

Measurement and Parameterization of Sea-Air Trace Gas Transfer Using Micrometeorological Techniques: A Decade of Progress

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In May-June 1998 a team of the NOAA and university scientists executed the first motion-corrected, direct covariance measurements of the transfer velocity of CO₂ from a ship in the joint NOAA National Science Foundation (NSF) Gas Exchange field program, GasEx1998. Since then, CO₂ observations have been repeated in two subsequent GasEx field programs (2001 and 2008). Furthermore, the development of fast sensors for Dimethylsulfide (DMS) and Ozone has permitted similar direct measurements of transfer velocities for those gases in a series of NOAA and NSF-sponsored field programs. These observations have yielded insights into the physics of near-surface oceanic processes driving gas transfer over the ocean. This has led to the development of the NOAA Cuppled Ocean Atmosphere Response Experiment (COARE) gas transfer algorithm, which can be applied generally to most gases with known solubility and Schmidt number (air and water). In this talk we will discuss the measurement technology, recent field programs, and provide a synthesis of progress to date. Figure 1 shows a summary of observations of gas transfer velocity for CO₂ and DMS from this series of field projects.

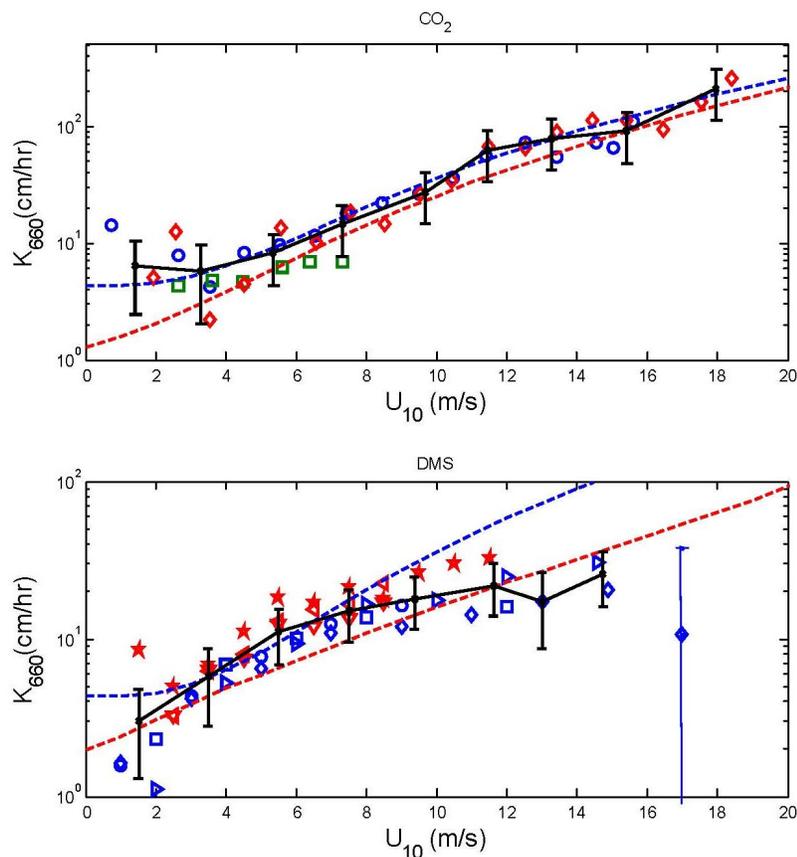


Figure 1. Gas transfer coefficients as a function of 10m neutral wind speed from direct surface-based observations. The black line is the mean of the data sets; the error bars are statistical estimates of the uncertainty in the mean. Upper panel CO₂ symbols are: circle - GASEX98, square - GASEX01, diamond - GASEX08. The parameterizations shown are: blue dashed line - McGillis et al 2001, red dashed line - NOAA/COARE CO₂. Lower panel DMS symbols are: square - Sargasso, circle - TAO, right triangle - Department of Geological and Environmental Engineering, diamond - GASEX08, left triangle - Wecoma 04, down triangle - Knorr 06, pentagram - Knorr 07 (red symbol data courtesy E. Saltzman). The parameterizations shown are: blue dashed line - McGillis et al 2001, red dashed line - NOAA/COARE DMS.