Abstract: The HIGHWAVE project (2019-2025) is primarily on wave breaking. The major novelty during the first half of the project has been the experimental campaign with a smart boulder. The data, obtained by altering the breaking position of a wave impacting a vertical cliff, have demonstrated the influence of wave-impact mode (aerated, breaking or sloshing) on the displacement of clifftop boulders. This experimental campaign has shown the range of wave focusing positions most conducive to boulder movement and the range of displacement values we may expect in laboratory experiments. The absence of multiple repeated tests and the inability to fully quantify scaling effects mean that future work will firstly seek to reliably extrapolate these laboratory boulder displacement measurements to the real-world scale by quantifying pressure scaling errors using large scale tests, carrying out a larger number of repeated tests, and obtaining frictional similarity between prototype and laboratory scales. Additionally, a comparison between the importance of the wave-breaking position with the significant wave height and peak wave period should be carried out.

At the beginning of the project we have been going back and forth between what one would like to measure to better understand wave breaking and what can be realistically measured in a hostile environment. The real potential impact of our results will be the degree to which they are able to describe real oceanic free surface profiles in a sea state where
breaking occurs. However, although we have been able to access a range of data sets from wave buoys, ADCPs, radars, stereo vision, we have been surprised to note the lack of reliability of measurements of breaking wave events recorded in a given measurement time series or image as measurements hit technical recording limits or generate artifacts in the data. Indeed, we have come to realize that both the quality of the data and the sophistication of data analysis of existing wave measurements from sensors are based on decades-old technologies and methodologies and are unsatisfactory for the detailed study of breaking waves.

Several theoretical results have been obtained as well: they range from new limiting configurations for surface waves to new links between superharmonic instability and wave breaking. Interesting results on wave forecasting and on the effect of rain on waves will also be presented.

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