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Breaking of storm waves on sand and reef zone in the Lesser Antilles Arc

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The most part of the exposed coastal zone of the Lesser Antilles Arc are composed by sand and coral reef. The high frequencies of passage of cyclones near these islands and anticyclone's swell subject them to waves of large amplitude. These waves are 4 to 5 times lager to the normal conditions. The weak slopes observed on these zones are particularly sensitive to this type of waves and cause the process of surfing. The mode of dissipation of these waves influenced the run-up and the floods on the coast. The surf zones are situated in 5 in 20 meters of the line of coast. A displacement of sea water towards the coast line is provoked by the breaking of the waves. These quantities of water are held by the particularly bathymetry of these islands and provoke a raised of the sea level. The propagation of the waves are allowed by the sea elevation in the surf zone

In the evaluation of the marine risk in the Lesser Antilles Arc, a model of sea state forecast are developed in the Laboratory of Geosciences and Energy (LaRGE) in the French West Indies and French Guiana University (Guadeloupe , FWI). This forecast model is based on the coupling of several numerical models. WaveWatch III and SWAN are used for the wave propagation on large and small sectors. An ocean circulation model based on POM is used to evaluate the sea current and the sea level.
To improve the forecasts on the exposed coast, in the zone included between the surf and swash, the sea elevation induced by the large amplitude wave are particularly studies.
The numerical model of wave propagation near the coast SWAN is used to determine the sea state before the surf zone. The dissipation and the breaking of the large amplitude waves are studied with the spectral values give by SWAN and the local conditions (bathymetry, sea level, slope, bottom friction).

During the months of November and December 2009, several large amplitude waves, coming from the North Atlantic Ocean, impact the west coast of Guadeloupe. The waves are produced by the powerful North Atlantic anticyclones. The main consequences were a sea elevation, flood on several sites, sandbank and blocking of mouth river. The western site of Grande Terre Island in Guadeloupe, Pointe des Chateaux in Saint François city is particularly studied to determine the limit of the safety conditions for the users.
Some ground observations are made to improve the precision of the bathymetry of this spot and to determine the nature of the bottom (sand, reef or the both). The simulation of the wave propagation and the wave breaking are compared with the ground observations.
The wave breaking was filmed on this spot. The geometry of waves and its variations during this phase are characterized and use to improve the numerical model. The precision of numerical model and its validity are discussed.