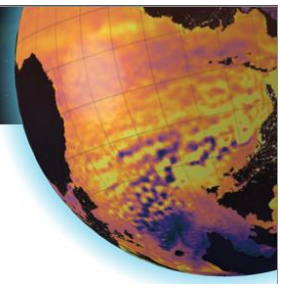

One-way and Two-way Coupling Surface Currents to Wind Stress over the Gulf Stream

The ocean and atmosphere interact both thermodynamically and dynamically at the air-sea interface. The atmosphere responds to changes in the sea surface temperature and ocean surface velocity, while the ocean is forced by atmospheric heat and momentum fluxes. The thermodynamic interactions are routinely included in numerical model simulations; however, the dynamic interactions, specifically the coupling of ocean surface currents with atmospheric winds, are less often included. As discussed by previous studies, dynamically, the atmospheric wind stress should be determined based on the relative surface wind speed as opposed to the absolute surface wind speed. The relative surface wind speed is computed as the absolute surface wind speed minus the surface current velocity. For this study, we show results from simulations that include the current coupling in both an ocean-only model and in a coupled atmosphere-ocean model. We focus our evaluations on the Gulf Stream extension region using the Navy Coastal Ocean Model (NCOM) for the ocean-only simulations and the Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS) for the coupled atmosphere-ocean simulations. We show that including the coupling of surface currents to wind stress in both the ocean-only and the coupled atmosphere-ocean model simulations is found to lead to a general reduction in the surface currents and wind stress. This is also found to have further implications on the primary and secondary circulations within the upper ocean, as well as throughout the atmosphere.

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