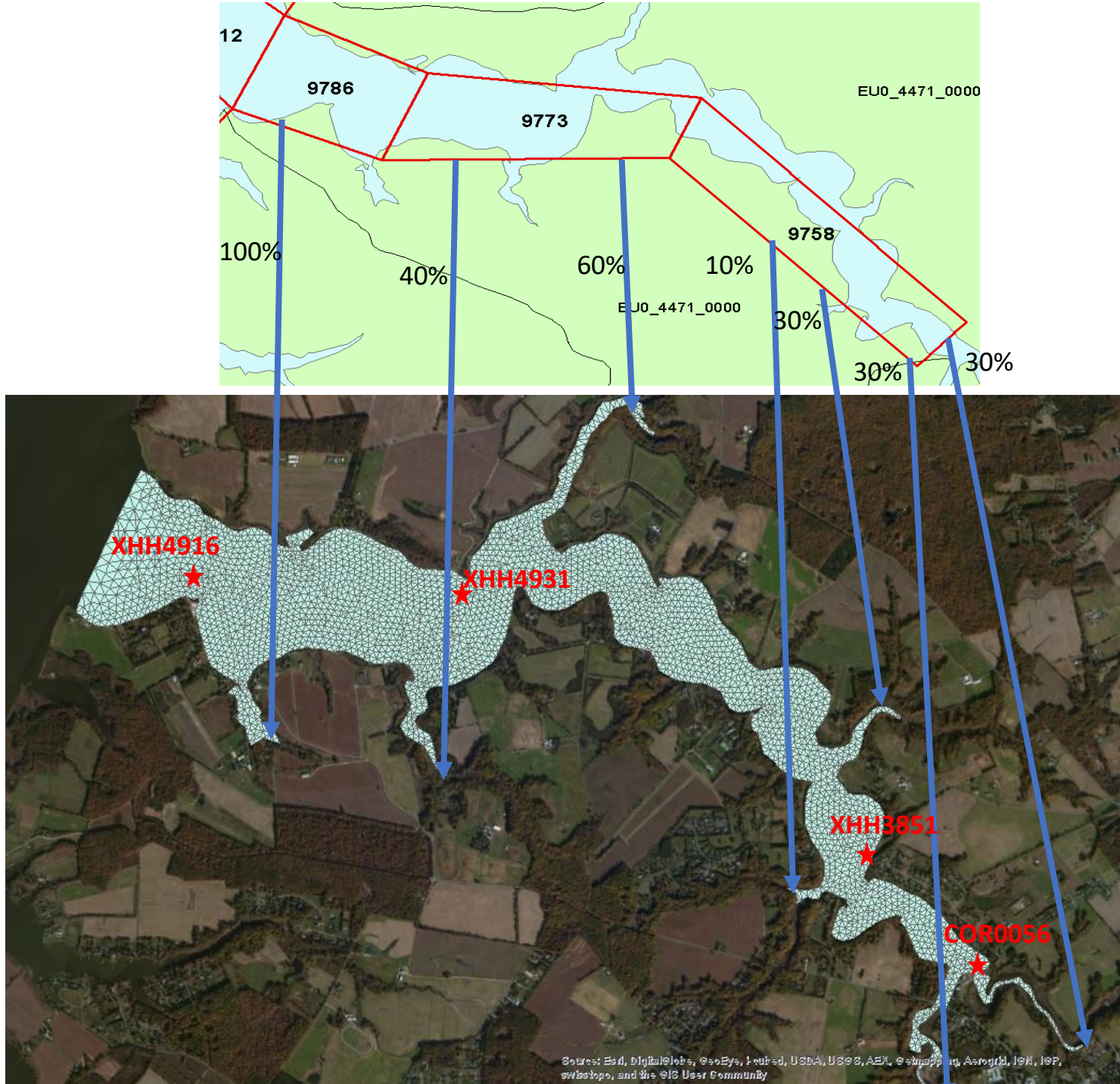



**Carl's quote holds.**

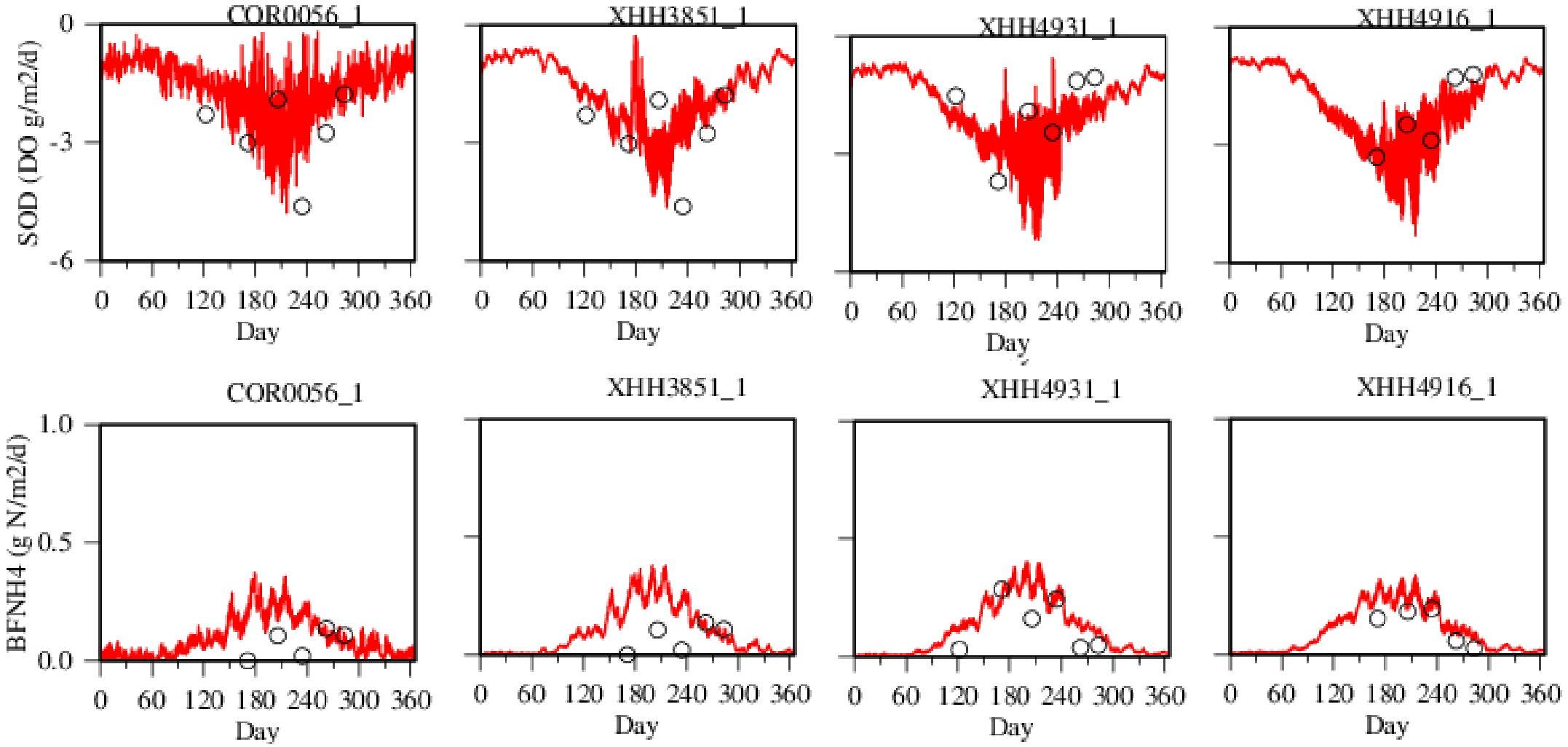
**Why XHH3851 is less responsive than COR0056?**

# Watershed loading

- 3 CH3D runoffs partitioned into 7.
- Arbitrary
- Is further partitioning needed?
- Local nutrient load may be missing at XHH3851.
- If feasible, best to resolve sub-hydrologic units by the watershed model in the coastal area.



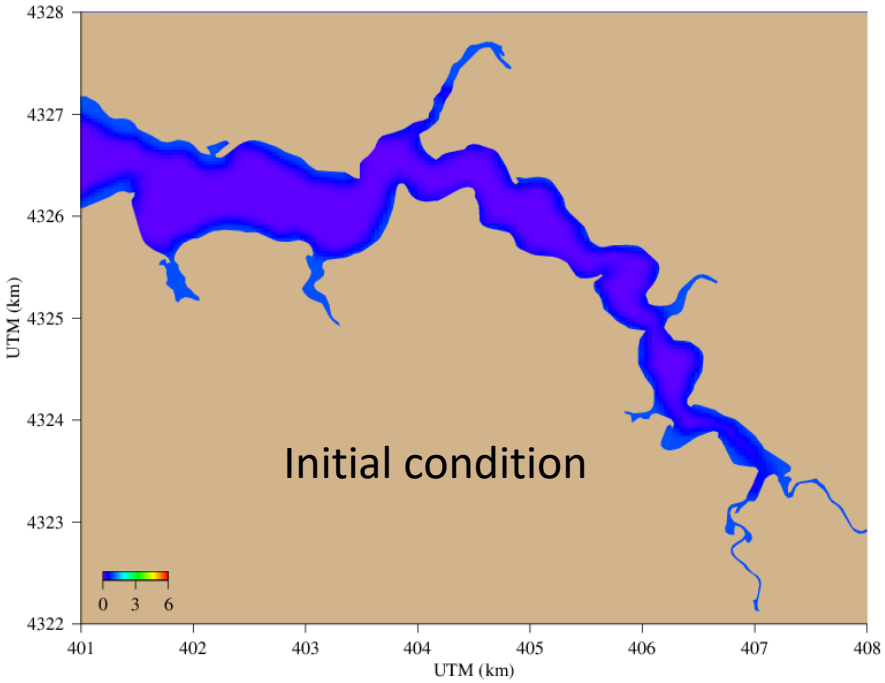
# Simulation of SOD and NH4 sediment fluxes at 4 stations from the upper to the lower estuary

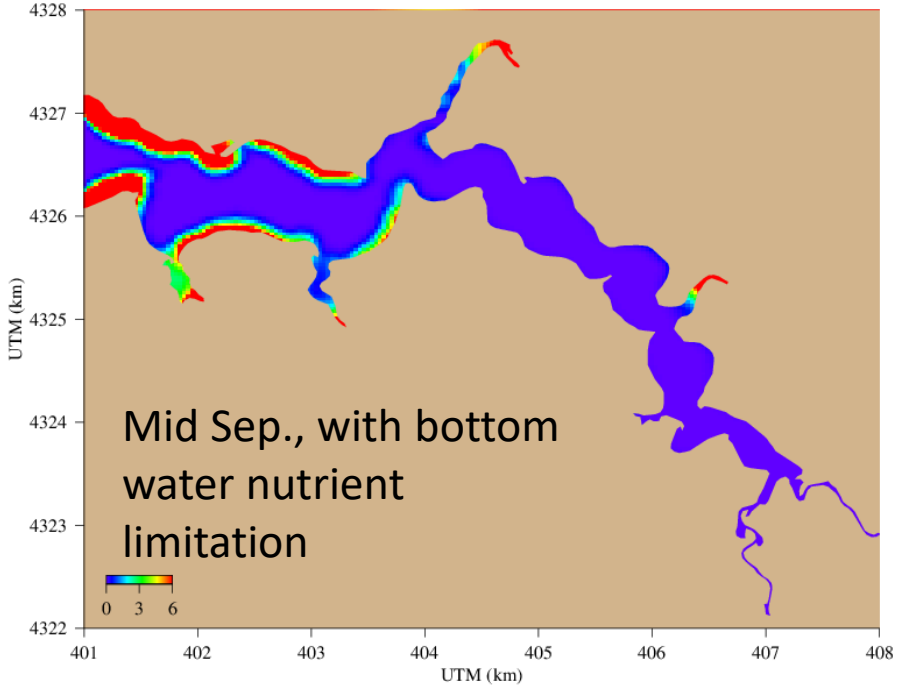


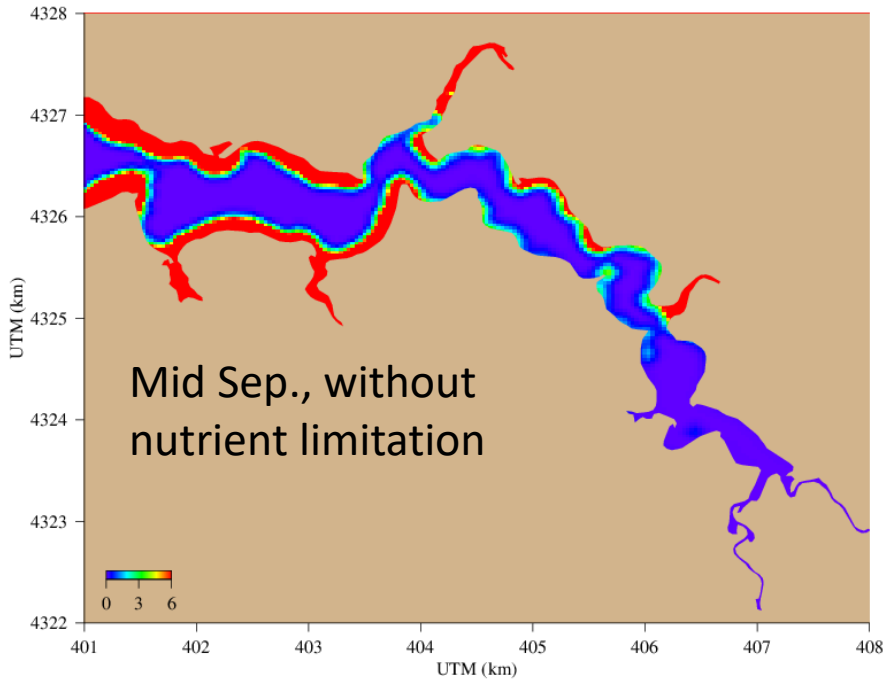
# Benthic algae simulation

**Message:**

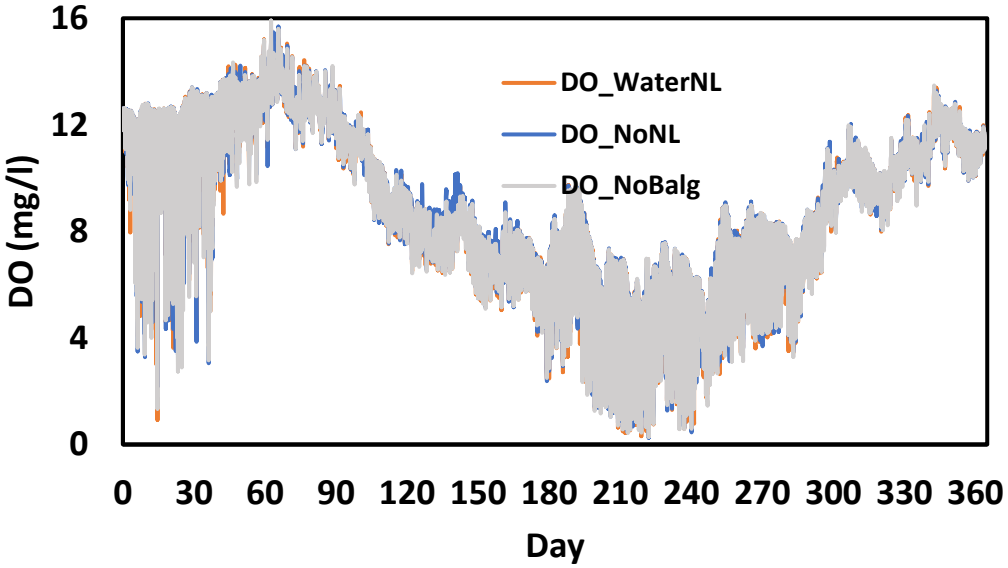
- **We are working on it.**
- **No reliable results.**
- **Lack of data for calibration.**
- **1 m depth limit.**
- **Did not grow well in the upper estuary.**

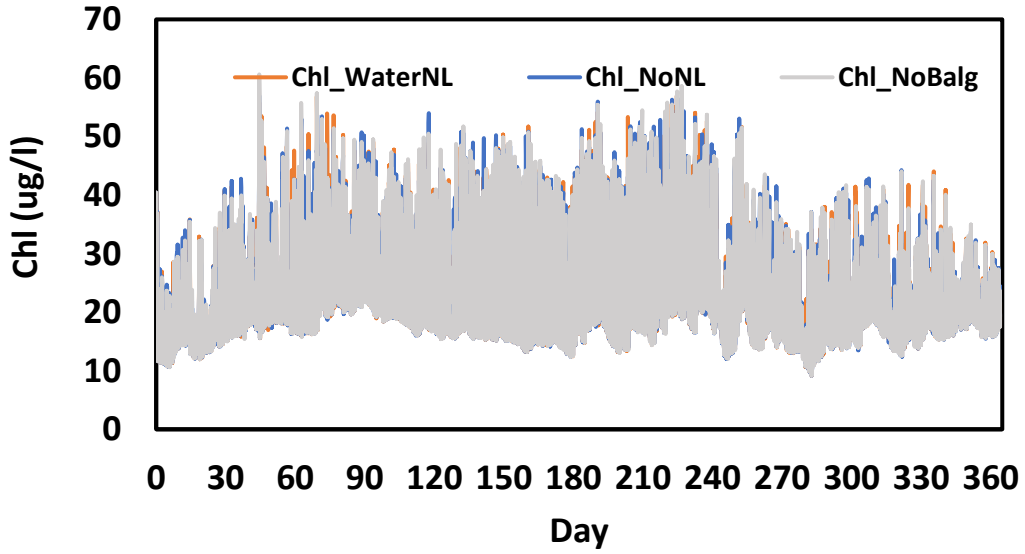


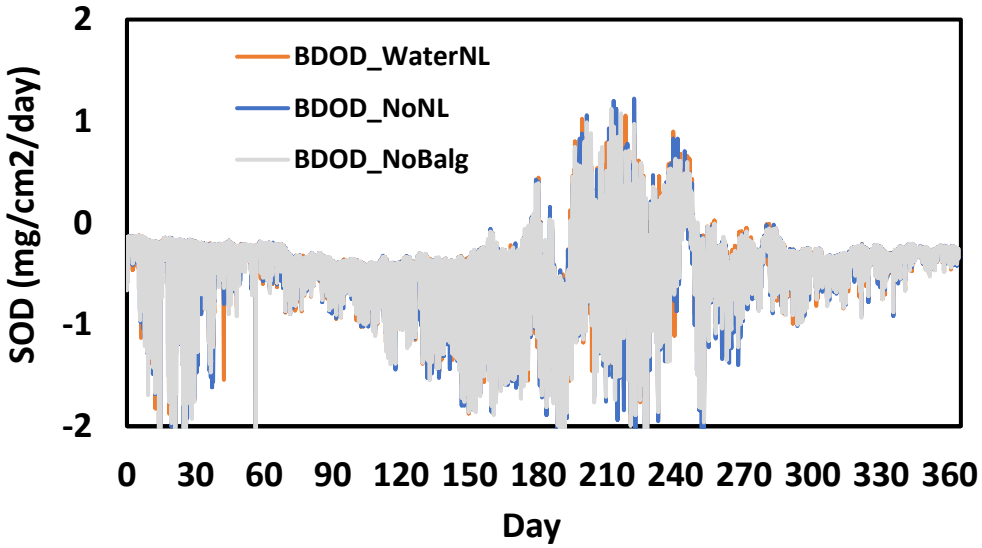



# Are there signals of benthic algae impact in the water column and sediment oxygen demand (SOD)?




**No significant signals were simulated at the monitoring stations at this point.**

# Messages

- **It seems physical dynamics can be as important as biogeochemical processes in determining DO variability in the Corsica.**

- **Will focus on the benthic algae simulation to see whether it can have a significant impact on water quality.**