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Optimization of high resolution climate model EC-Earth3-HR on CRAY-CX50

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A climate model is a canonical example of multi-physics multi-scale modeling that requires a significant amount of computation time to extract signals of climate change, especially in finer resolution configurations. Finer resolution is pertinent because it enhances the fidelity of resolved features, and allows for the representation of missing processes and feedback, such as mesoscale eddies in ocean modeling. This thesis aims to identify and optimize algorithms in the global climate model EC-Earth3. Specifically, the high resolution configuration (EC-Earth3-HR) at 0.25° in the ocean subcomponent Nucleus for European Modeling of the Ocean (NEMO). Using diagnostics on the average CPU and elapsed time per subroutine, it is identified that the calculation for horizontal transport of sea-ice advection/diffusion is most time-consuming. Another subroutine of interest is the calculation of diagnostics on the poleward heat and salt transports, which doubles in runtime time (both elapsed and CPU) when resources increase by a factor of 1.25. Further analysis must be carried out to determine which of these can lead to faster performance once optimized.

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Field of study

Computational Physics

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