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Metric Analysis of Subgrid Scale Dynamics of the Southern Ocean's Carbon and Heat Fluxes for subsequent Machine Learning parameterisation

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The exchange of carbon and heat fluxes occurs between the atmosphere and the ocean on different scales. In particular, the upper ocean called the mixed layer is involved in these exchanges. This mixed layer is affected by eddies. Eddies result from turbulence on different time and spatial scales. Subgrid scale turbulence with spatial scale of O(1-100 km) and timescale of O(seconds-hours-months) will be considered in this research.
Due to the computational power of CHPC computing, it is possible to interactively using python, analyse the metrics associated with the subgrid scale dynamics at different resolutions. In addition to the computational power, the CHPC also uses Dask, which allows for parallel computing. The parallel computing will be used to reduce the time of running the various metrics analyses.
From metric analysis, selected variables will be considered in a Machine Learning, ML parameterisation process using Convolutional Neural Networks, CNN. Since the CHPC offers the use of a GPU the ML process will be faster than doing it on a CPU system.
In this research the initial experiments will make use of 1/2th degree and 1/12th degree resolutions. This experiment will then be resolved to computationally more intense scales 1/36th and 1/48th degree resolution for the same domain. Of course, this will increase the computational requirement which will increase the need for processing power and storage. These requirement cannot be possible on personal devices but can be done on CHPC super computers.
This research is related to extreme events. Extreme events is reduced by the process of carbon and heat being absorbed into the ocean. By understanding how the ocean's mix layer absorbs the carbon and heat is related to eddies, suitable mitigation and adaptation strategies can be suggested for the predicted frequency and intensity of the extreme events.
This research links, Southern ocean and atmospheric sciences. It also combines data science and physical modelling to create an improved model. This improved model will serve to enable better predictions for future extreme events.

Student?

Yes

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