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Atmosphere-Wave Coupling in a NWP System

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Modeling the interactions between the ocean and atmosphere both advances our understanding of the physical mechanisms operating in rapidly changing Arctic environments and is critical to improve the predictability of extreme weather events, wave activity, and sea ice behavior. This study presents the development of a two-way coupled atmosphere-wave numerical weather prediction (NWP) system in the Arctic as well as the initial evaluation of the coupled model performance. The HARMONIE-AROME configuration of the ALADIN-HIRLAM NWP system (AROME-Arctic) is coupled to the wave model Wave Watch III (WW3) using the OASIS3-MCT coupling toolkit. The coupled model is configured over the AROME-Arctic domain in the Barents sea region with a horizontal grid resolution of 2.5km. The two-way coupling is structured as follows: AROME-Arctic receives sea surface properties from WW3, which influences the calculation of the surface roughness and surface fluxes. This in turn effects the near surface dynamics in the atmospheric model. The 10m wind is then passed to WW3, which updates the sea surface properties. The coupled model performance is evaluated against observations such as Advanced Scatterometer (ASCAT) surface wind data as well as significant wave height based on Jason-3 and Sentinel-3A satellite altimeter data. High impact events are selected for sensitivity experiments. Future work will include sea ice and wave interactions within this coupled model framework.