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Field and video observations of morphological change under consecutive storm events (ECORS Truc Vert'08)

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Morphological changes occurring over short and long temporal scales remain a major challenge in nearshore research. Because of the expected rise in mean sea level and storminess increase, beach response to changing wave conditions is of key interest to coastal managers. Current numerical models of beach change have limited predictive skills and the need to collect field observations to gain insight on processes determining beach response is widely acknowledged. A field experiment was performed in 2008 at Truc Vert, a macrotidal beach on the southern part of the French Atlantic coast. The experiment involved scientists from 6 countries (for a total of 16 institutions) and measurements of waves, currents, sediment transport and morphological changes were collected for a period of 6 weeks. We here focus on the analysis of morphological changes that occurred on the beachface and intertidal area during the experiment. Bed levels over an area spanning about 800 m in the alongshore direction were monitored daily using a DGPS system mounted on an ATV while the lower part of the swash zone was surveyed on foot. Video observations were collected using a 2-camera system deployed on a tower on top of the dunes and provided observations of shoreline and underwater sandbar position. During the field experiment, the beach experienced 2 major storms (offshore significant wave height above 5 m) as well as a period of time when offshore wave height was constantly around or above 3 m (average annual wave height at this site is 1.36 m) for a period of 10 days. Morphological response to storms and subsequent recovery patterns varied in both the alongshore and cross-shore direction and appear to be strongly influenced by the angle of wave approach and pre-existing morphological conditions of the beachface and the intertidal sandbar. Our analysis shows that the response of the upper intertidal part of the beach was very different between the three storms. In particular, whereas the first storm, with Hs up to 8 m, resulted in a rapid decrease in undulating patterns, the second storm of less intensity but similar duration resulted in an increase in undulating patterns. Finally, the last period associated with energetic waves covering 15 consecutive days resulted in an increase in undulating patterns up to the 3 m contour level. Generally, as described in the conceptual model of beachface evolution a decrease in undulating patterns is associated to increasing wave conditions whereas increase in undulating patterns is associated to decreasing wave conditions. This conceptual model does not seem to be appropriate for the fast changes occurring as a result of consecutive storm events. This type of behaviour is also concomitant with the growth and alongshore migration of features we term "sand-waves". A bulge of sediment, the sand-wave, is present at the shoreline already before the first storm. Over time, this feature tends to grow in size and migrate, and its dynamics, clearly coupled to the intertidal sandbar, affect the large-scale sediment budget.