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Numerical Modeling of Summer Arctic Boundary Layer during the Arctic Summer Cloud Ocean Study (ASCOS)

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A growing body of evidence suggests that the Arctic region is experiencing rapid environmental changes. One of the most striking changes is the drastic decrease in multi-year sea ice concentrations. The coverage of the multi-year ice now comprises just 10 percent of winter ice cover, down from 40 percent 20 years ago. These changes are certain to have serious impacts on the Arctic weather and regional climate. The Arctic Summer Cloud Ocean Study (ASCOS) is one of the most extensive summer expeditions with concentrated measurements deployed for more than a month (August-September 2008) in the North Atlantic sector of the central Arctic ocean. The detailed observations provide an opportunity for evaluating model performance in capturing boundary layer structure over changing sea-ice conditions during the Arctic summer and ultimately improving Arctic weather prediction.

In this study we examine the impact of the evolving sea ice states on the Arctic atmos-pheric conditions using the Navy's regional numerical weather prediction model (Coupled Ocean/Atmosphere Mesoscale Prediction System - COAMPS®) driven by the sea ice surface conditions predicted by the Arctic Cap Nowcast/Forecast System (ACNFS). ACNFS is a coupled sea ice and ocean model that generates real-time forecasts of ice concentration, ice edge location, ice thickness, ice draft and ice drift for all sea ice covered areas in the northern hemisphere (poleward of 40N). These fields are used by COAMPS as the surface boundary condition, which directly modulates distribution of turbu-lent and radiative surface fluxes. The improved physical parameterizations in COAMPS are compared with the benchmark simulations and evaluated for the Arctic conditions. Systematic verification of the boundary layer structure over the evolving sea ice with high heterogeneity is performed against the Arctic surface observations and data from the ASCOS experiment.