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MEASURING CONTINUOUS GREENHOUSE GAS FLUXES FROM PACIFIC NORTHWEST TIDAL WETLAND SEDIMENTS FOLLOWING SALT-WATER INTRUSION

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U.S. DEPARTMENT OF
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Overview

- Background on greenhouse gases and tidal wetlands
  - Significance
- Methods and experimental design
- Results
- Preliminary conclusions

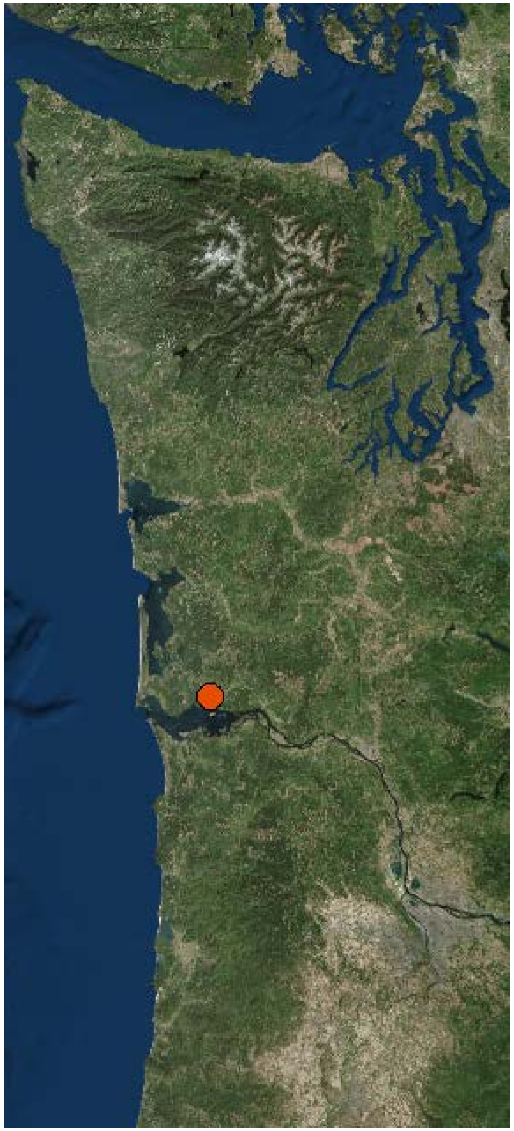
Background & Purpose

- **Project goals:** To mechanistically understand, quantify, and predict shifts in CH_4, CO_2, and N_2O fluxes from an intact wetland community in response to salt water intrusion

- Why is this important?

Methods: Site and Field Sampling

- Tidally-influenced, forested wetland near the mouth of the Columbia River, WA
- Six experimental cores and multiple surrogate cores taken at each sampling
- Sampling dates: June and Dec 2016, April 2017



Methods: Experimental Design

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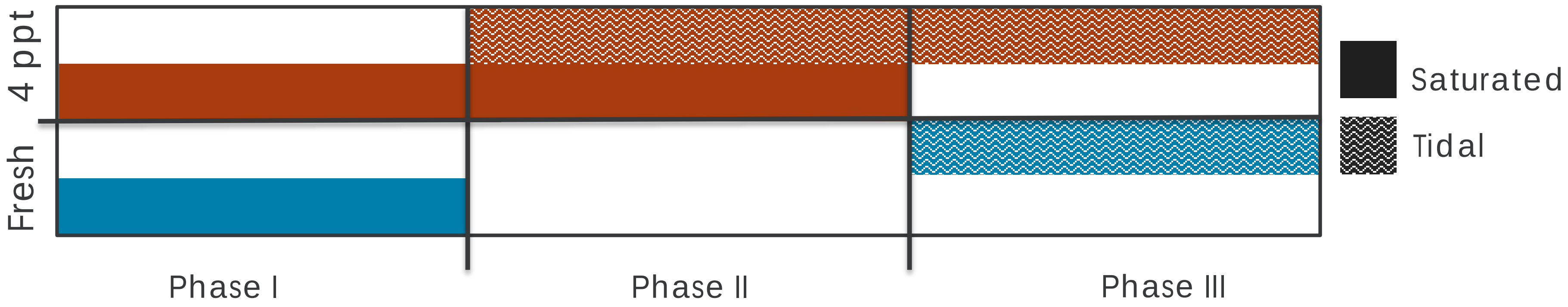
- Conducted three 4-month experiments on cores:

  Phase I: Freshwater vs. 4 ppt salinity conditions on cores under **saturated** conditions (July to October 2016)

  Phase II: Saturated vs. tidal (periodic saturation) conditions on cores at **4 ppt** salinity (January to April 2017)

  Phase III: Freshwater vs. 4 ppt salinity conditions on cores under **tidal** condition (June to September 2017)



Methods: Experimental Setup

- Pre-experimental: all reps fully saturated with treated water
- Experimental phase: Maintained for saturation (4ppt or fresh) and/or drained and saturated 2-week tidal cycle
- Experimental cores measured for CO_2, CH_4 and N_2O fluxes hourly over 4-mo experimental period using Eosense autochambers

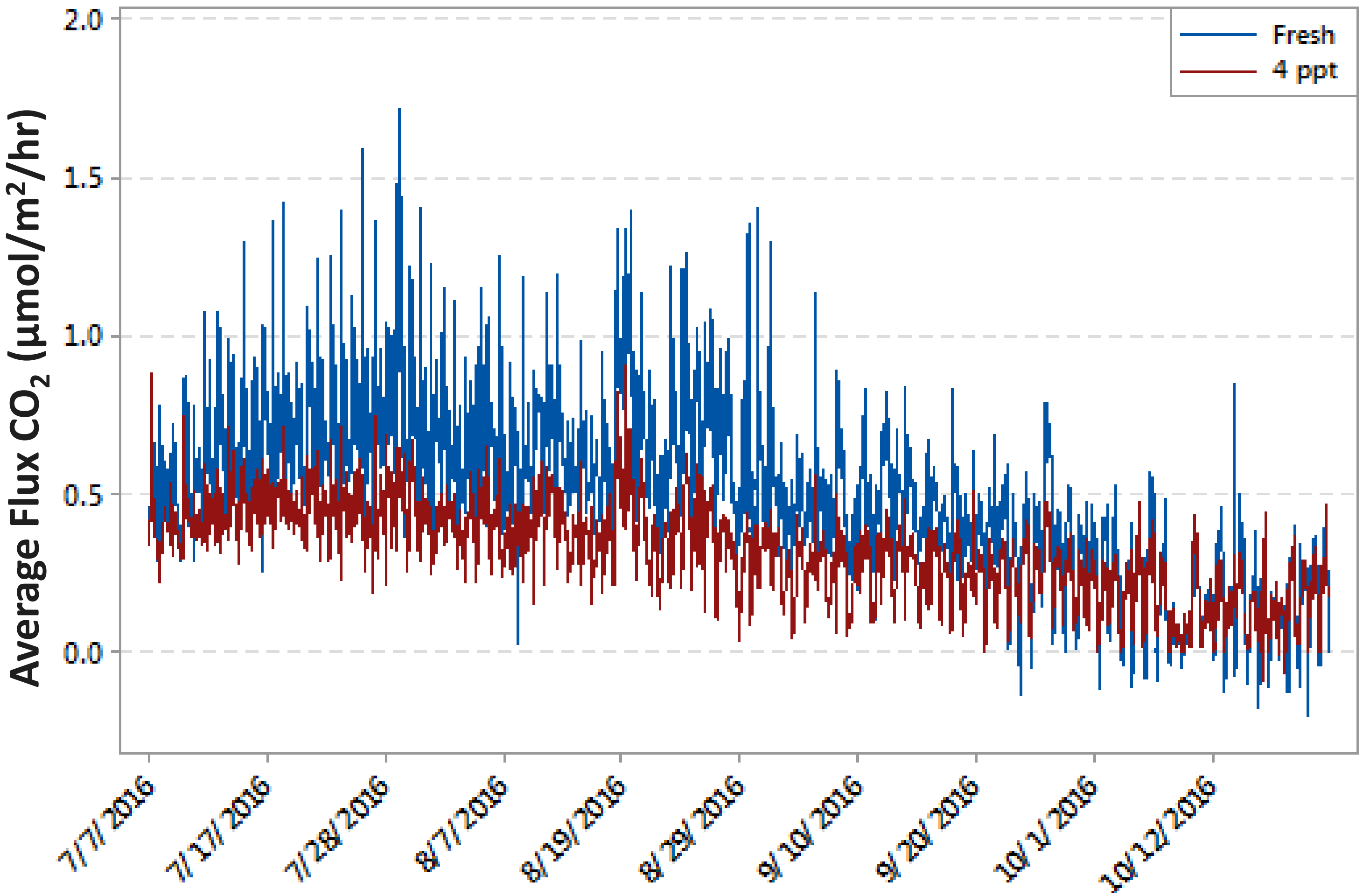
PHASE I SATURATED

PHASE II TIDAL

PHASE II Experimental setup, oligohaline treated, saturated vs. tidal

Results Phase I: CO_2

All saturated; 4ppt vs. fresh



- Result: CO_2 flux reduced over time, increasing salinity suppressed CO_2 flux

Results Phase I: CH_4

All saturated; 4ppt vs. fresh

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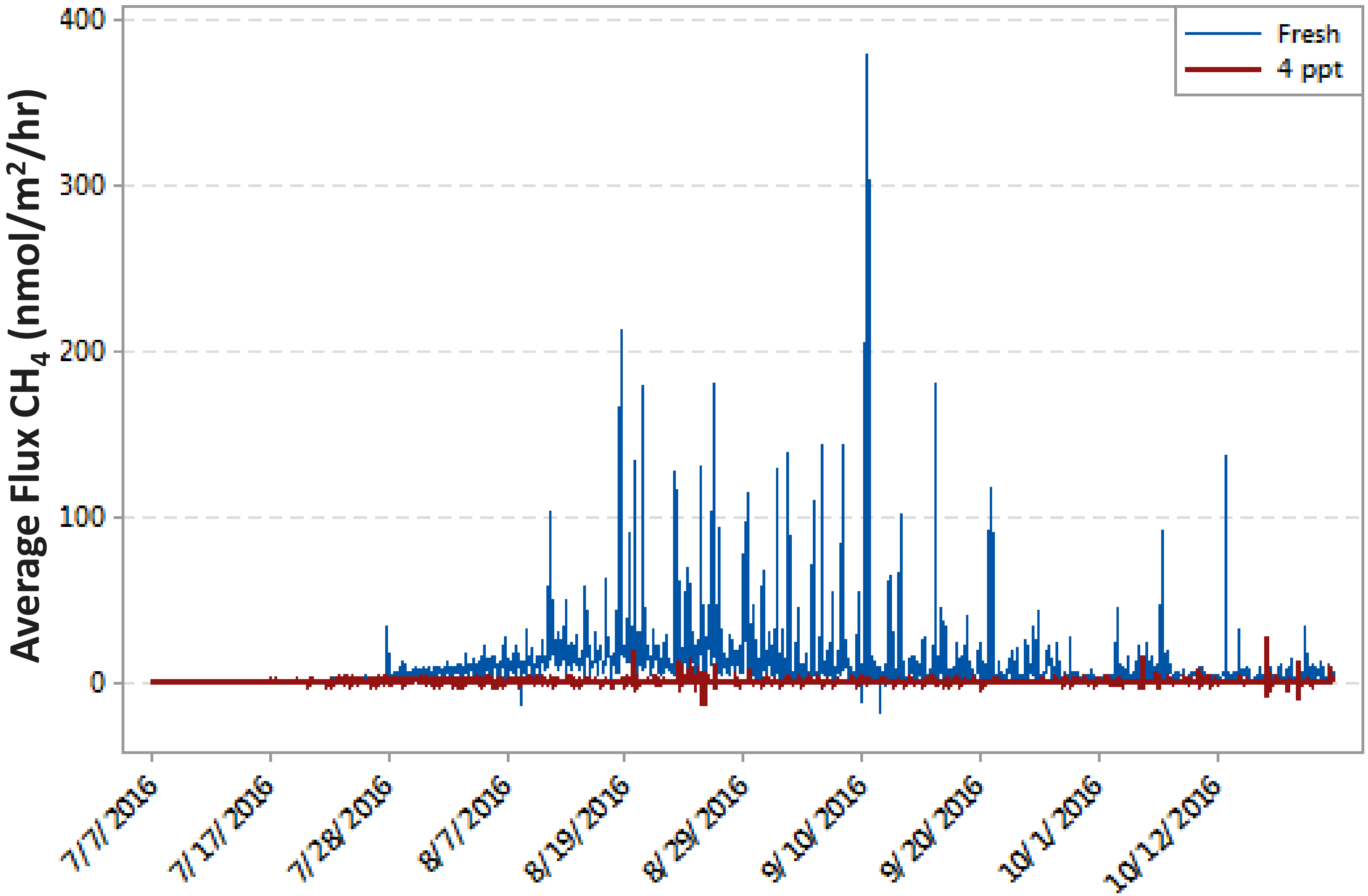

- Result: increased salinity suppressed CH_4 flux

Results Phase I: N_2O

All saturated; 4ppt vs. fresh

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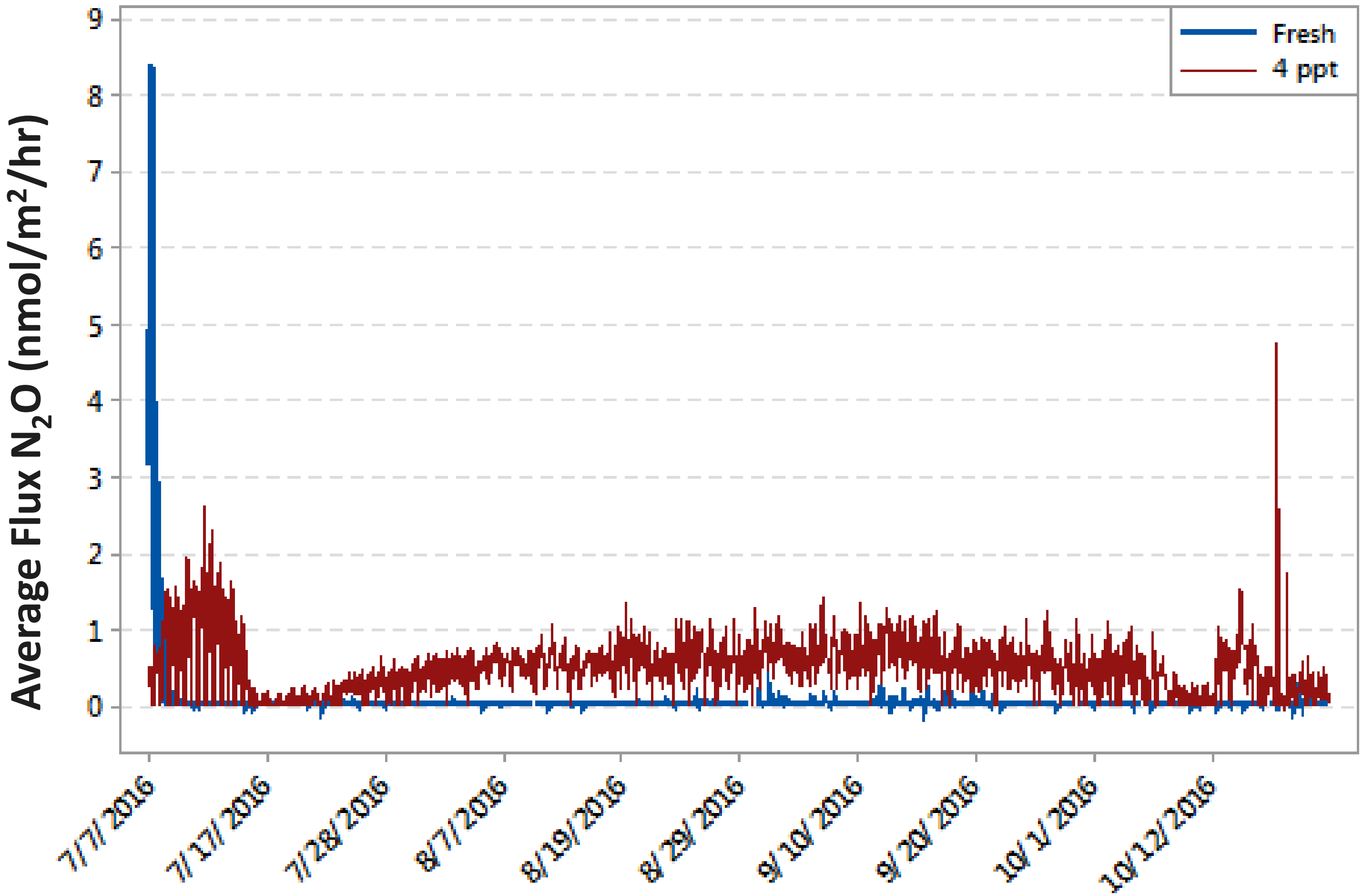
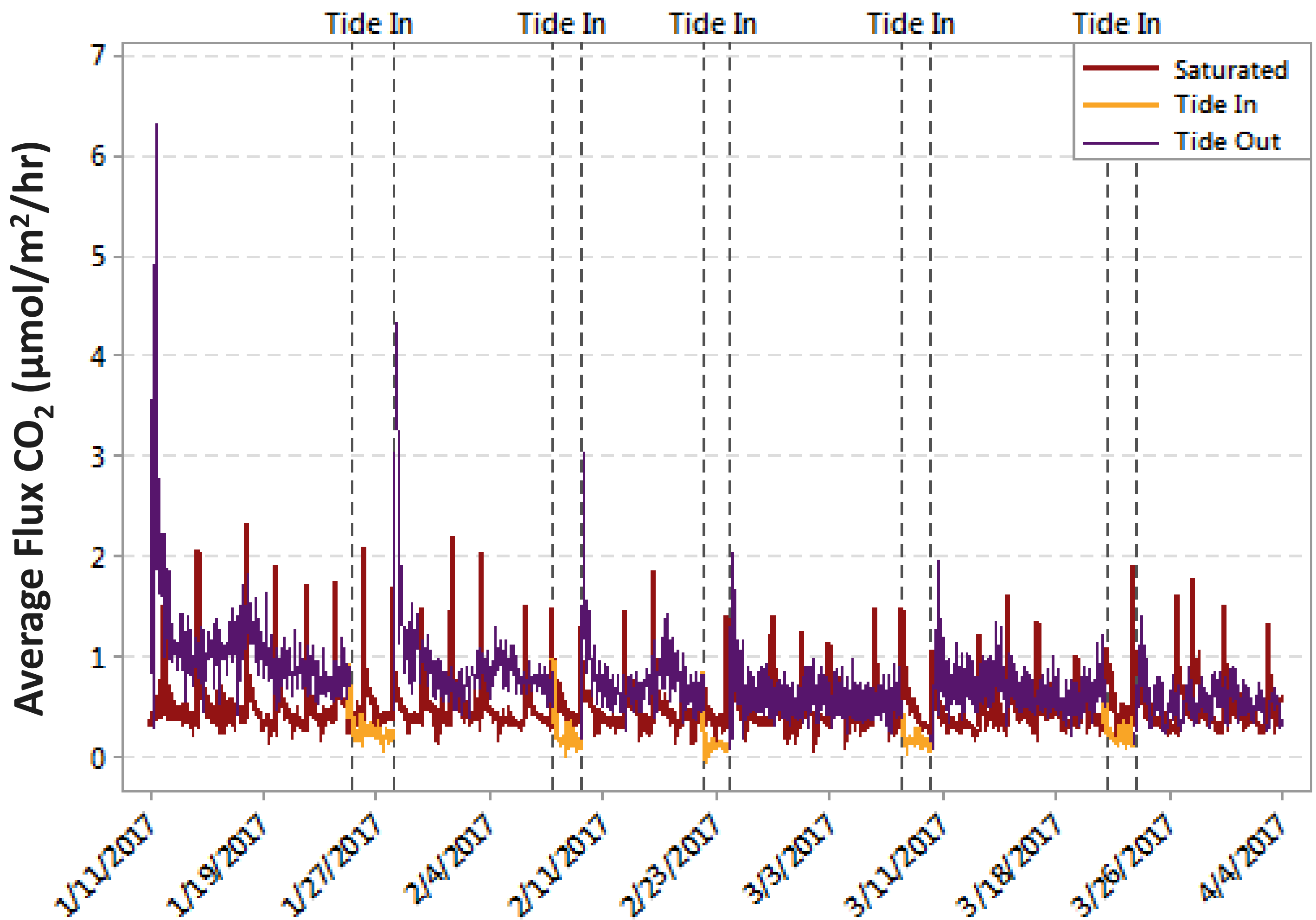


- Result: fully saturated freshwater conditions may have suppressed N_2O flux

Results Phase II: CO_2

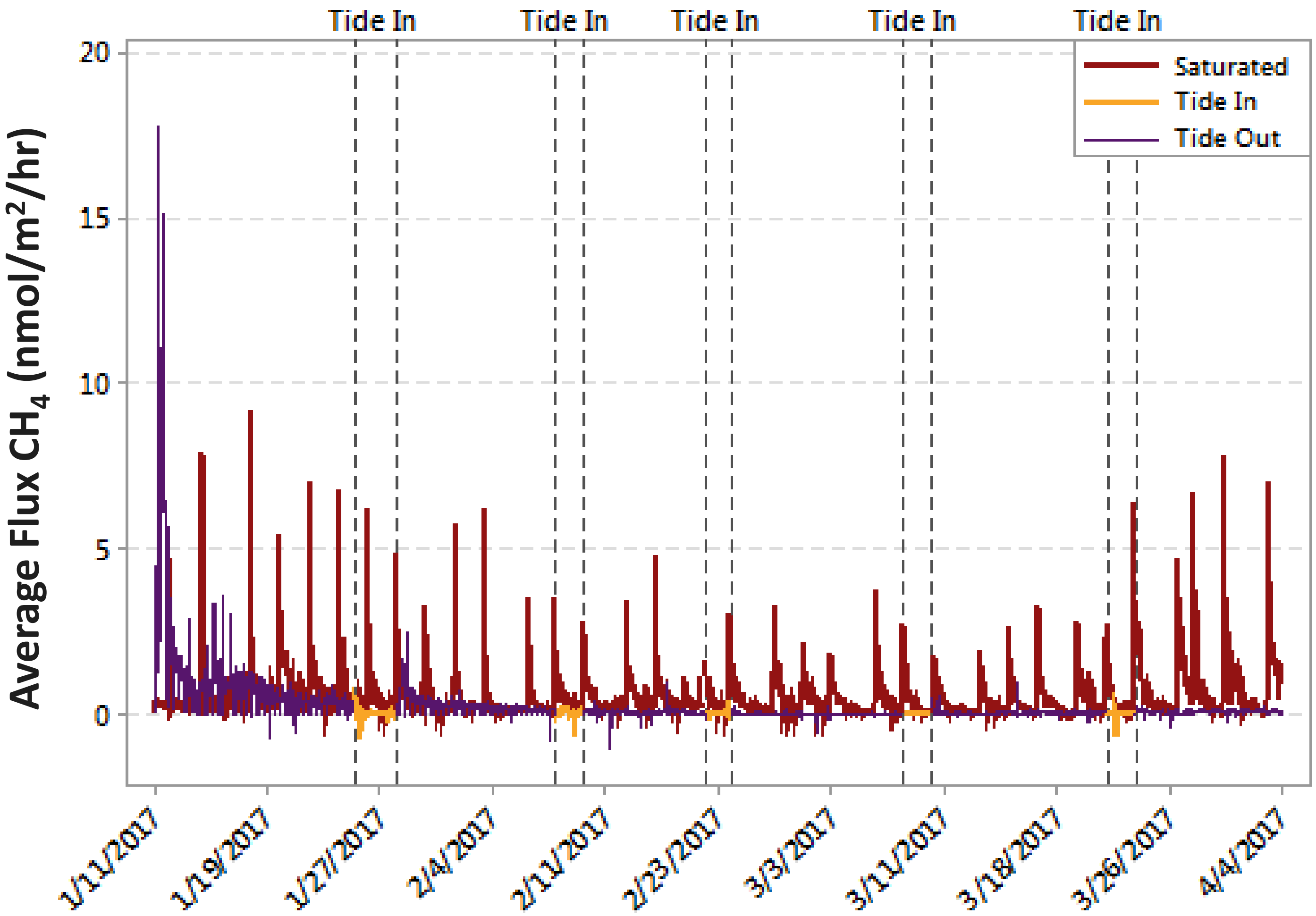
All 4ppt; saturated vs. tidal



- Result : Tidal inundation suppressed CO_2 flux

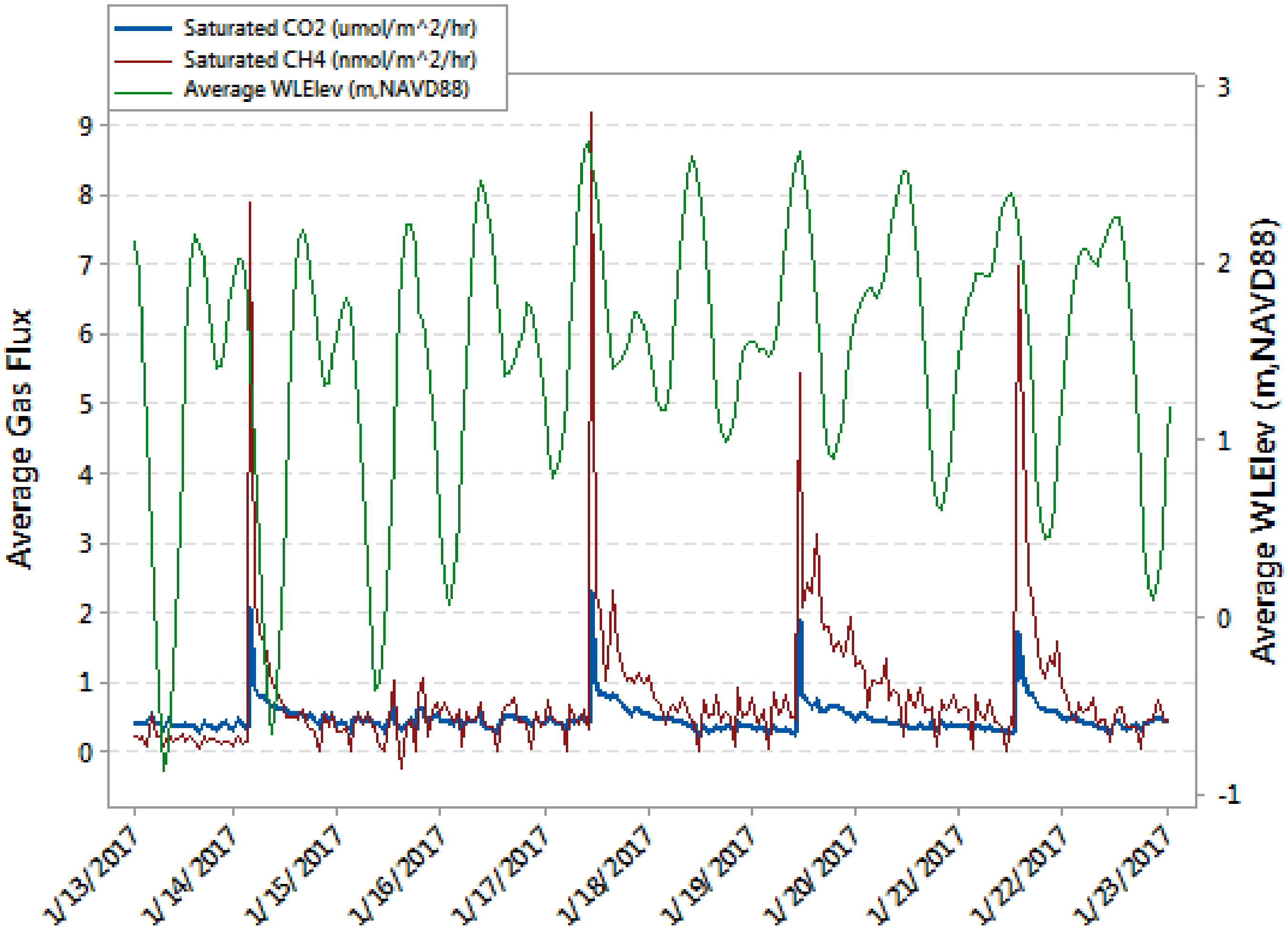
Results Phase II: CH_4

All 4ppt; saturated vs. tidal



- Result: Tidal inundation suppressed CH_4 flux

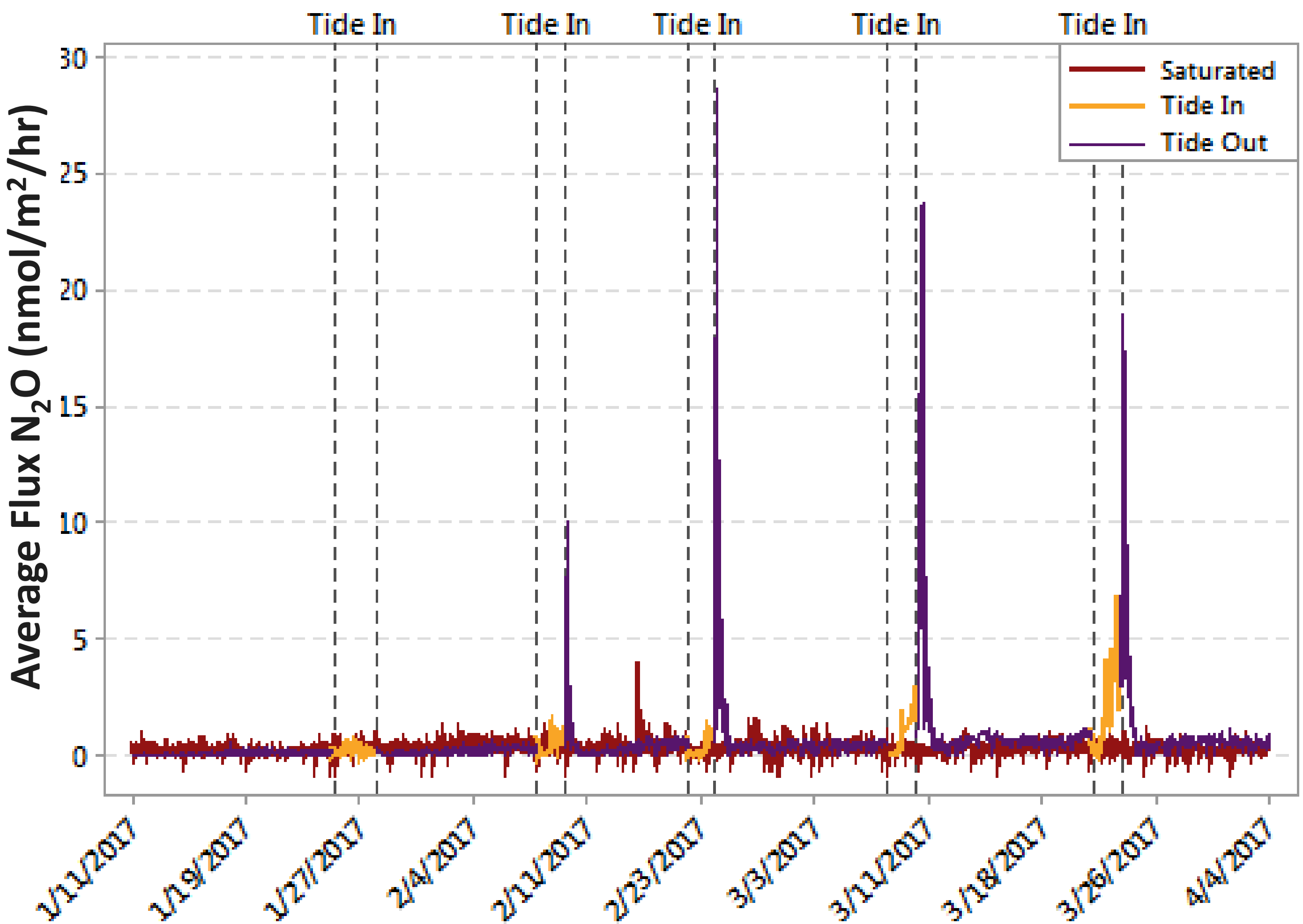
Phase II CO_2 and CH_4 Fluxes and the Tidal Cycle



- Are pressure changes caused by tidal shifts causing CO_2 and CH_4 to flux?

Results Phase II: N_2O

All 4ppt; saturated vs. tidal



- Result: Outgoing tide increased N_2O flux

Results Phase III: CO_2

All tidal: 4ppt vs. fresh

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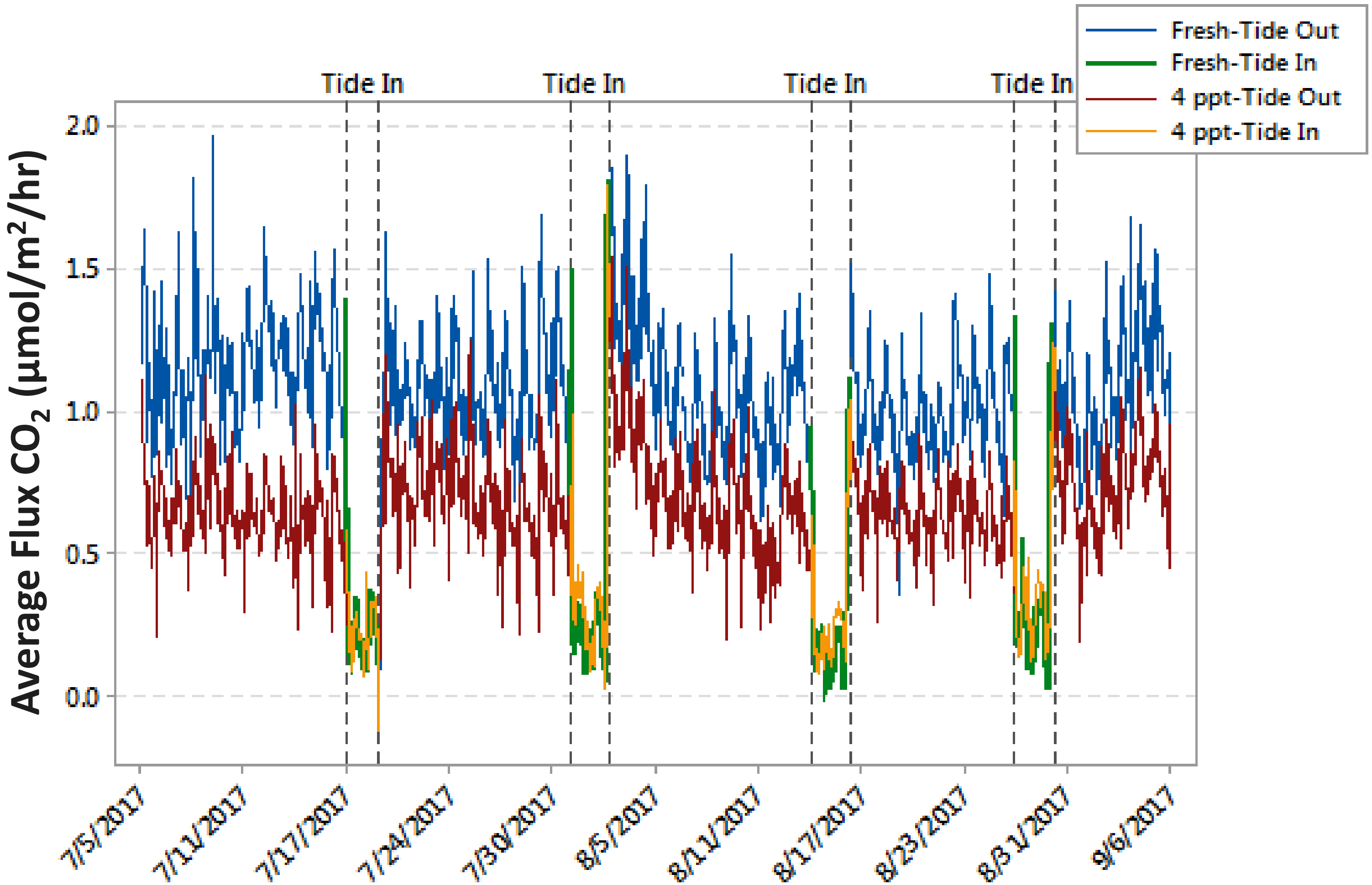
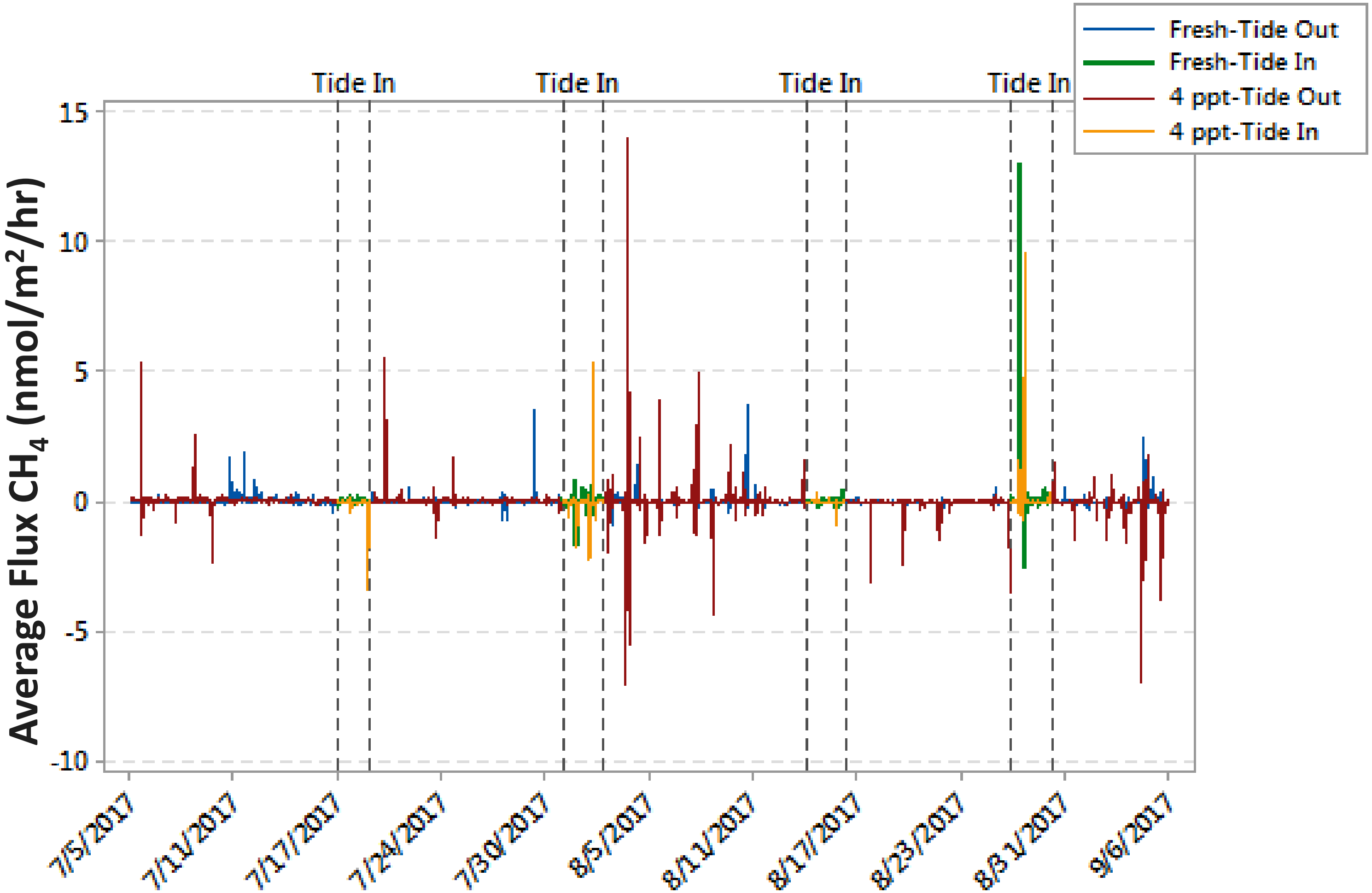


- Result: tidal inundation suppressed CO_2 flux; salinity suppressed CO_2 flux when tide was out

Results Phase III: CH_4

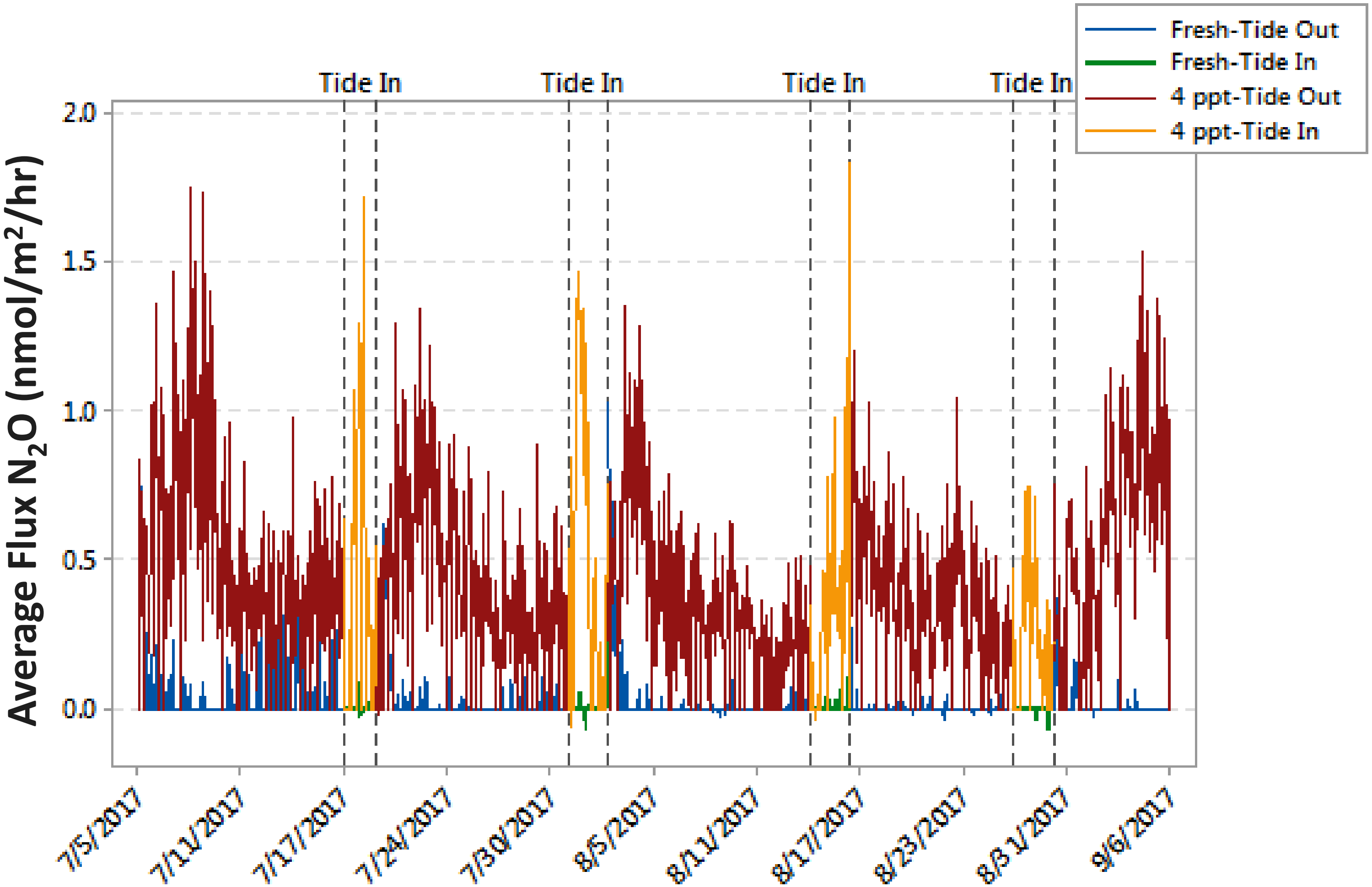
All tidal: 4ppt vs. fresh



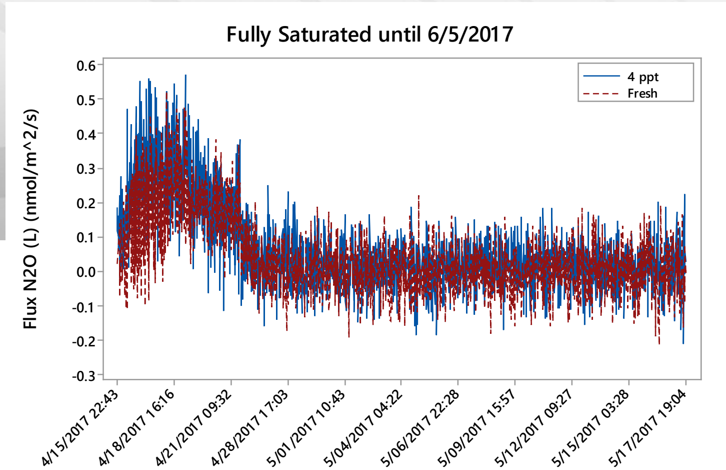
- Result: Both treatment CH_4 fluxes reduced over time, generally tidal inundation reduced CH_4 flux

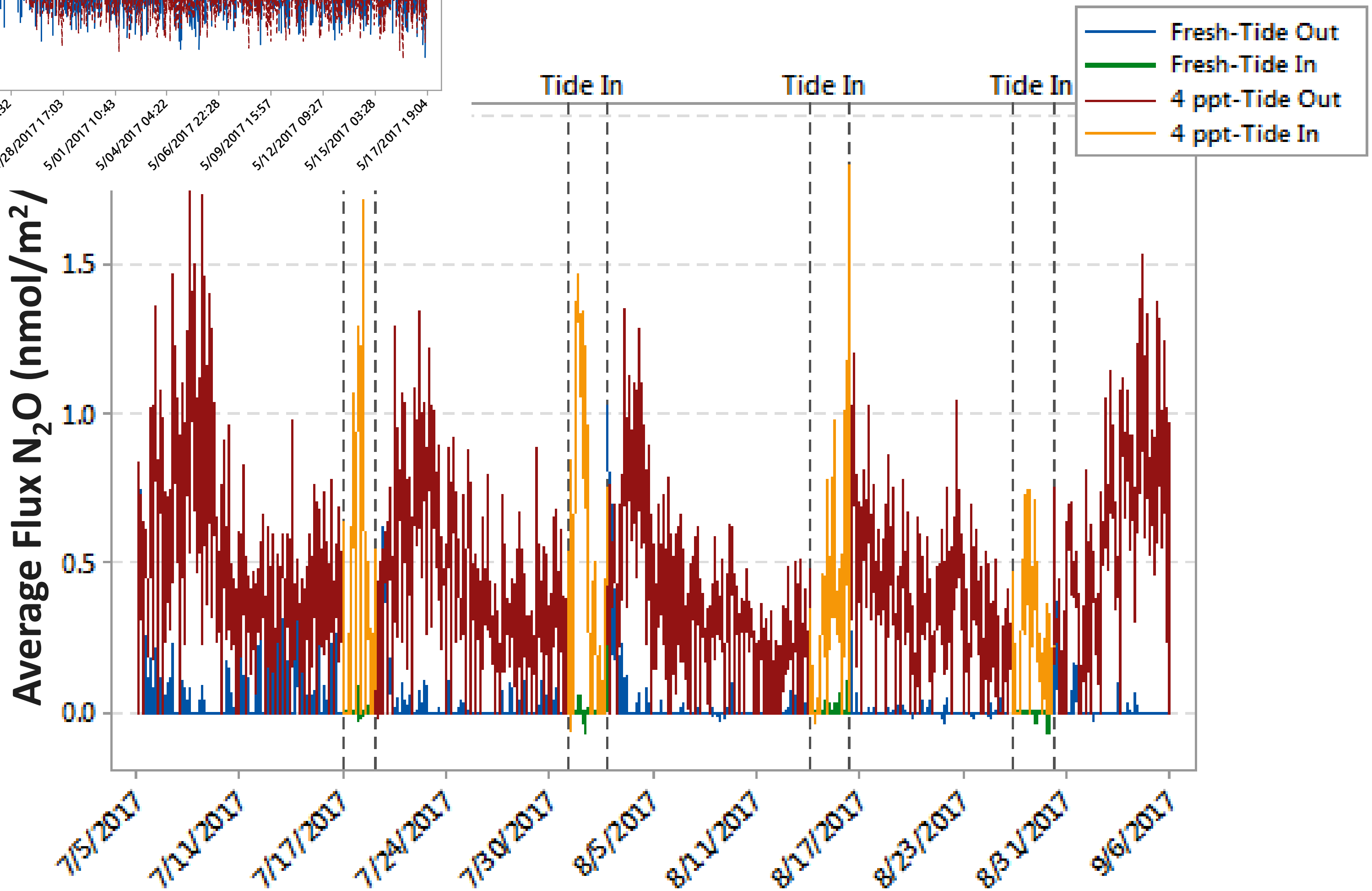
Results Phase III: N_2O

All tidal: 4ppt vs. fresh



- Result: Salinity treatments resulted in higher N_2O flux than freshwater; N_2O flux increased during tidal shifts in 4 ppt reps





- Result: N_2O flux began to increase in 4 ppt reps after tidal cycle began

Conclusions & Implications

In tidal, freshwater wetland sediments:

- Increased salinity may suppress CH_4 and CO_2 fluxes, and increase N_2O flux
- Tidal inundation and total saturation may suppress CH_4 and CO_2 flux, and increase N_2O flux
- N_2O fluxes spike as the water level from tides shifts

- These high frequency, real-time data allow us to further explore temporal trends and relate these data to high-frequency environmental datasets

Acknowledgements

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