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Physical Problems in Modeling the Global Ocean

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Understanding and modeling the physical ocean circulation is of primary importance for both enhancing the science of the ocean, and for providing rational projections of future climate. This talk aims to outline fundamental physical and numerical aspects of ocean climate modeling. We highlight features associated with representing elements of the continuum ocean fluid using a discrete model lattice. A major challenge of this representation includes the parameterization of scales which are unresolved by the simulation. This subgrid-scale problem is ubiquitous in computational fluid dynamics, and forms a major focus of ongoing research and development with ocean climate models. Another challenge involves developing robust numerical methods whose truncation errors do not adversely corrupt the quasi-ideal nature of much of the ocean circulation outside of boundary layers. Progress has been made on both fronts, with improvements arising from better understanding of the ocean, smarter methods used to simulate the ocean, and enhancements in computational power.