Novel Optical Oxygen Sensor for Profiling Observation Platforms: Fast Response Time Enables Higher Spatial and Temporal Data Resolution

Tobias Hahn[1]*, Steffen Aßmann[2], and Arne Körtzinger[1,3]

*thahn@geomar.de

[1] GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany
[2] Kongsberg Maritime Contros GmbH, Kiel, Germany
[3] Christian-Albrechts-Universität zu Kiel, Germany

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SFB 754 | Ocean Deoxygenation: Drivers and Consequences · Past · Present · Future ·

Topic 1: Prediction and Monitoring

Problem

Data show a decline in the global oceanic O_2 content of more than 2% since 1960 (Schmidtko et al., 2017).

Quantifying global and regional changes of the O_2 distribution improves the understanding of chemical, biological and physical processes in the global ocean, especially in Oxygen Minimum Zones (OMZ).

The faster response time of the novel optical oxygen sensor (optode) HydroFlash™ O2 compared to other optodes is promising to observe various processes with higher spatial and temporal data resolution.

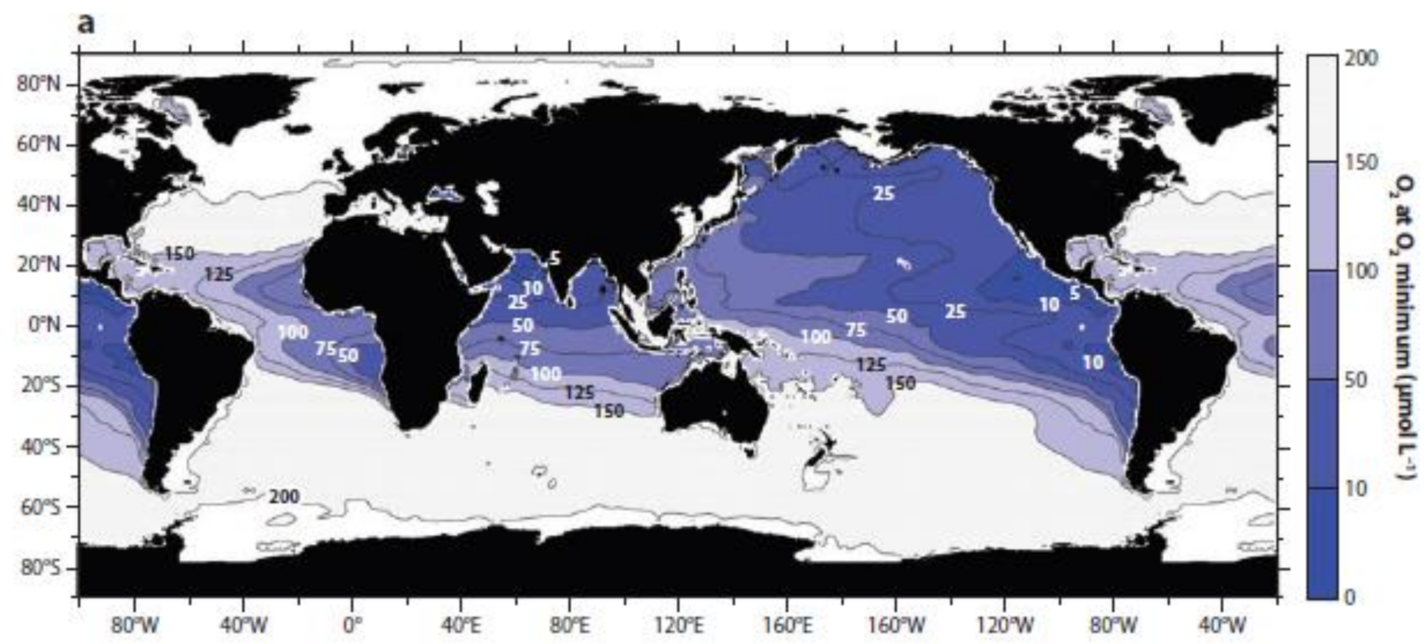


Fig. 1: Global Oxygen Minimum Zones (Keeling et al., 2010)

Aim

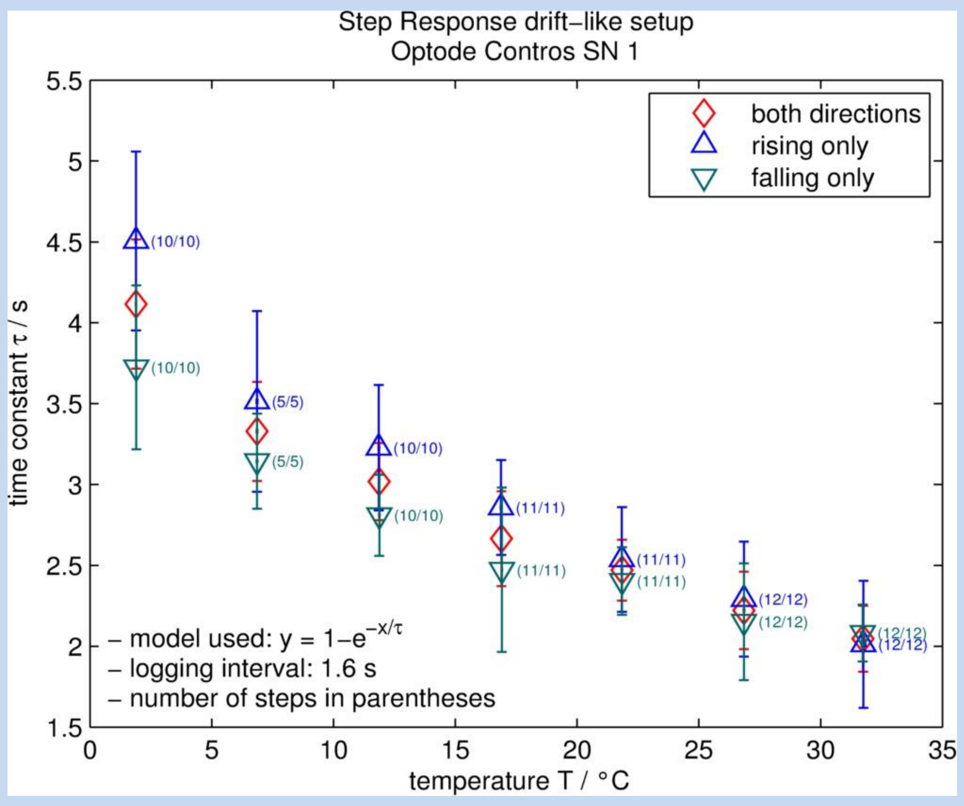
Integrated characterization of the HydroFlash™ O2 is aimed regarding accuracy, precision, pressure dependance, long-term stability & drift and response time in lab and field (according to Bittig et al., 2018).

AADI 4330

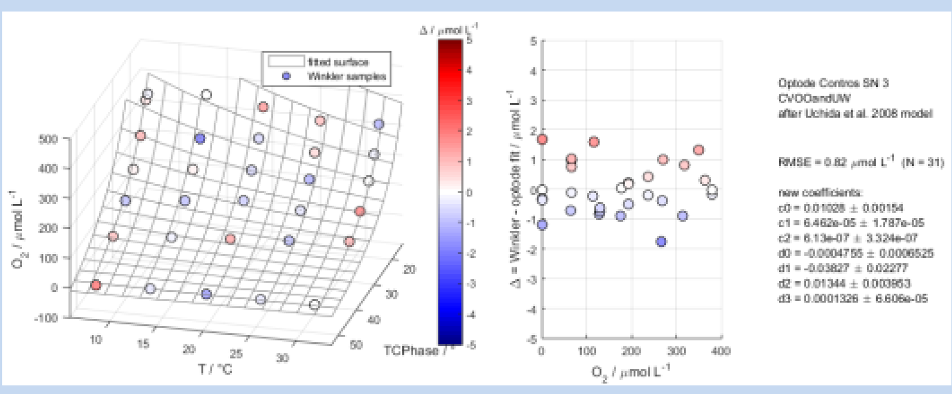
Sea-Bird SBE63

KM CONTROS HydroFlash™ O2

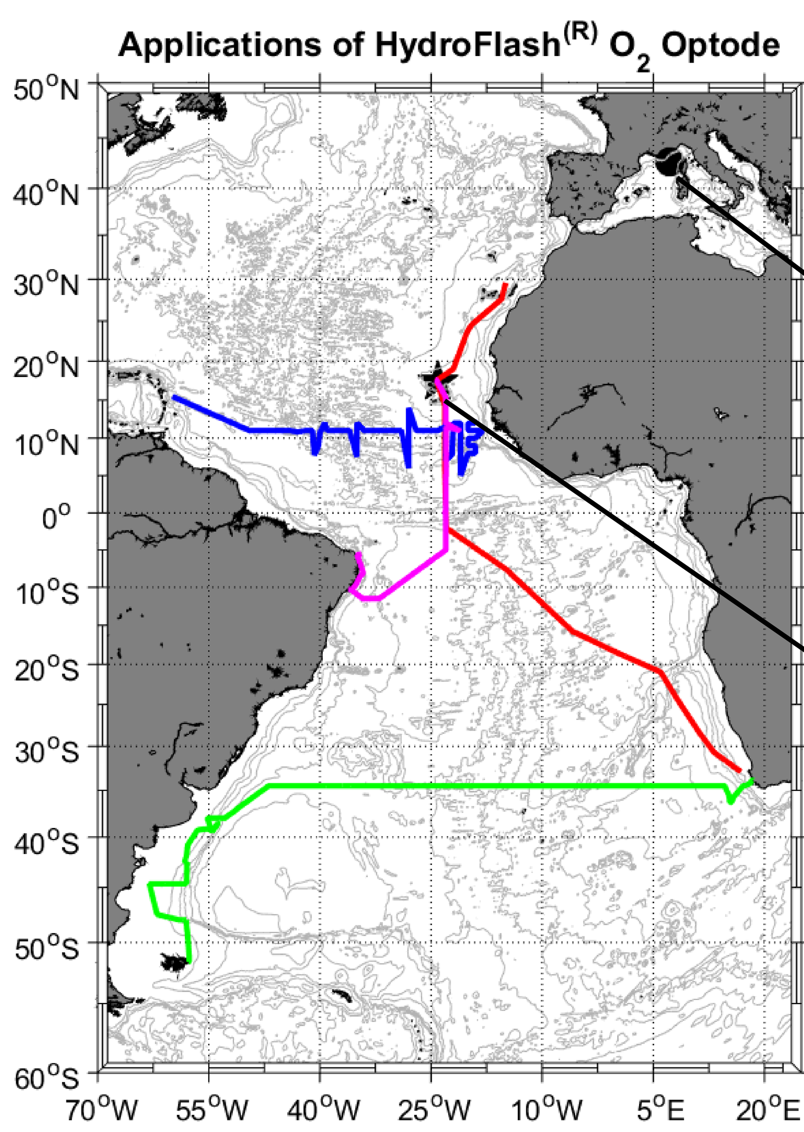
Results



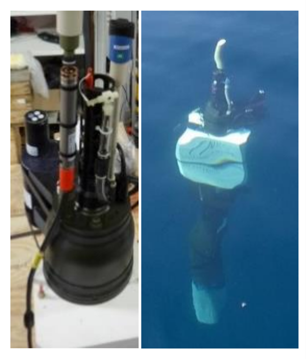
The response time of $t_{63\%}$ = 3 – 4s is ~50% faster compared to other optodes.



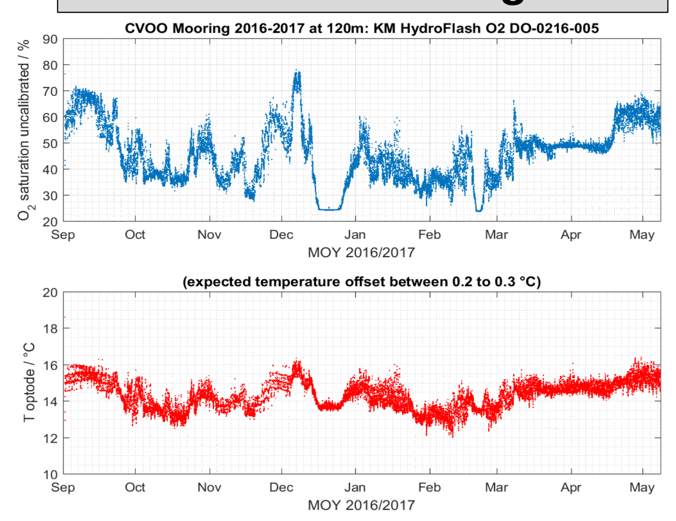
Lab calibrations yield accuracies with RMSE < 1 µmol·L⁻¹.



Implementation on Argo-Float



8+ months mooring data

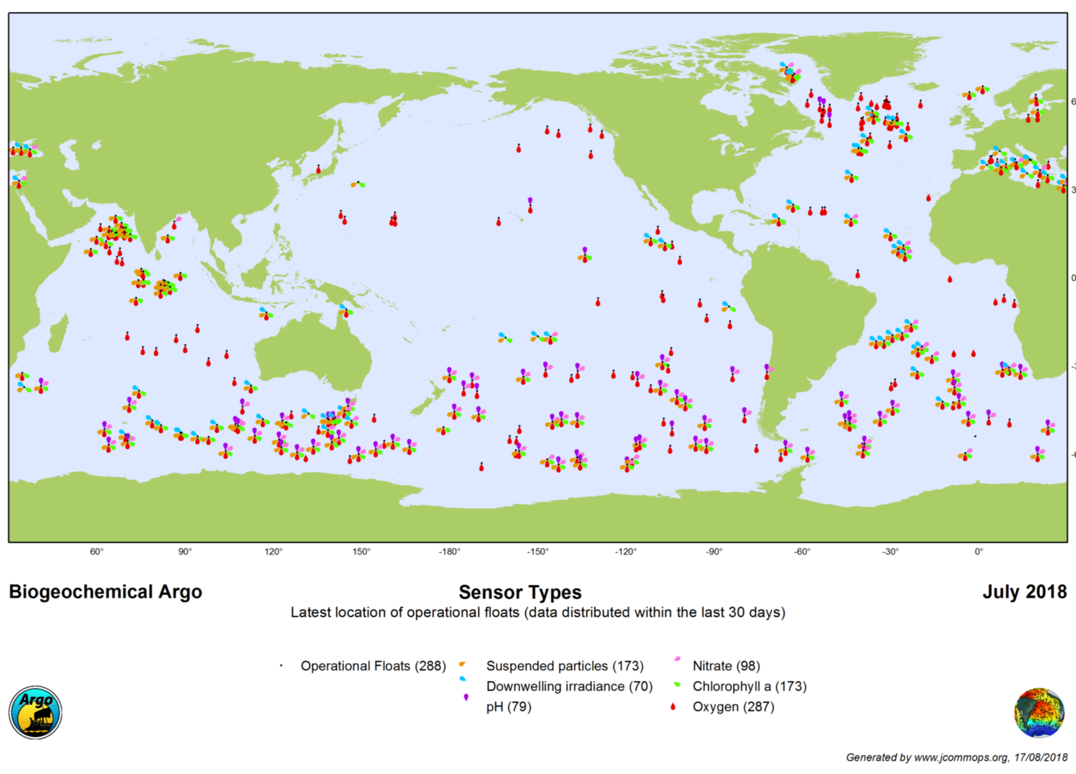


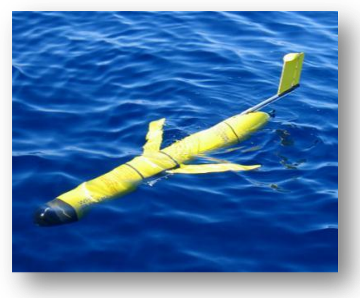
Underway (UW) measurements: 100+ days
Performance on CTD-Casts: 80+ profiles (up to 6000m)

Conclusion & Outlook

Due to its small dimensions and response characteristics, this novel optode could be used on a wide range of autonomous observation platforms such as ships, time-series stations and wave gliders, yet it is potentially promising on floats and gliders.

Next steps: Complete data & performance evaluation of optode, biogeochemical analysis of South Atlantic M133 underway data





References:

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