Influence of sub-daily processes on the air-sea flux of CO₂.

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The air-sea flux of CO₂ is driven by the difference between the partial pressures of CO₂ in the ocean and atmosphere and scaled by the gas transfer velocity. The gas transfer velocity is dependent on wind speed and sea surface temperature (SST) while the partial pressures of CO₂ depend upon air pressure, humidity, SST, sea surface salinity, solar radiation, chemical and biological interactions and turbulent mixing through the water column. Many of these variables change on a diurnal time scale and many of them are highly correlated. These short time scale variations and covariances are ignored when monthly averages are used to estimate CO₂ flux leading to large errors in flux [eg: Wanninkhof et al., 2002]). Here we present a thorough analysis of the effects of sub-daily processes on air-sea CO₂ flux using a 1-d bio-geochemical ocean turbulence model consisting of a general ocean turbulence model (GOTM) coupled with the Hadley Centre ocean carbon cycle (HadOCC) model. The model is forced with high frequency meteorological data from a number of locations with diverse meteorological/oceanic conditions to demonstrate regional differences in flux errors due to temporal averaging.

REFERENCES