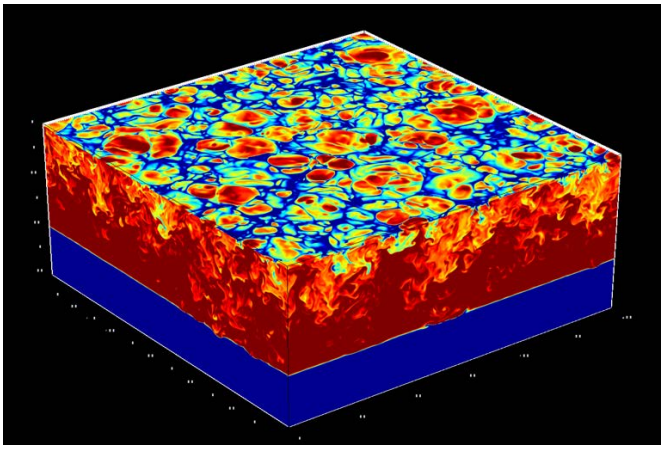
Potential roles for small-scale ocean heat fluxes in the rapid decline of Arctic sea ice



The Arctic is undergoing a large and rapid reduction of its sea-ice cover, and the general consensus is that this decline will continue. However, Global Climate Models participating in CMIP5 still underestimate the rate of decline of sea ice when compared with observations. There are also large uncertainties with respect to the timing of a seasonally ice-free Arctic, this being linked to natural variability of the system. The remaining uncertainty is linked with the physics and with processes that are not resolved by current Global Climate Models. In this research, we focus on the crucial role of under-resolved ocean mechanisms that contribute to vertical heat fluxes to the sea ice during the Arctic winter. These include processes associated with sea-ice leads and interactions with topography. To this end, we use a hierarchy of numerical models having different levels of complexity. High-resolution patches of a non-hydrostatic model will be used to explicitly resolve the small-scale mechanisms associated with convection, near-inertial motion, non-linear Ekman pumping, and internal wave breaking. These high-resolution patches will be imbedded in a large-scale model of the Arctic from which the hydrography will be used to prescribe open boundary conditions for each high-resolution patch. We will use this tool to estimate the relative importance of these mechanisms on the larger scale ice mass balance of the Arctic sea-ice cover.

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