EGU2020-13781
https://doi.org/10.5194/egusphere-egu2020-13781
EGU General Assembly 2020
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From red to white: the time-varying nature of ocean heat flux to Arctic sea ice

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Arctic sea ice is one of the most sensitive components of the Earth's climate system. The underlying ocean plays an important role in the evolution of the ice cover through its heat flux at the ice-ocean interface which moderates ice growth and melt. Despite its importance, the spatio-temporal variations of this heat flux are not well understood. In this work, we combine direct numerical simulations of turbulent convection over fractal surfaces and analysis of time-series data from the Surface Heat Budget of the Arctic Ocean (SHEBA) program using Multifractal Detrended Fluctuation Analysis (MFDFA) to understand the nature of fluctuations in this heat flux. We identify key physical processes associated with the observed Hurst exponents calculated by the MFDFA, and how these evolve over time. We also discuss ongoing work on constructing simple stochastic models of the ocean heat flux to the ice, and potential use as a parameterisation.