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Recent major meteorological events like Katrina (2005) or Xynthia (2010) were at the origin of erosion periods, overwash phenomena and also breaching processes in the coastal shore.Suchstorm events have caused flood damage with disastrous consequences. The associated hydrodynamic and morphological phenomena which modify the beach and coastal dunes morphology during storm events are still not widely enough known to be able to evaluate the level of protection offered by this natural defense system.

In this study we focus on the processes which contribute to sand dune systems destruction/breachinginduced by storm events. These processes are linked to the structure type and morphology of the coastal shore and the hydraulic loading (due to tides, waves and surges) which is exerted on it.To investigate the morphological damages on the coastal dune system induced by the different hydrodynamical and morphodynamical processes, we use the X-beach morphodynamical model (Unesco-IHE, Delft University and Deltares, Roelvink et al, 2009).X-beach solves short wave energy, flow and long wave propagation, sediment transport and bed update.This model is applied on a French site (Atlantic coast) where dune breaching has been observed during the Xynthia storm event (2010). After a comparison with observations for this event, a sensitivity study of the coastal dune behavior is done regarding: the hydraulic forcing, the sediment transport parametrisation ((resistance to erosion (McCall et al, 2010), dry and underwater bed slope for avalanching,…), the contribution of longshore processes and wave-current interactions. This leads to a qualitative and quantitative estimation of the different possible answers from the coastal shore tackled in that study to storm events.Finally some thresholds linked to the morphological answers of the studied dune system, such as sediment transport, dune retreat or breach initiation, are proposed. These thresholds are compared to the criteria defined by Donnelly (2006) to predict cross-shore profile response to overwash event.