Linking glider and mooring data to advance biogeochemical measurements in the Labrador Sea

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ABSTRACT: Ocean gliders can provide high-resolution gas observations necessary to interpret the space and time scales of highly dynamic processes such as gas uptake or outgassing in the ocean surface layer and there is a critical need to make high-resolution in situ gas measurements in the ocean for the biogeochemical community (Johnson et al., 2009). Small optical sensor, called optodes, have now for some time been used on gliders to measure dissolved oxygen in the oceans and recently optodes were modified to measure pCO_2 (Atamanchuk et al., 2014). This CO_2 optode is still in early prototype stage and has not undergone previous tests on a glider and much uncertainty remains around sensor drift and data quality. We describe our method to reference glider based measurements of O_2 and pCO_2 to data from a vertical profiler mooring – the SeaCycler in the Labrador Sea and validate the accuracy of this novel sensor on a profiling platform. SeaCycler carried a Pro-Oceanus Ltd., CO_2-Pro CV as part of its instrument float, an extensively tested gas analyzer, based on non-dispersive infrared refraction (NDIR), with stable performance during lengthy observations (Jiang et al., 2014). We flew glider missions to test the glider against the SeaCycler's O_2 and pCO_2 data and compute a isopycnal-matched in-situ optode correction. We also compare oceanic surface observations from these instruments to atmospheric measurements to calculate drift of the foil calibration (Bittig et al., 2015). Repeat tests of the sensor on the glider on the Newfoundland Shelf in 2018, further revealed characteristics on response time in profiling applications and performance in real ocean conditions. We used data from both deployments to improve the characterization of sensor response and applied response time-lag corrections (Fiedler et al., 2013). Using SeaCycler corrected glider data we discuss the spatial differences in the glider observations over time in the surface mixed layer and below and compute spatial and temporal correlation length-scales.

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