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Frontal-scale air-sea interactions along the Gulf Stream simulated by a convection-resolving/eddy-resolving coupled regional climate model

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By coupling a convection-resolving two-way nested (up to 3km) Weather Research and Forecasting model (WRF) with an eddy-resolving (9km) Regional Ocean Modeling System (ROMS), we investigate air-sea interactions between winter storms and warm SST front along the Gulf Stream. The high-resolution numerical simulations provide new insights into coupling processes at frontal-and meso-scales in the Gulf Stream extension region. The model simulates strong ascending motions along the Gulf Stream front extending from PBL to mid troposphere with an astonishing footprint of Gulf Stream meanders and associated oceanic mesoscale eddies. These events occur intermittently and interact strongly with winter storm systems propagating through the region. The result suggests that the presence of the warm Gulf Stream front is only a necessary condition, but not a sufficient condition for strong air-sea interactions. We explore mechanisms governing the intermittent air-sea coupling by conducting a series of coupled model simulations.