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Air-Sea Fluxes of Momentum, Heat, and Carbon Dioxide at High Wind Speeds in the Southern Ocean

The objective of this research is to deploy an underway system to measure air-sea fluxes of momentum, sensible and latent heat, and CO_2 in the Southern Ocean using the micrometeorological eddy covariance technique. The system will be installed on the R/V Palmer and collect air-sea flux data for two austral summer seasons. These efforts are expected to generate a large database of direct flux measurements during high winds. The air-sea CO_2 flux data will be combined with simultaneous underway measurements of pCO_2 made by Columbia University to compute the CO_2 piston velocity. It is anticipated that the data set generated over 2 years will include sufficient data over a wide range of atmospheric and oceanic conditions to better constrain the functional relationship between the piston velocity and wind speed (e.g., quadratic vs. cubic). These efforts will help to improve the way in which air-sea gas exchange is parameterized in global climate models, and, ultimately, to the understanding of both Southern Ocean and global carbon budgets. A goal will be to make these data available rapidly via an appropriate online data server, such that measured fluxes will be useful to the broader community for calibrating and validating models of air-sea coupling. The proposed research is consistent with the goals of the International SOLAS (Surface Ocean Lower Atmosphere Studies) program (http://www.uea.ac.uk/env/solas), and will significantly expand air-sea flux data coverage in the Southern Ocean, which is currently under sampled compared with other ocean regions.

Broader Impacts:

The broader impacts of this project stem from the societal importance of understanding the role of air-sea gas exchange in climate change. These field studies are an essential component of developing and verifying global models that play an important role in developing a national climate policy. In terms of human resources, the project will support the professional development of a postdoctoral researcher at SUNY Albany, who will be trained in micrometeorological measurements and data analysis, and will participate in presenting and publishing the results. The flux data will be made available for download and use by the general science community in a timely manner.