An early warning scheme to detected swell at Brazilian Coast associated to intense wave systems

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Abstract

The Brazilian Coast receives wave systems (WS) generated by extratropical cyclones (EC) along almost its entire coast. Some ECs develop near the coast over South Atlantic and generated WSs achieving the Southern Brazilian Coast with Significant Wave Height (H_s) higher than 3m; others ECs develop faraway, and the WSs achieve the coast with small H_s , but very high flux of energy P, defined by $P = 0.5 \times H_s^2 * T_a$ (in kW/m), where T_a is the average period of the WS. In general these energetic swells receive less attention from the operational warning services, but they can cause flood at the coastline because the H_s can enhance when the WS is propagating over shallow water.

In this research the patterns of the most energetic inciding swells on the Brazilian Coast are described. The cases are selected from a WAVEWATCH hindcast for a 31-years period forced by the CFSR wind field with 1 hour and 0.3125° resolutions. The cases are detected by a rather practical and efficient procedure, consisting in: • decompose the spectra produced by at WAVEWATCH at 61 sites around the Brazilian Coast in WS;

• for each WS compute P and the Potential H_s (defined as the H_s corresponding to P for a constant T_a);

• decompose the Potential H_s into the parallel and perpendicular directions to the coast;

• evaluate the Potential H_s strength by ranking it according to the probability distribution produced by the long term WAVEWATCH simulation.

Many WSs generated at North and South Atlantic are detected, and their patterns are described in this research. Additionally, the method is illustrated by applying it in the case 15/January/2013, when an intense WS generated at North Atlantic arrived at North Brazil coastline with period greater than 15s and several damages were reported. This procedure provides a useful method to classify a WS, which can be used by the operational warning service.