EGU24-8590, updated on 09 Nov 2024
https://doi.org/10.5194/egusphere-egu24-8590
EGU General Assembly 2024

A stochastic model for the turbulent ocean heat flux under Arctic sea ice

Srikanth Toppaladoddi[1] and Andrew Wells[2]
[1]University of Leeds, School of Mathematics, Department of Applied Mathematics, Leeds, UK (S.Toppaladoddi@leeds.ac.uk)
[2]University of Oxford, Department of Physics, Atmospheric, Oceanic and Planetary Physics, Oxford, UK
(andrew.wells@physics.ox.ac.uk)

The physics of planetary climate features a variety of complex systems that are challenging to model as they feature turbulent flows. A key example is the heat flux from the upper ocean to the underside of sea ice which provides a key contribution to the evolution of the Arctic sea ice cover. Here, we develop a model of the turbulent ice-ocean heat flux using coupled ordinary stochastic differential equations to model fluctuations in the vertical velocity and temperature in the Arctic mixed layer. All the parameters in the model are determined from observational data. A detailed comparison between the model results and measurements made during the Surface Heat Budget of the Arctic Ocean (SHEBA) project reveals that the model is able to capture the probability density functions (PDFs) of velocity, temperature and heat flux fluctuations. Furthermore, we show that the temperature in the upper layer of the Arctic ocean can be treated as a passive scalar during the whole year of SHEBA measurements. The stochastic model developed here provides a computationally inexpensive way to compute an observationally consistent PDF of this heat flux, and has implications for its parameterisation in regional and global climate models.