The Interdisciplinary Research for Arctic Coastal Environments (InteRFACE) project is developing new and complementary capabilities to better model the high north in the Energy Exascale Earth System Model (E3SM). We are utilizing the advanced meshing capabilities of the Model for Prediction Across Scales (MPAS) in close collaboration with the core E3SM water cycle campaign to simulate the Arctic Ocean at eddy permitting resolution (14 km) in fully coupled simulations. Our first goal is to establish an envelope of internal variability of Arctic sea ice extent and thickness, storm behavior, and runoff for E3SM with a standard resolution atmosphere and regionally focused North American and Arctic mesh using E3SM Version 2. Upon this code base, we are experimenting with higher-order closure oceanic mixing, and its impact on Arctic Ocean stratification. We are also adding benthic biogeochemistry befitting the vast shallow Arctic bathymetry extending far from coastlines. Enhancements in MOSART primarily developed as part of the Integrated Coastal Modeling (ICoM) project are being combined with outcomes from simulations using the Advanced Terrestrial Simulator (ATS) to improve permafrost hydrology in E3SM critical for an ocean that receives 10% of all global runoff. Finally, we are working to improve the simulation of sea ice through the implementation of landfast sea ice and wave-ice coupling. In this talk, we will present the first results from our baseline simulations, highlight the work of our postdoctoral fellows, and illustrate how our developments contribute to and benefit Arctic research of the RGMA and MSD programs.