What drives variability in nitrate concentration off the Oregon Coast?

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Background

- Nitrate is a key nutrient for phytoplankton productivity
- In general, phytoplankton uptake nutrients in a specific ratio called the Redfield ratio (C:N:P = 106:16:1)
- Wind driven coastal upwelling brings up cold, nutrient rich water to the surface
- The Columbia River brings fresh water into the offshore environment

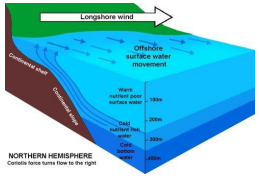
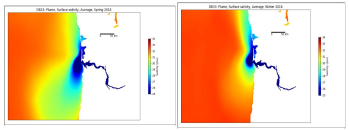
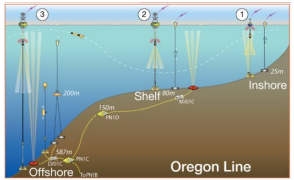


Diagram of the process of coastal upwelling in the Northern Hemisphere (seos-project.eu)



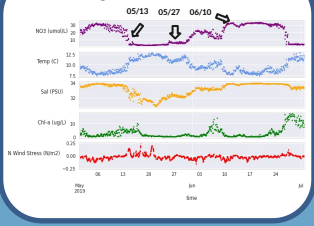
Left: Summer Columbia River plume model 2018
Right: Winter plume 2018 (CMOP)

Site Map

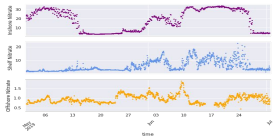


Results

Oregon Inshore Station

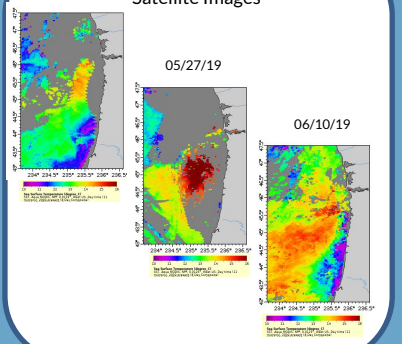


Nitrate Between Sites

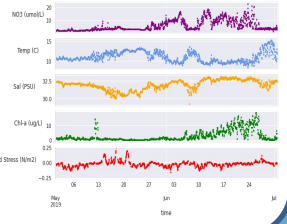


This figure shows nitrate from all three stations. Note the different scales on the y-axis to show relative trends.

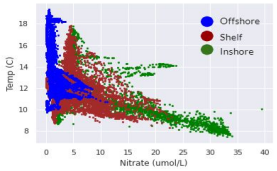
Sea Surface Temperature Satellite Images



Shelf Station

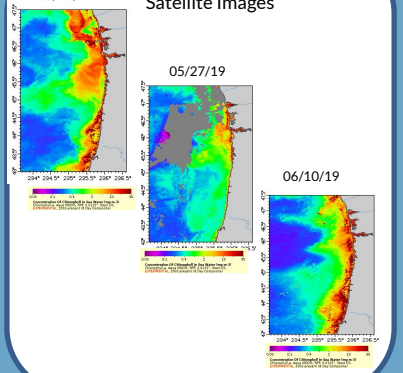


Nitrate and Temp between sites

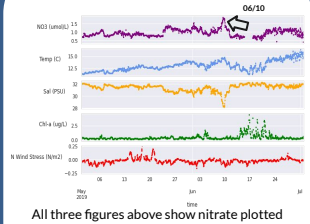


Correlation between temperature and nitrate between all three sites. Temp on y-axis, nitrate on x-axis

Chlorophyll Satellite Images

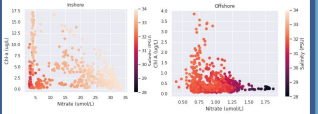


Offshore Station



All three figures above show nitrate plotted with various physical and biological factors between the three sites. Arrows show satellite image events

Different trends onshore vs offshore



Left plot is inshore, right plot is offshore. Chl-a is on y-axis, nitrate on x-axis, and salinity is represented by the color bar. Salinity is on the same scale, but chl-a and nitrate are on different scales.

Methods

- Data was taken from the Ocean Observing Initiative Endurance Array off the coast of Oregon
- The SUNA nitrate sensor, fluorometer, and the Bulk Meteorology Instrument Package were used
- The data was hourly averaged and quality controlled
- Wind stress was added to my analysis using wind velocity and momentum flux data
- Satellite data from NOAA CoastWatch was added to better see events.

Discussion

- **Inshore:** Nitrate was much higher at this station. Time series shows strong trends consistent with coastal upwelling. The satellite images also show the same time periods of cold water along the coast.
- **Shelf:** Some similar trends as the inshore, but lacking the first large increase. There is probably a mix of factors at play at this site
- **Offshore:** Relatively limited nitrate. Largest nitrate spike occurs with a negative spike in salinity, a signature of freshwater likely from the Columbia River.
- There are different trends between inshore and offshore.
- In the future, it would be interesting to add in different seasons to the analysis.

Acknowledgements

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