

Improved estimation of Arctic air-sea CO₂ fluxes from QuikSCAT and shipboard measurements of surface wave slope

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In order to quantify CO₂ exchange on a regional or global scale it is useful to relate the exchange to parameters that are readily measured with remote sensing techniques since satellites can provide global coverage on a daily timescale. Although remote sensing methods allow for better comparison of ocean carbon uptake over changing locations and seasons, there is also variability in oceanic CO₂ uptake estimates depending on how the exchange calculation is formulated, since it is not measured directly by this technique. Many satellite-derived estimates have been obtained using wind speed, but uncertainties of this relationship grow at higher wind speeds. It has been suggested that wave slope, a less commonly measured parameter, may hold a stronger relationship with CO₂ exchange than wind speed (Frew et al. 2004), providing an opportunity to lower estimate uncertainties. To further algorithm development of the relation between CO₂ exchange and wave slopes, ground measurements of both CO₂ exchange and wave slopes, concurrent with remote sensing measurements are vital.

We have collected 15 weeks worth of data including ship-based CO₂ fluxes and time series of wave slopes, concurrent and collocated with QuikSCAT overpasses. Our data set includes stations in Baffin Bay, the Northwest Passage, Amundsen Gulf, and the Beaufort Sea, collected between July 2007 and August 2008. Our work aims to improve on our existing (Bogucki et al., in print) model of gas transfer. The improvements include incorporating locally measured parameters such as mean near surface temperature and salinity fields, turbulent microstructure profiles and meteorological data. This will allow us ultimately to develop a set of model parameters for the Beaufort Sea and expand to the rest of the Arctic Ocean. As a part of this larger effort, the work presented here details ground truthing of QuikSCAT measurements in the arctic region with collocated wave slope measurements.

References

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