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Sensitivity of ocean hydrography and fluxes across Fram Strait in the Regional Arctic System Model

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HE24C-2897: Sensitivity of ocean hydrography and fluxes across Fram Strait in the Regional Arctic System Model

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Oregon Convention Center - Poster Hall

The Arctic has experienced some of the most extreme climate changes currently occurring anywhere on Earth, including a warming trend. One of the key indicators of such decadal changes has been the decrease of the sea ice cover, driven by atmospheric forcing and the inflow of warm waters from the sub-polar oceans. While Earth System models (ESMs) are in broad agreement with such changes, they are limited in representing some critical high-latitude processes. Those include processes controlling the inflow, accumulation and distribution of heat in the upper ocean and its interaction with the sea ice cover. Such ESM limitations are likely due to a combination of coarse resolution, inadequate parameterizations, or under-represented processes, and they affect model skill in representing and predicting polar climate.

To better understand some of these limitations, a series of sensitivity experiments are performed using the Regional Arctic System Model (RASM). RASM consists of the atmosphere, ocean, sea ice, land hydrology and runoff routing components, coupled through the flux coupler. The ocean and sea ice configurations include the horizontal resolution of $1/12^{o}$ (~9km) or $1/48^{o}$ (~2.4 km) and 45 or 60 vertical levels. We focus on the oceanic volume and property fluxes across Fram Strait and analyze their sensitivity to altered horizontal and vertical resolution as well as to parameterizations of air-ice-ocean coupling. Next, we compare model output against moored and hydrographic observations in the Fram Strait region. Our analyses suggest that both surface momentum coupling and model resolution influence the upper ocean thermohaline structure and fluxes at Fram Strait. The role of mesoscale eddies in the recirculation within and exchanges through Fram Strait will be quantified. Suggestions for a limited observational monitoring approach will be provided. Finally, comparisons with observations will be summarized to guide improved simulations of such exchanges.

Plain Language Summary

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