



## **Aircraft-based observations of air-sea fluxes at high latitudes during high windspeed cold-air outbreak conditions**

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During the Greenland Flow Distortion experiment (GFDex) aircraft-based observations of air-sea fluxes were obtained over Denmark Strait and the Irminger Sea. High frequency observations of velocity, temperature and water vapour content have been used to calculate turbulent fluxes of momentum, heat and moisture using the eddy covariance method. These are the first direct air-sea flux observations in this region and add to the relatively small collection of direct air-sea flux observations made in high wind speed conditions. The aircraft-based turbulence legs were flown at remarkably low-levels - only 30-50 m above the sea surface and so within the atmospheric surface layer. The flux data were obtained in 10-m neutral wind speeds of up to  $25 \text{ ms}^{-1}$ , with 80% of the flux data in the range  $15\text{-}19 \text{ ms}^{-1}$ . The observed range of air-sea turbulent fluxes was large. Over open water, the wind stress varied from  $0.2$  to  $1.9 \text{ Nm}^{-2}$  and the surface sensible and latent heat fluxes from  $50$  to  $300 \text{ Wm}^{-2}$  - resulting in total surface heat fluxes of up to  $600 \text{ Wm}^{-2}$ .

The exchange coefficients are at the upper end of those previously observed. Mean values for the  $15\text{-}19 \text{ ms}^{-1}$  range are  $\text{CDN} = 2.04 \times 10^{-3}$ ,  $\text{CHN} = 1.63 \times 10^{-3}$  and  $\text{CEN} = 1.57 \times 10^{-3}$  for momentum, heat and moisture respectively. The value of the momentum exchange coefficient is in line with previous studies, however both the heat and moisture exchange coefficients are higher than the bin-median coefficients suggested by previous work. Values of  $\text{CDN}$  over sea ice and the marginal ice zone ranged from  $1.67 - 6.29 \times 10^{-3}$  and were, for these conditions, generally higher than  $\text{CDN}$  over adjacent open water areas. No significant spatial patterns in the exchange coefficients over open water have been detected, although there is some suggestion of higher exchange coefficients immediately downwind of the sea ice.

If time permits, some further aircraft based turbulent flux observations from over a thin-ice covered coastal polynya in the southern Weddell Sea will also be discussed.