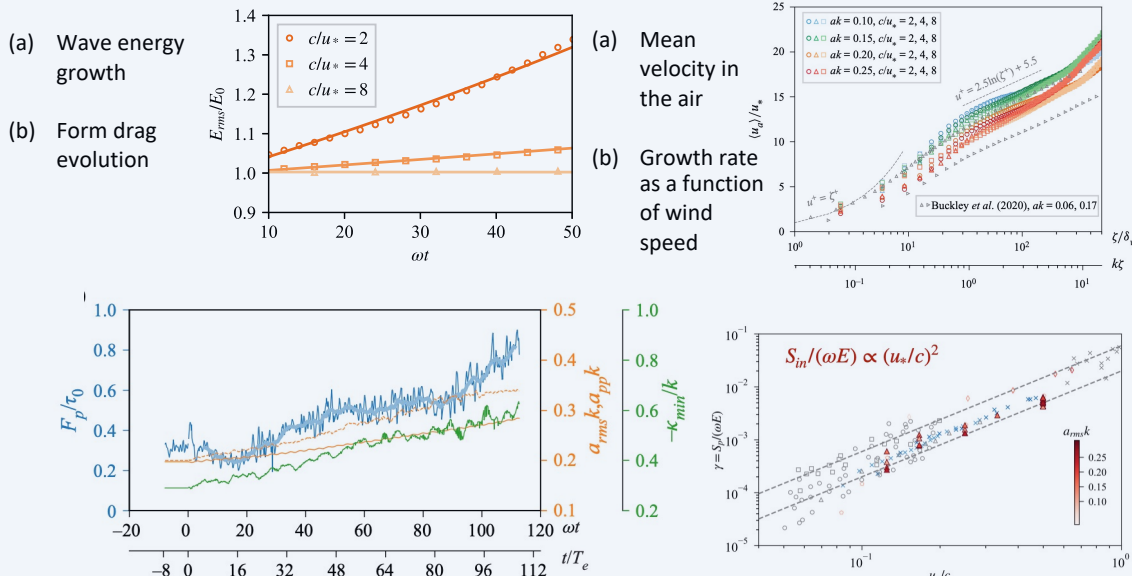
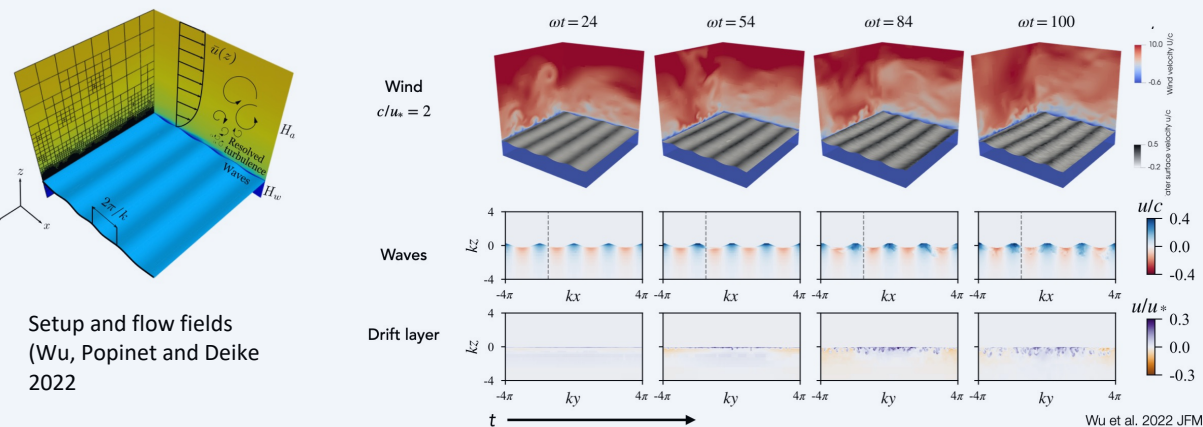


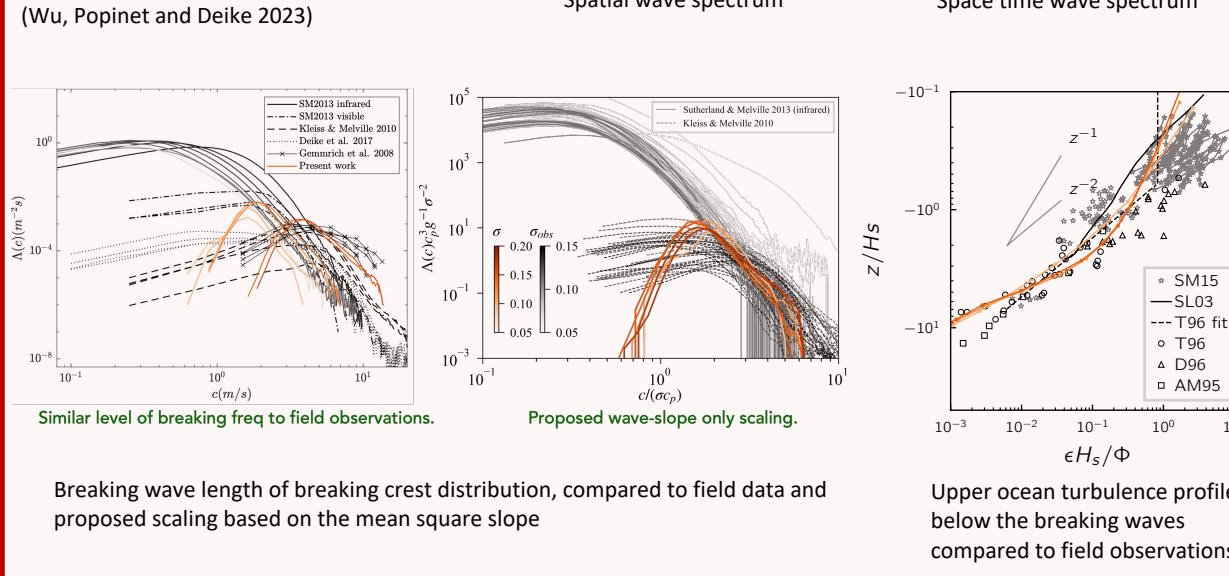
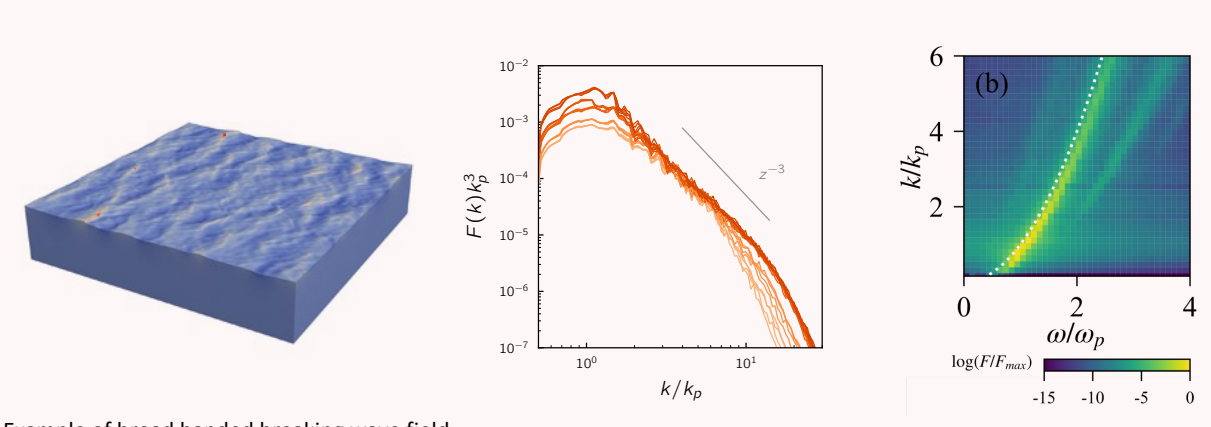


Scope and approach: high fidelity modeling of small scale surface waves coupled with atmospheric and oceanic turbulent boundary layers

Direct numerical simulations of wind-wave-current coupling; including breaking and parasitic capillary waves



Multi-layer modeling for wave dynamics coupled with upper ocean, including breaking waves



Title:

High fidelity modeling of surface waves dynamics and statistics

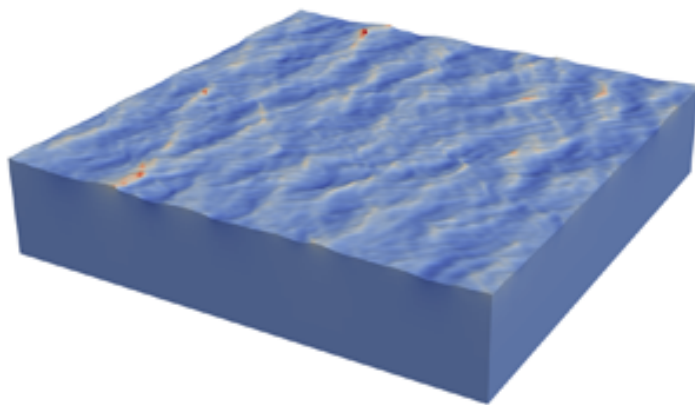
Authors:

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Abstract:

The accuracy of wind retrievals from scatterometers and ocean surface current retrievals from Doppler scatterometers requires to understand the dynamics of small scale ocean waves (called parasitic capillary waves) riding on longer gravity waves. The lack of direct measurements or detailed knowledge of gravity-capillary wave phenomenology, such as “parasitic” capillary wave generation by breaking waves and modulation by the longer gravity waves, hinders our ability to make physically based geophysical model functions. Part of the challenge in terms of modeling is the large range of scales to be represented, from centimetric capillaries to tens of meters for the carrier gravity wave.

In this project, we aim to develop and perform high-fidelity modeling of the full non-linear dynamics of the short capillary waves riding on top of larger gravity waves, forced by realistic turbulent wind. We will present two modeling approaches, relying on novel algorithm to probe the physics of capillary waves interacting with longer gravity waves, wind and current, focusing on i) the dynamics of gravity-capillary waves forced by turbulent wind of various intensity and ii) characterize the distribution of breaking waves and parasitic capillary waves for a wide range of realistic sea-states.



*Figure 1: Illustration of the modeling of a multi-scale ocean wave field including breaking waves. The surface wave colors indicate the speed of the underlying wave, with red areas corresponding to wave breaking regions. Box size is 200m, with resolution down to 20cm.*