Mimicking storms in experimental ecosystems: stepwise erosion experiments

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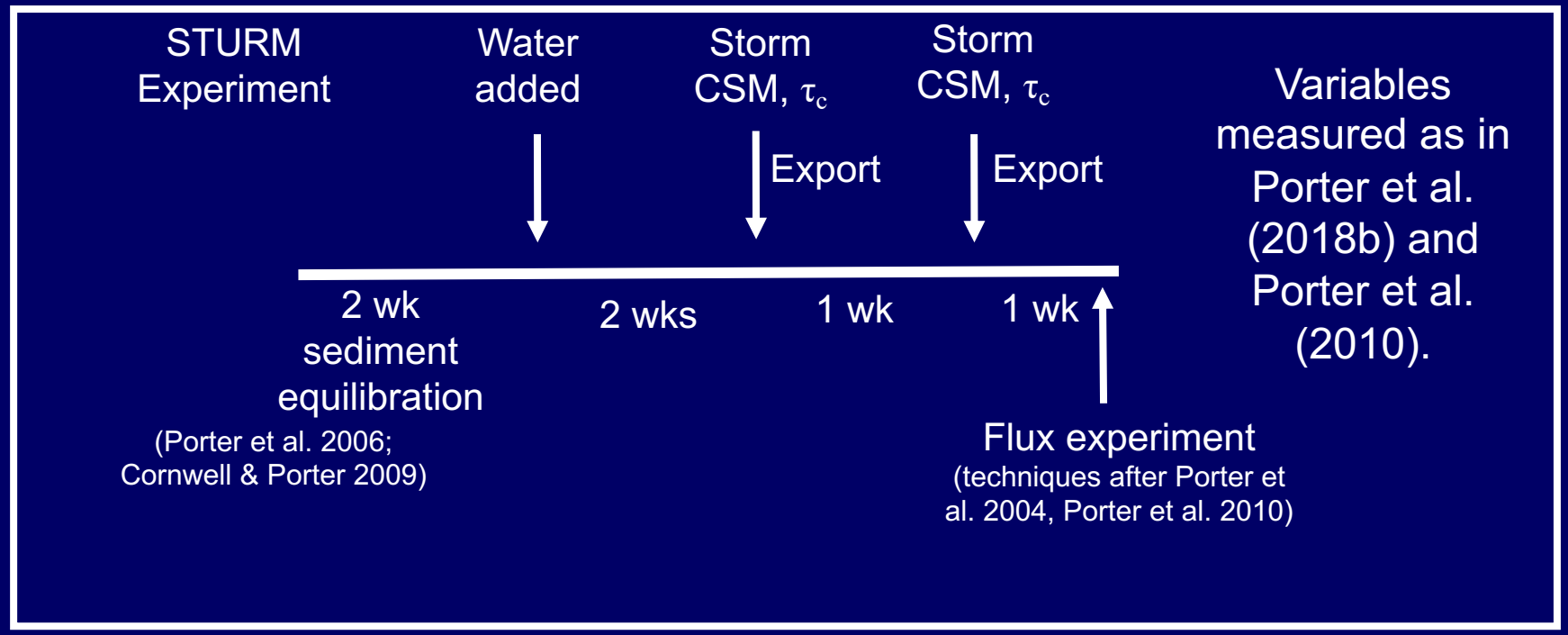
Objectives

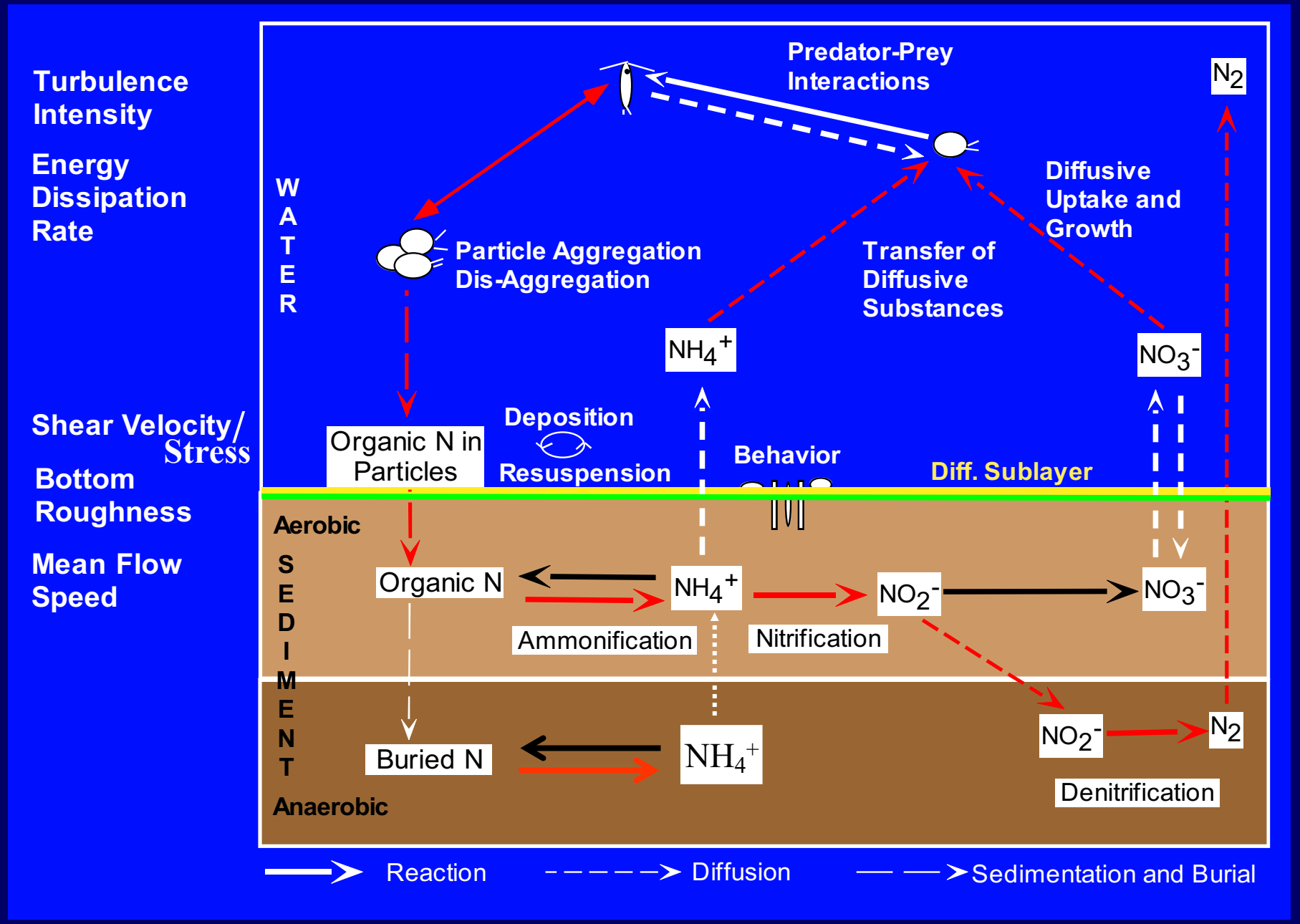
- Determine the effect of biodeposit export and storms on ecosystem processes.
- Determine the critical shear stress.
- Determine the effect of shear stress and bio deposit erosion on seston quantity and quality.
- Focus here: Mimicking storms in an ecosystem experiment. Rianna: ecosystem processes.

Research Method

- Mesocosm experiment
- Morning Measurements
- Two Storm experiments
- Storm days
- OBS Calibration


STURM Experiment
Water added
Storm CSM, τ_c
Export
Storm CSM, τ_c
Export
2 wk sediment equilibration
2 wks
1 wk
1 wk
Flux experiment
(techniques after Porter et al. 2004, Porter et al. 2010)
(Porter et al. 2006; Cornwell & Porter 2009)
Variables measured as in Porter et al. (2018b) and Porter et al. (2010).

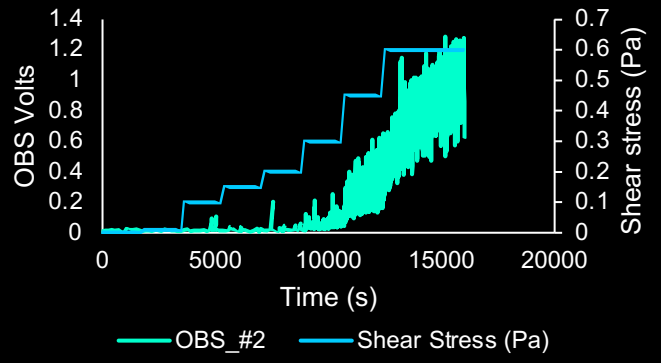
Importance of Water Flow on Benthic-Pelagic Coupling Processes:



Porter et al. 2004 a,b, Porter et al. 2010, Porter et al. 2013, Porter et al. 2018a, Porter et al. 2020, Porter et al. in press

STURM facility at PEARL / MSU

(Porter et al. 2018b)

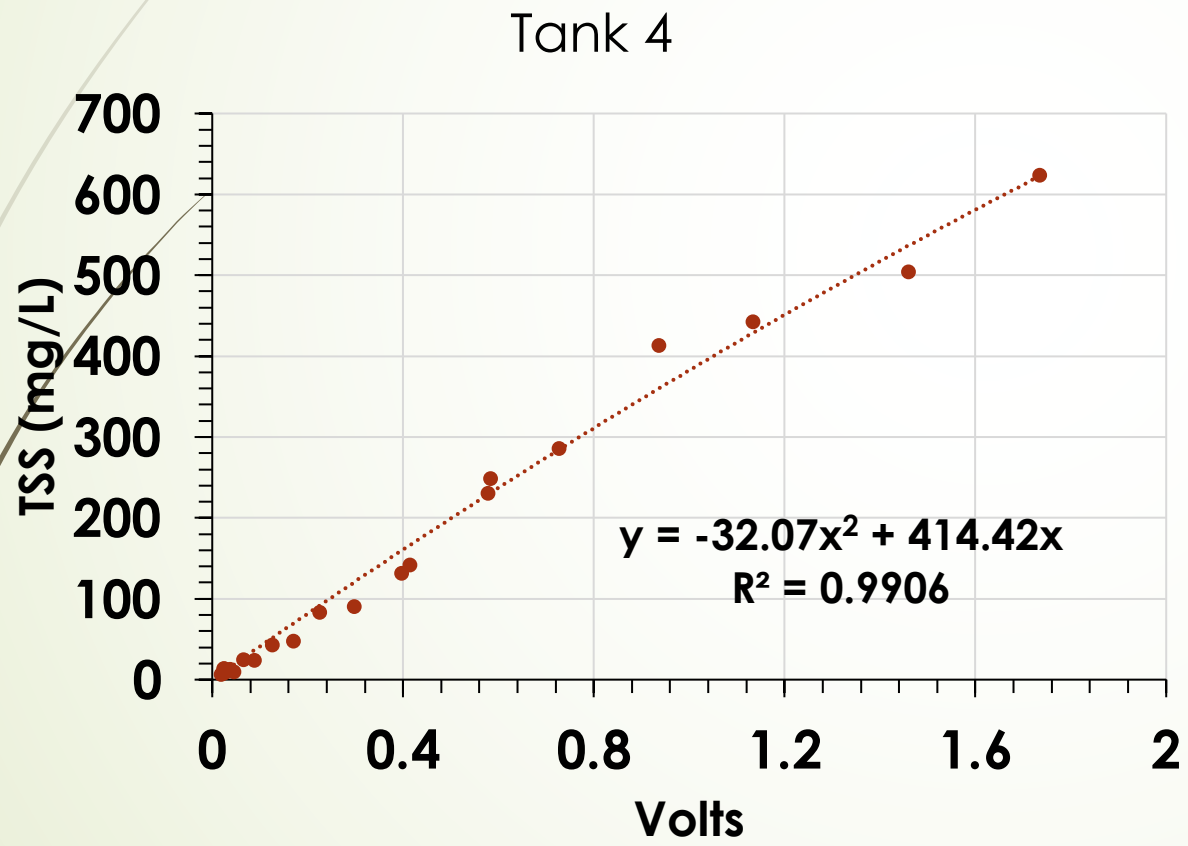


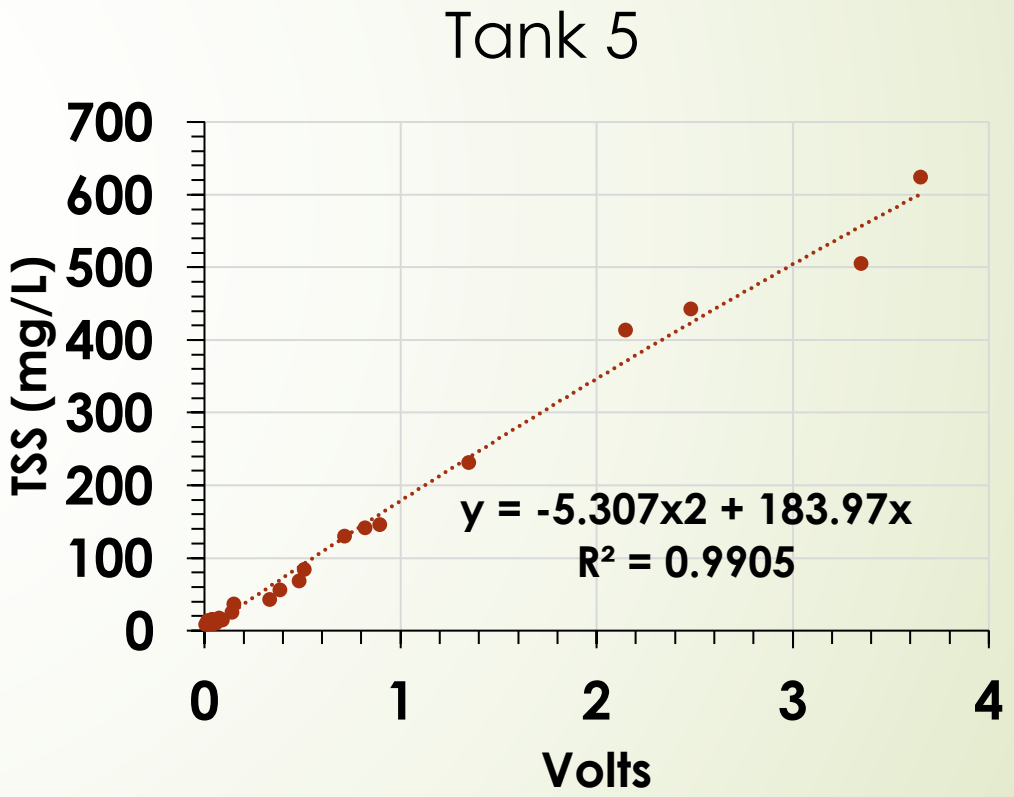
Mixing and Data Control Center for STURM

How storms affect biodeposit resuspension

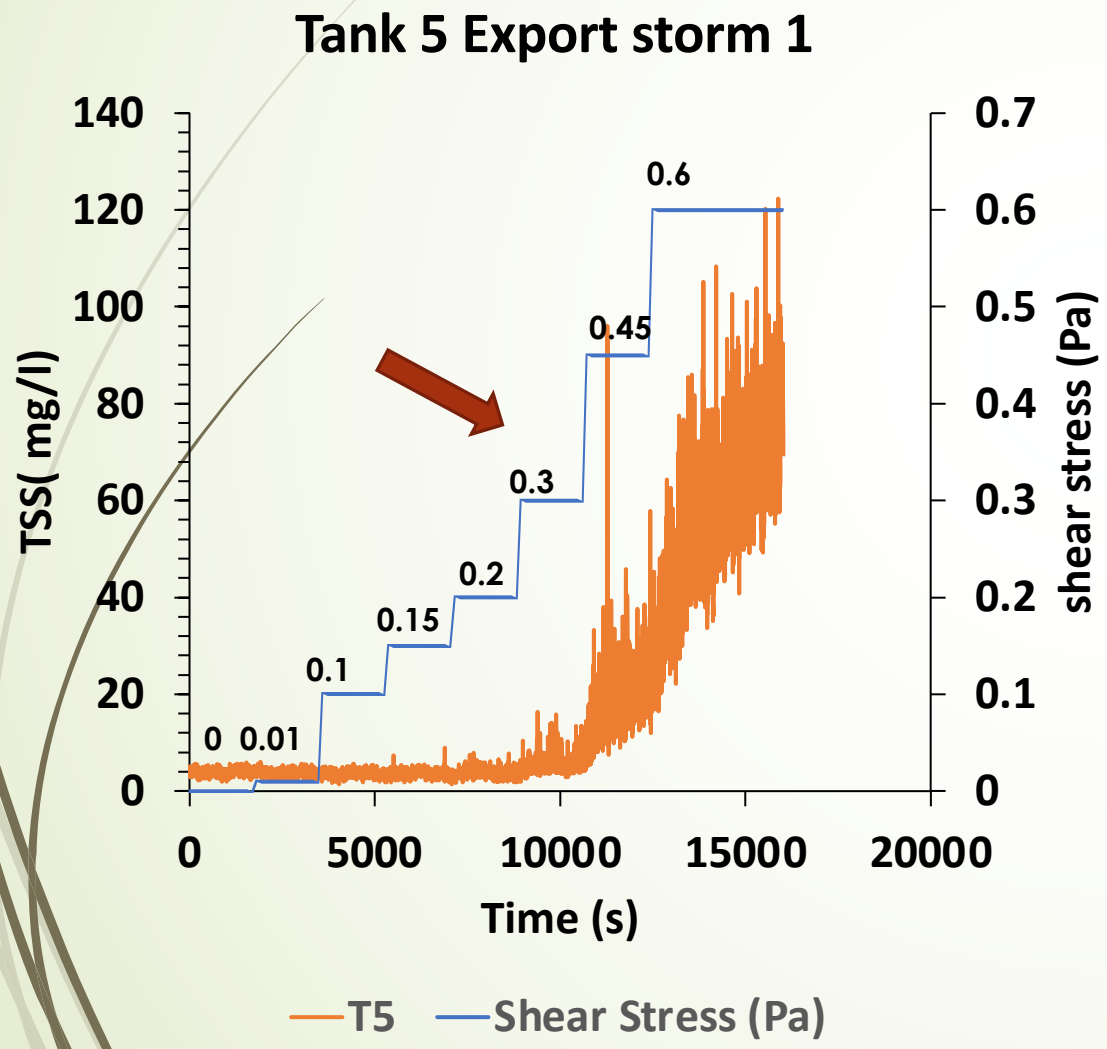
OBS Calibration

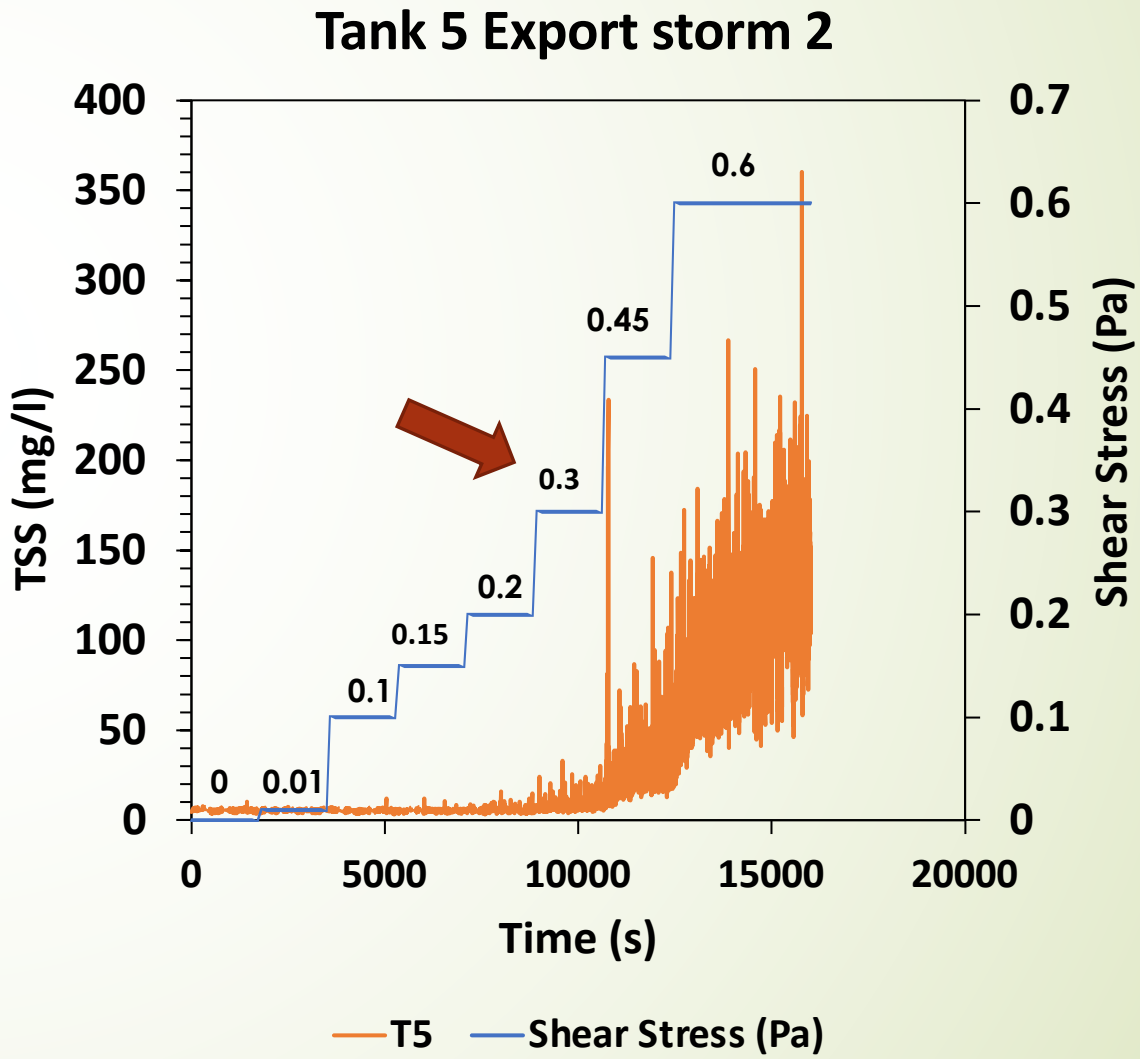
Equation:
polynomial fit



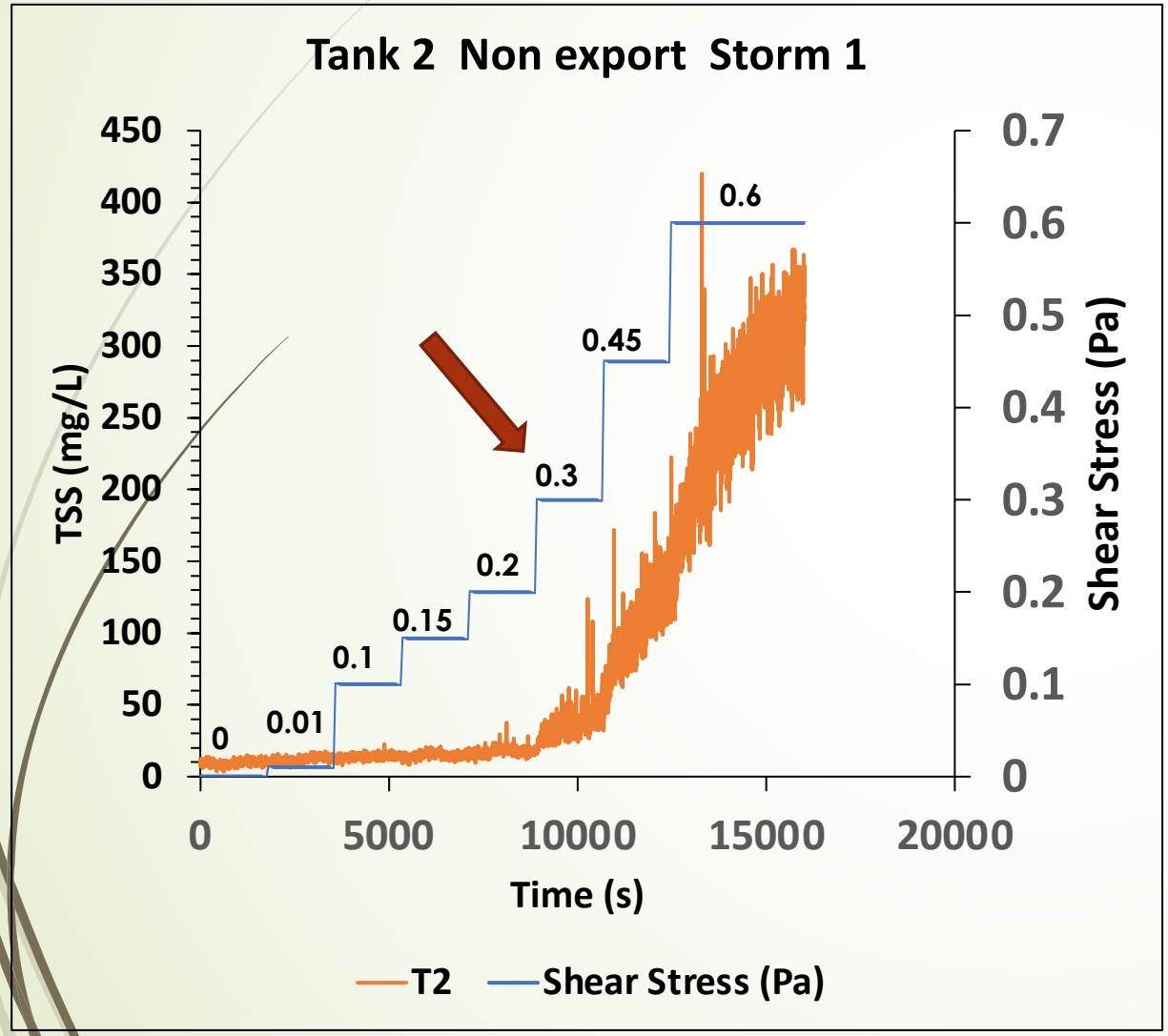


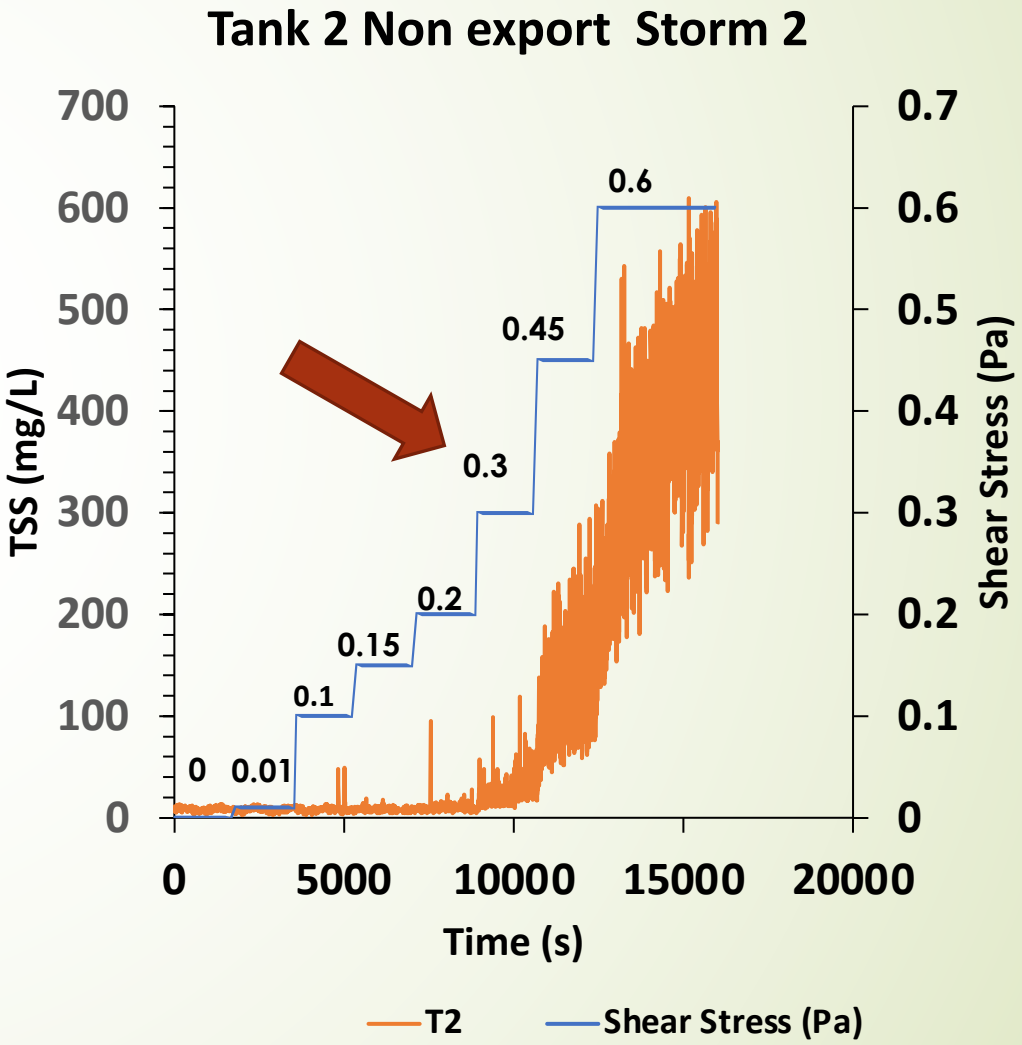
Storms


Tank 5 Export storm 1
TSS(mg/l)
shear stress (Pa)
Time (s)
0
0.01
0.1
0.15
0.2
0.3
0.45
0.6
T5
Shear Stress (Pa)

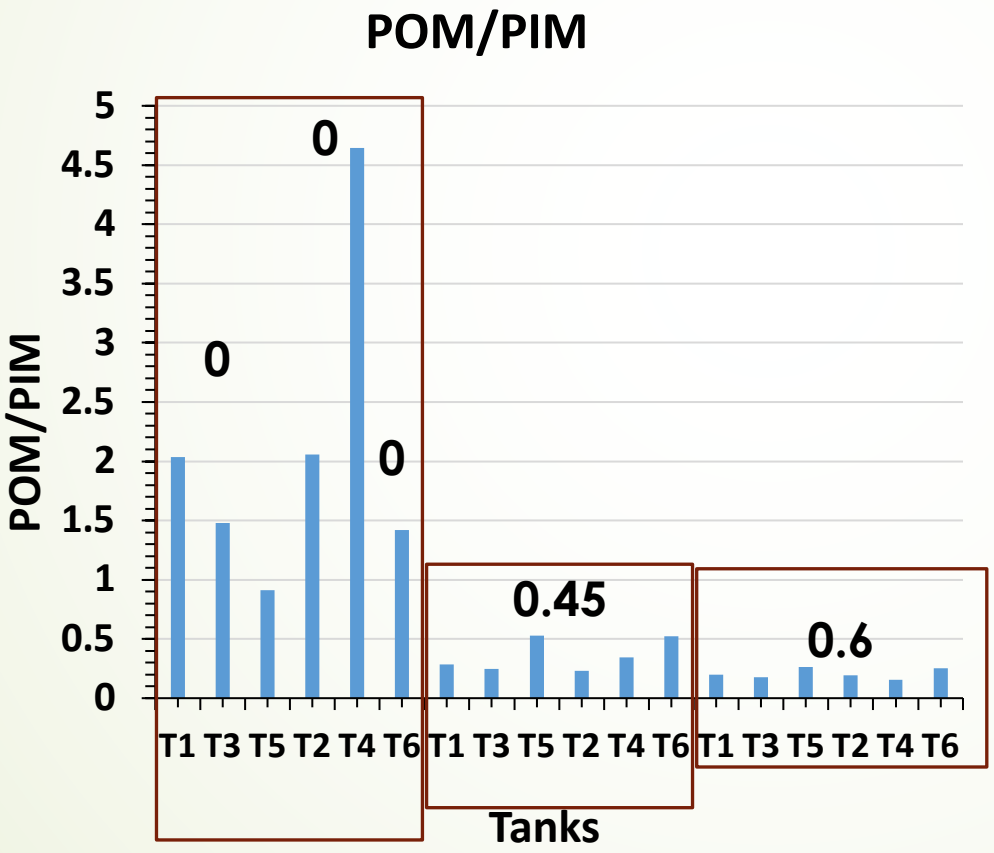

Tank 5 Export storm 2
TSS (mg/l)
Shear Stress (Pa)
Time (s)
0
0.01
0.1
0.15
0.2
0.3
0.45
0.6
T5
Shear Stress (Pa)

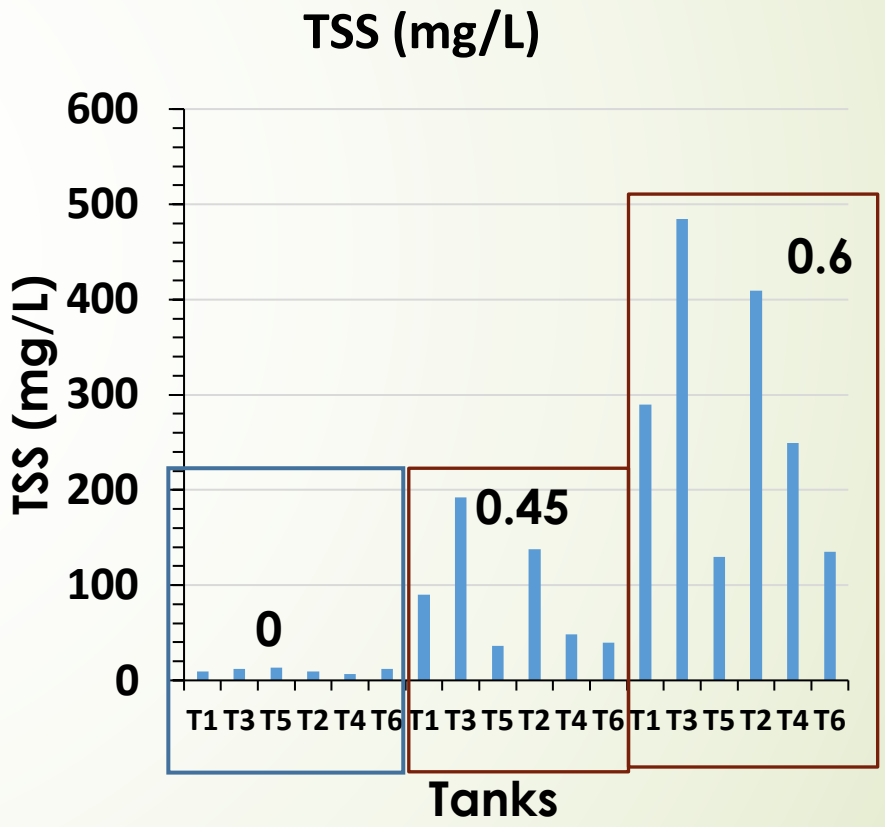
Storms


Tank 2 Non export Storm 1
TSS (mg/L)
Shear Stress (Pa)
Time (s)
0
0.01
0.1
0.15
0.2
0.3
0.45
0.6
T2
Shear Stress (Pa)

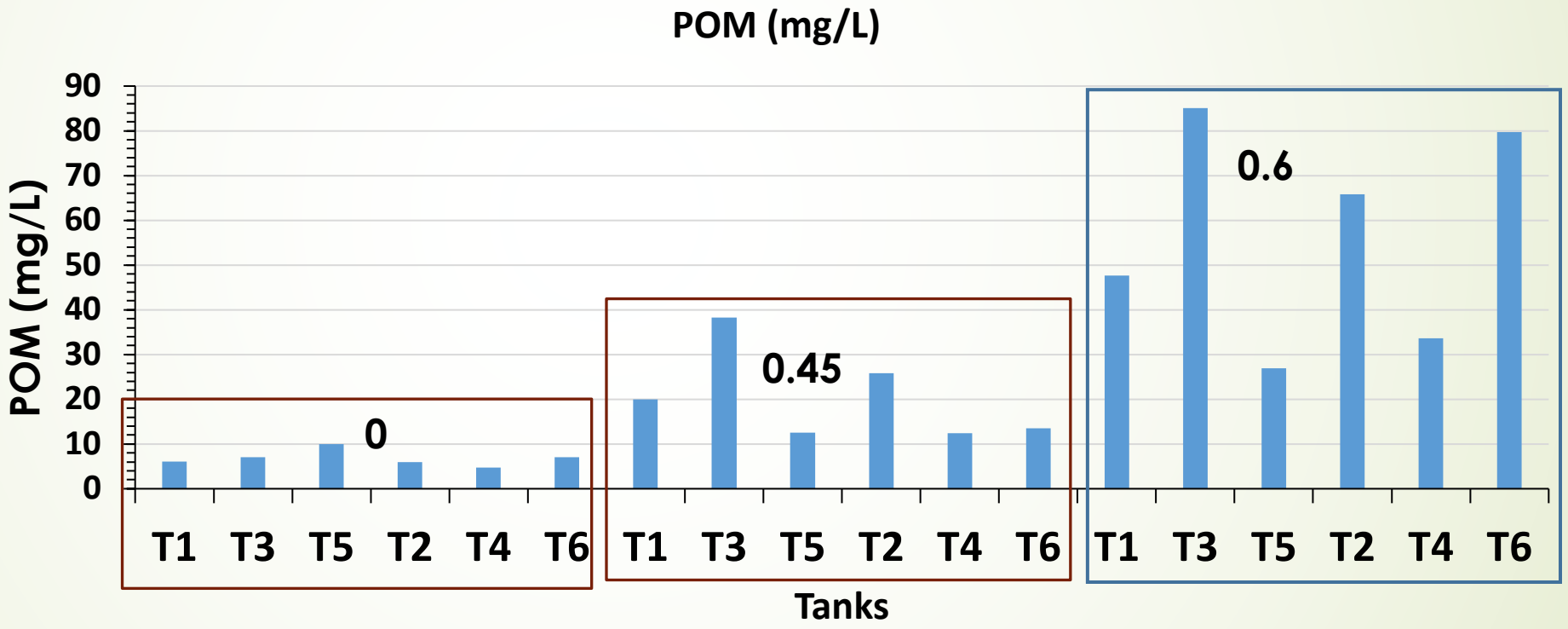

Tank 2 Non export Storm 2
TSS (mg/L)
Shear Stress (Pa)
Time (s)
0
0.01
0.1
0.15
0.2
0.3
0.45
0.6
T2
Shear Stress (Pa)

Samples taken during a storm





Particulate Organic Matter (POM)



Research Findings

- First time ever that storms were mimicked in a STURM experiment for an ecosystem experiment.
- Resuspended TSS from storms was variable between treatments for storm 1 and storm 2.
- Resuspension was higher after storm 2 (storm1 4 weeks of no resuspension, storm2 1 week of no resuspension).
- Critical shear stress in all systems was 0.3 Pa.
- Seston quality (POM/PIM) decreases with resuspension.
- POM in the water column increases with resuspension.

Conclusions

- Mimic two storms in the experiment setting.
- Length of time of no resuspension affects the amount of TSS resuspended.
- Seston quality decreases with resuspension.
- POM increases with resuspension.
- First of its kind of research.

Acknowledgments

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