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Directly measured and calculated fluxes of carbon dioxide in the Baltic Sea

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The details of global carbon cycle and specifically the exchange of CO_2 between the atmosphere and the surface are presently not fully known. The exchange of CO_2 between the ocean and the atmosphere is a function of the difference in partial pressure of carbon dioxide (pCO_2) at the surface and of the transfer velocity. Biological, chemical and physical processes in the ocean control the partial pressure at the water surface and the transfer velocity depends mainly on the turbulence structure in the atmosphere.

With a unique measuring site in the Baltic Sea (the Östergarnsholm site) extended data of direct measurements of the flux of CO_2, the difference in partial pressure between the atmosphere and the ocean, as well as the parameters that most likely controls the transfer (turbulence, heat fluxes and waves) gives the opportunity to gain significant new understanding of the processes controlling the transfer of CO_2 (as well as other gases) at the air-sea interface. The station has been running since 1995, with measurement of the flux of carbon dioxide since 2001 and measurements of the partial pressure of carbon dioxide at the ocean surface since 2005.

The result that will be presented includes a new method of replacing the well-known 'Webb-correction' with a direct correction of the high-frequency open-path measurements. This gives the opportunity to investigate the CO_2-spectra and thus show on what scale the exchange at the air-ocean interface is taking place. This is necessary for further understanding of the important processes. An analysis of the first annual cycle shows the sensitivity of the calculated fluxes to the variability of the surface partial pressure of CO_2 as well as of the expression used for the transfer velocity. The transfer velocity shows different behaviour for stable and unstable atmospheric stratification.