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Problems and prospects with ocean mesoscale eddying climate models (Fridjof Nansen Medal Lecture)

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Numerical models are skillful tools for understanding and predicting climate, thus making them an essential tool for climate science. This skill is the result of concerted efforts by scientists to produce faithful numerical methods and physical parameterizations, along with the analytical skills to evaluate the models with respect to increasingly detailed observation based datasets. Nonetheless, climate modelling has evolved in the absence of an explicit representation of ocean mesoscale eddies and the associated vigorous boundary currents and jets. Questions thus remain concerning how faithful a coarsely resolved ocean simulation can be in the absence of the most energetic of intrinsic oceanic variations. Hence, the climate science community maintains a ubiquitous quest for fine resolution simulations to better represent the mesoscale and even smaller scales. Today, we have entered an era in which the ocean mesoscale can be explicitly represented for centennial scale physical climate simulations. What can we expect with such ocean mesoscale eddying climate models? What are the fundamental questions of numerical methods and physical parameterization confronting scientists building the models? What simulation features should scientists expect when they analyze the output? This talk provides a personal perspective on these and other research questions framing the leading edge of ocean climate science.