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Modeling the Beaufort Sea coastal wind regime using MM5 and WRF

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The North Slope of Alaska, bounded in the south by the Brooks Range and in the north by the Beaufort Sea, is a complex geographical and topographical environment which offers unique challenges for mesoscale meteorology modeling. The combination of orographic effects caused by wind flow over the Brooks Range along with Arctic sea breeze effects due to the land-sea ice/ocean contrast along the Beaufort Sea coast results in a particularly difficult environment to successfully model. As larger-scale models are generally incapable of sufficiently resolving these localized effects, and are therefore insufficient for properly simulating the coastal surface wind regime, a study has recently been established to correct this deficiency through the development of a mesoscale model tuned specifically for the Beaufort Sea region, with the goal of producing more accurate long-term simulations of the surface wind speed than are currently available.

As an initial step in this project, the two preeminent community mesoscale models, MM5 and WRF, were each used to produce two months of simulations for a domain encompassing the Beaufort Sea. As environmental conditions along the northern Alaskan coast are radically different in the summer and winter due to the extreme changes in solar insolation and presence of sea ice, both summer and winter months were selected for the comparison in order to test the ability of the two models to simulate the wind regime in varied conditions. In-situ observational data collected as a part of this study were used to validate model performance, with particular emphasis placed on evaluating the capabilities of the models to simulate the orographic and sea breeze-influenced surface wind regime.