



Coastal flooding events on the French coast of the eastern English Channel: the result of a combination of meteorological, marine, and morphological factors

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On account of increasing inhabitation and development of coastal areas, the economical stakes are high for forecasting and prevention of coastal flooding risk. Because of its exposure to prevailing Westerlies, morphological, and topographic features, low coastal areas on the French coast of the eastern English Channel are particularly sensitive to this natural risk. This sensitivity, that has always characterized this study area, is becoming worrying to politicians and inhabitants. The study aim is to identify, from 1949 to 2010, the possible increase of frequency and intensity of these meteorological and marine events, and their characteristics for forecasting objectives.

The chosen approach is made up of three elements:

1) An analysis of strong west wind over the last decades has been implemented from Meteo-France data of Dieppe, reliable regional meteorological station. Beyond multi-annual random fluctuations, we have noticed a decrease in frequency and intensity of strong winds traditionally involved in flooding events.

2) An analysis of past events has been carried out from many information sources to warrant the accuracy of statements and their exhaustiveness. Thanks to this database, the main results are: i) the absence of increasing trend about frequency and intensity of coastal flooding events; ii) the cartography of coastal flooding risk for each urbanized area; iii) the definition of wind and tide level thresholds (7 m/s and 8.49 m at Dieppe) above which there is flooding.

3) A characterization, on the synoptic scale, of meteorological conditions ending in flooding has been performed. In matching this piece of information with the past events inventory, we have identified: firstly the two major types of low pressure trajectories that generated overflowing, so the two main atmospheric circulations prone to flooding, and secondly the fundamental meteorological aspect of the high north-west pressure gradient (≥ 20 hPa from "Pointe du Raz" (France) to Cromer city (U.K.)) of these flooding events. Frequency of this particular pressure configuration in the English Channel does not highlight any significant trend during the last century.

Beyond tide level and wind (speed, direction) thresholds, another factor explains coastal flooding events. This is the matter of atmospheric cold front during high tide, observable in 70 % of coastal flooding events in the eastern English Channel.

Analysis of these coastal flooding events cannot be restricted to simple meteorological and marine conditions during overflowing by the sea. This work emphasizes the need for longer analysis period. It is important to encompass the possible beach "preparation time" (lowering of the beach profile) by meteorological and marine conditions for a few days or weeks before flooding event. This "preparation time" may be short: 48 hours of strong winds (> 8 m/s) may be sufficient to shape a beach profile prone to overflowing.

Coastal flooding is the result of a combination of factors from various time and space scales, which goes over the simple combination of extreme sea-level and strong wind perpendicular to coast.