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Bering Sea dynamics and variability – A modeling perspective

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The Bering Sea is an important Sub-Arctic ecosystem, connecting the North Pacific to the Arctic Ocean, which has recently experienced significant changes including a reduction of sea ice cover and an increase in temperatures on the shelf. Such changes impact the state of the ecosystem, which is economically important due to the large fish and shellfish catch. There are several underlying and interrelated oceanic meso-scale processes affecting the climatology and variability of the Bering Sea. These include upwelling of cold, nutrient-rich water onto the shelf, frontal systems influencing water mass distributions, eddies mixing various water masses, and bathymetry-controlled inter-basin exchanges. Together these processes contribute to the overall large-scale circulation and water mass distribution and properties of the Bering Sea shelf, slope, and basin.

To address some of these issues, we have developed a coupled ice-ocean model of the pan-Arctic region to allow for realistic representation of the ocean dynamics, sea ice conditions, and exchanges between the Bering Sea and adjacent basins. Model results utilizing realistic atmospheric forcing (1979-2003) are presented and validated with observations. We focus on the Aleutian Island throughflow, Bering Sea circulation features, the presence of upwelling, and the distribution of sea ice. Finally, we examine the eddy kinetic energy distribution throughout the Bering Sea and along the path of the Alaskan Stream from the model and as computed from TOPEX altimeter estimates.