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Influence of precipitation on the CO_2 air-sea flux, an eddy covariance field study

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During the SPACES-OASIS cruise (July-August 2015) from Durban, SA to Male, MV direct fluxes of CO_2 and dimethyl sulfide (DMS) were measured using the eddy covariance (EC) technique. The cruise covered areas of sources and sinks for atmospheric CO_2, where the bulk concentration gradient measurements resembled the Takahashi (2009) climatology. Most of the time, bulk CO_2 fluxes (F=k* [cwater-cair]), calculated with the parametrization (k) by Nightingale et al. 2000, were in general agreement with direct EC measurements. However, during heavy rain events, the directly measured CO_2 fluxes were 4 times higher than predicted. It has been previously described that rain influences the k parametrization of air-sea gas exchange, but this alone cannot explain the measured discrepancy. There is evidence that freshwater input and a change in the carbonate chemistry causes the water side concentration of ?c=cwater-cair to decrease. Unfortunately this cannot be detected by most bulk measurement systems. Using the flux measurements of an additional gas like DMS, this rain influence can be evaluated as DMS does not react to changes in the carbonate system and has a different solubility. A pending question is if the enhanced flux of CO_2 in the ocean is sequestered into the ocean mixed layer and below. This question will be tackled using the GOTM model to understand the implications for the global carbon cycle.