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Enhanced air-sea CO2 flux during unstable atmospheric stratification

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To understand the effects of anthropogenic emissions of CO_2 it is crucial to understand all parts of the carbon cycle. The ocean is a sink of a large fraction of the anthropogenically produced CO_2. Understanding gas exchange across the air-sea interface is an important component in global climate dynamics. There have been a large number of measurements of oceanic CO_2 during the last decades but the quantification of the total oceanic uptake as well as the regional distribution is still uncertain. With a unique measuring site in the Baltic Sea (the Östergarnsholm site) extended data of direct measurements of the flux of CO_2, using the eddy covariance method, the difference in partial pressure between the atmosphere and the ocean, as well as some parameters that probably influences the transfer gives the opportunity to gain significant new understanding of the processes controlling the transfer of CO_2 at the air-sea interface. The station has been running since 1995, with measurement of the flux carbon dioxide since 2005.

Results from analysing the data shows that the variability of the partial pressure of CO_2 is surprisingly large both in the ocean and in the atmosphere. The atmospheric concentration varies between 360 and 410 ppm, the partial pressure in the ocean varies from 100 to 900 μatm The flux of CO_2 is thus much more sensitive to footprint area than the fluxes of heat and humidity previously calculated for the same site. In a substantial part of the data with unstable atmospheric stratification the air-sea flux is significantly larger than the corresponding flux calculated using the difference in partial pressure and transfer velocity, this indicates the presence of processes strongly influences by atmospheric stratification of importance for air sea exchange. These results

will be shown and possible explanations discussed.