OBSERVATIONS OF WAVE BREAKING STATISTICS

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Abstract. Wave breaking modulates fluxes of mass, momentum, heat and energy between the atmosphere and the ocean. Despite its importance, progress in better understanding this phenomena is impeded by the fact that breaking is a two-phase turbulent unsteady process that is intermittent in both space and time, making it difficult to observe. Traditionally, breaking statistics have been defined as the fraction of the ocean surface covered by whitecaps, estimated from still photos or video imagery. A more general framework proposed by **[1]** is to characterize wave breaking kinematics by defining the wave breaking distribution, $\Lambda(\mathbf{c_b})$: the average length of breaking crests with speed $\mathbf{c_b}$, per unit surface area. The utility of Phillips's approach is that the spectral moments of the distribution yields important physical variables, such as the wave breaking induced mean currents, air entrainment and the energy dissipation by breaking. In this work, we review the state of the art of observations and applications of wave breaking statistics over a broad range of environmental conditions, including near an ocean submesoscale front, where breaking effects may be particularly pronounced. Technical challenges (e.g. georeferencing, wave breaking kinematics characterization through optical flow and other methods etc.) are discussed; we present a novel open-source code capable of computing wave breaking distribution, $\Lambda(\mathbf{c_b})$, for a broad range of environmental conditions.

References

1. O. M. Phillips, *Spectral and statistical properties of the equilibrium range in wind-generated gravity waves*, J. Fluid Mech. **156** (1985), 505–531.

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