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Strongly Coupled Assimilation of a Hypothetical Ocean Current Observing Network within a Regional Ocean-Atmosphere Coupled Model: An OSSE Case Study of Typhoon Hato

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The forecast of tropical cyclone (TC) intensity is a significant challenge. In this study, we showcase the impact of strongly coupled data assimilation with hypothetical ocean currents on analyses and forecasts of Typhoon Hato (2017).

Several observation simulation system experiments were undertaken with a regional coupled ocean-atmosphere model. We assimilated combinations of (or individually) a hypothetical coastal current HF radar network, a dense array of drifter floats and minimum sea-level pressure. During the assimilation, instant updates of many important atmospheric variables (winds and pressure) are achieved from the assimilation of ocean current observations using the cross-domain error covariance, significantly improving the track and intensity analysis of Typhoon Hato. As compared to a control experiment (with no assimilation), the error of minimum pressure decreased by up to 13 hPa (4 hPa / 57 % on average). The maximum wind speed error decreased by up to 18 knots (5 knots / 41 % on average).

By contrast, weakly coupled implementations cannot match these reductions (10% on average). Although traditional atmospheric observations were not assimilated, such improvements indicate there is considerable potential in assimilating ocean currents from coastal HF radar, and surface drifters within a strongly coupled framework for intense landfalling TCs.