An attempt to unify wave breaking measurements formalism

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This work is part of the DiMe project, a collaborative initiative lead by France Energies Marines and aiming to provide a better characterization of the extreme sea state with a focus on their wave breaking properties for the extreme design of Marine Renewable Energy converters (floating/fixed offshore wind turbine, wave energy converters, floating tidal turbine, Thermal Energy plants).

Two main approaches have been developed to quantify the wave breaking statistics. The first one is based on the estimation of the breaking probability or rate (Q) measured at a single location in the ocean. The main drawback of this method lies in the difficulty to assign the wave breaking events to a given wave scale. To go around this difficulty, Phillips (1984) introduced the concept of spectral density of breaking crest length per unit area of ocean, Λ. This quantity is in theory easily observable from image of videos of the sea surface and allows for a simple spectral decomposition of the breaking event. Indeed, it is assumed that the breaking their velocity can be related to the phase speed of the underlying wave. Most of the theories and wave breaking statistics parameterizations fall in the first framework because they are based on wave properties accessible from elevation signal collected at a single point. However, because of the development of new detection method based on video (including stereo-video) most of the wave breaking observations fall and will fall in Phillips's framework.

Here we will discuss how the two frameworks can be connected. Illustrations will then be presented of validation from wave breaking statistics parameterizations with wave breaking observations coming indifferently from the Q or Λ frameworks.