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Technology Developments:
UV Biofouling Control for DO Sensors and Glider Optode Air Calibration

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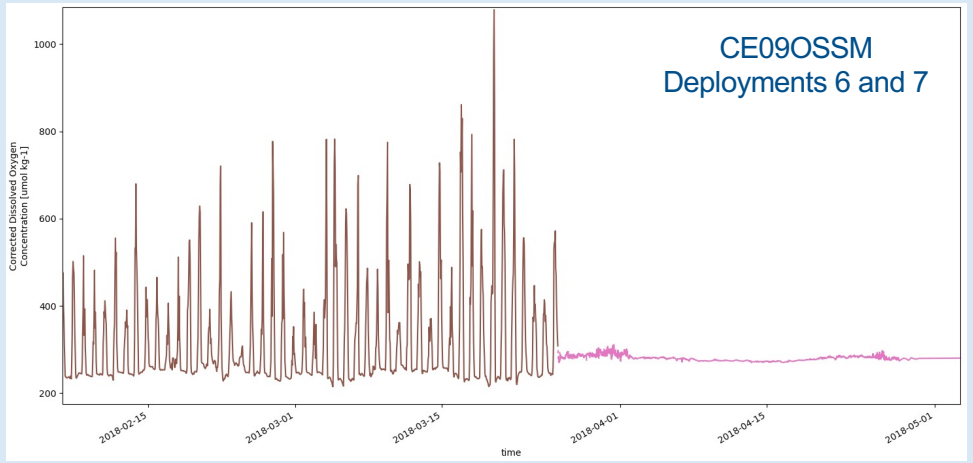
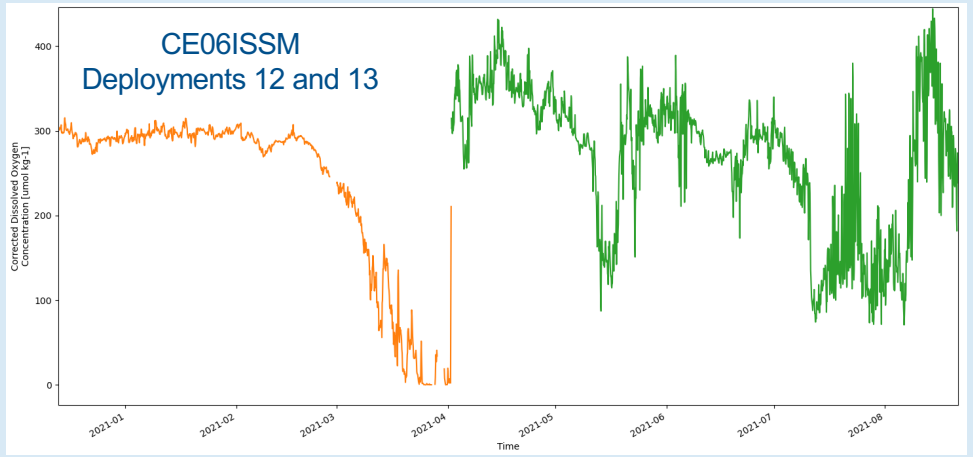
NSF

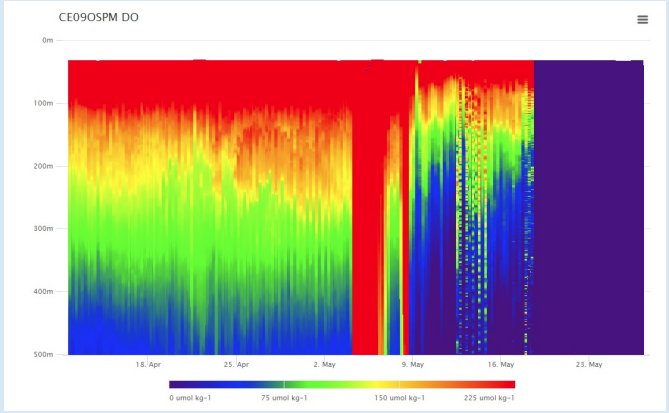
Biofouling Impacts on DO Sensors

- Biofilm
  - Daytime increases in O_2 due to photosynthesis, with nighttime decreases due to respiration
- Encrusting
  - Barnacles or other encrusting organisms (e.g., bryozoans) cover the sensor face leading to anoxic measurements (potentially damaging the foil)
- Obstruction
  - Pumped DO sensors. Blocking flow, fouling or damaging the membrane
- Primarily limited to near surface (photic zone) sensors*
- Encrusting biofouling dominates in the near-shore environment, with biofilms dominating offshore. Mid-shelf patterns are less predictable*

*Qualitative assessments based on field experience







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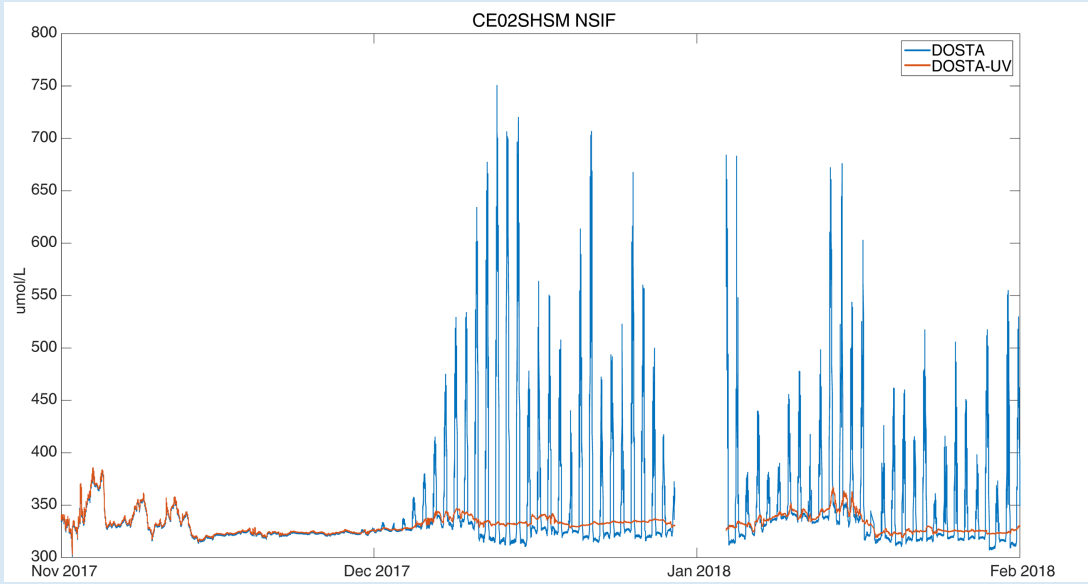
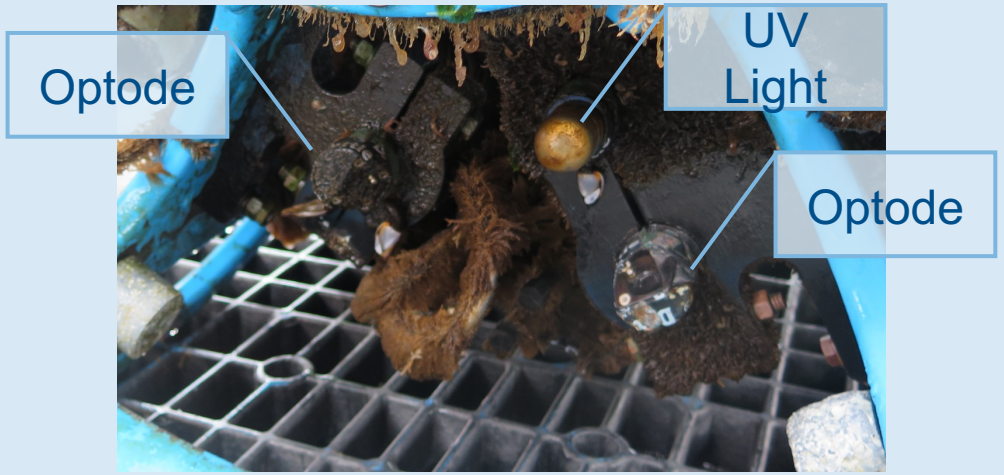
UV Biofouling Control

- Aanderaa Data Instruments AS, manufacturer of the Optode 4831 DO sensor used by OOI, recommended use of a UV biofouling control system to protect the instruments
- AML Oceanographic Cabled UV Biofouling Control
- Tested in side-by-side comparison with an unprotected Optode over the course of Deployment 6 (2017-10-10 to 2018-04-04) of the Oregon Shelf Surface Mooring (CE02SHSM)
- Deployed on all OOI surface moorings (photic zone sensors only) beginning in the Spring of 2018
- Proven effective (some lamp failures), extended use to include additional sensors: downwelling spectral irradiance (SPKIR) and the lens of the digital still camera (CAMDS)





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Glider Optode Air Calibration

- From Nicholson and Feen (2017) and references therein:

  "Over recent years, oxygen optodes have come to predominate in oceanographic applications displacing polarographic Clark electrode type sensors. These sensors are robust and reliable, yet they are not perfect and are still subject to issues including drift after factory calibration which can vary from undetectable rates to several percent per year."

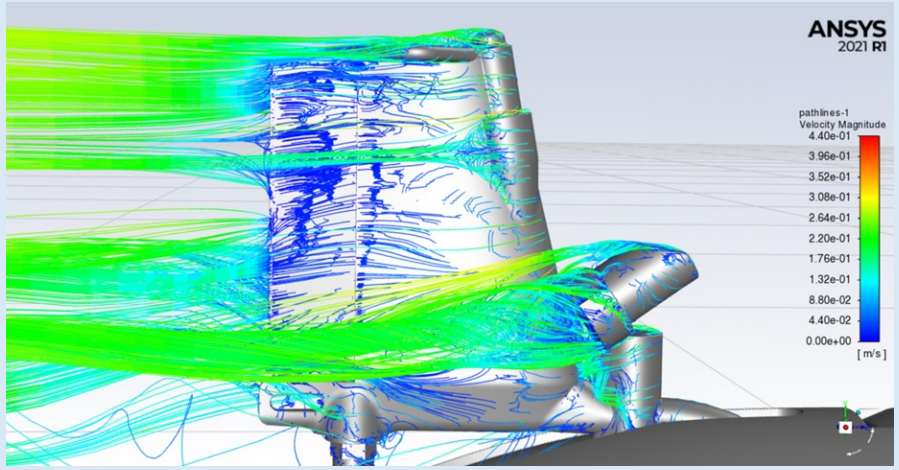
- "air calibration" method has been developed (Argo Float Program, Bittig and Körtzinger (2017)) to help address issues with optode accuracy and drift

- Nicholson, D.P. and M.L. Feen. 2017. Air calibration of an oxygen optode on an underwater glider. Limnol. Oceanogr.: Methods **15**: 495–502. doi: 10.1002/lom3.10177

- Bittig, H. C., and A. Körtzinger. 2015. Tackling oxygen optode drift: Near-surface and in-air oxygen optode measurements on a float provide an accurate in situ reference. J. Atmos. Ocean. Technol. **32**: 1536–1543. doi:10.1175/JTECH-D-14-00162.1

Glider Optode Air Calibration

- Nicholson and Palevsky submitted a CO NSF proposal in 2017 to modify two OOI Global Irminger Sea gliders to make surface air measurements (data used to correct O_2 measurements on the gliders and 12, co-located subsurface sensors)
- Based on their results, an OOI Change Request was submitted in April 2020 to modify all OOI gliders to make these measurements (approved by OOI and NSF, June 2020)
- Initial deployments worked well, but a recent switch in the glider fin design (DigiFIN to Radome) has impacted performance (pronounced wake effect impacting navigation)
- CFD analysis of alternative mounts has revealed two possible solutions, currently scheduled to be tested this summer (in continued collaboration with Nicholson and Palevsky)



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Questions?

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