Geophysical Research Abstracts
Vol. 16, EGU2014-12674-1, 2014
EGU General Assembly 2014

Fluxes of carbon and nutrients to the Iceland Sea surface waters and inferred primary productivity and stoichiometry

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Fluxes of carbon and nutrients to the upper 100 m of the Iceland Sea are evaluated. The study utilises hydrochemical data from the quarterly sampled Iceland Sea time-series station (68.00 °N, 12.67 °W), for the years between 1993 and 2006. By comparing data of dissolved inorganic carbon (DIC) and nutrients in the surface layer (upper 100 m), and a sub-surface layer (100-200 m), we calculate monthly deficits in the surface, and use this to deduce the fluxes into and out of the surface layer that affect the deficit: vertical mixing, horizontal advection, air-sea exchange, and biological activity. The deficits show a clear seasonality with a minimum in winter, when the mixed layer is at the deepest, and a maximum in September, when biological uptake has removed much of the nutrients. The annual vertical fluxes of DIC and nitrate amounts to 2.3 and 0.41 mol m^{-2} yr^{-1}, respectively, the annual air-sea uptake of atmospheric CO_2 is 4.4 mol m^{-2} yr^{-1}, and the net annual flux due to biological activity is calculated to 5.5 mol C m^{-2} yr^{-1}, and 0.37 mol N m^{-2} yr^{-1}. We also deduce seasonal NCP by summing up the months with a positive drawdown of DIC, and similar for new production by summing up the months with positive nitrate drawdown. We quantify these to 5.6 mol C m^{-2} yr^{-1}, and 0.51 mol N m^{-2} yr^{-1}, which gives a ratio markedly higher than Redfield. Results for phosphate and silicate are also shown and discussed, as are the stoichiometry of the all deduced fluxes.