2025-2026 EOAS Colloquium Series

Exploring feedback mechanisms between the ocean, atmosphere, and sea surface waves at the mesoscale

Mesoscale eddies significantly influence ocean-atmosphere interactions through both direct and indirect feedback mechanisms. Thermal feedback refers to how mesoscale eddies induce spatial anomalies in sea surface temperature, modulating the exchange of heat and momentum between the ocean and the atmosphere and driving local weather variability. In addition to thermal feedback, current feedback plays a crucial role in the energy dynamics of the ocean. This mechanism acts as an energy sink, transferring kinetic energy from the ocean's mesoscale features to the atmosphere, thus reducing eddy kinetic energy by approximately 30% in regions characterized by high mesoscale activity. In the Gulf of Mexico, a region with intense mesoscale dynamics influenced by the Loop Current and the eddies that the current detaches, the current feedback mechanism dampens mesoscale activity by roughly 20%. This energy reduction modifies the detachment statistics of Loop Current eddies, influencing their shedding frequency, size, and lifespan. Such alterations in eddy properties have broader implications for regional oceanic and atmospheric dynamics. Furthermore, mesoscale eddies indirectly impact the generation of sea surface waves. By inducing anomalies in the wind stress field, the current feedback leads to a tendency for increased wave heights. These findings underscore the importance of considering current feedback mechanisms in coupled ocean-sea surface waves-atmosphere simulations to enhance predictions of oceanic and atmospheric variability.

Dr. Marco Larrañaga
Center for Ocean-Atmospheric Prediction Studies
Florida State University

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Location: **EOA 1044**

Contact: **Robert Spencer (rgspencer@fsu.edu), Ming Ye (mye@fsu.edu), & Zhaohua Wu (zwu@fsu.edu)**