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Wind waves associated to the Caribbean low-level jet

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The atmospheric dynamics over the Caribbean Sea involve energy transfer between processes of different spatial and temporal scales, from the microscale to the mesoscale. The relevant events in the Caribbean that modulate the regional climate are the Caribbean low-level jet (CLLJ), the easterly waves (EW) and the tropical cyclones (TC). Two relative maxima of this CLLJ have been identified: the first one in February, with more than 10 m/s and the second one in July, with values greater than 15 m/s in its core, for the rest of the year it has been observed that maintains a persistence without migration, which generates significant ocean waves reaching the Caribbean coasts of Central America and Mexico. On the other hand, EW are observed between May and November, its winds are weak, but under conditions not yet fully understood intensify, generating TC with winds greater than 250 km/h.

One of the main impacts of the persistent or intense surface winds in the Caribbean is the ocean waves, which, due to the effects of the Greater and Lesser Antilles, maintains only local components, that is, the Atlantic Ocean waves do not fully penetrate the Caribbean Sea, as these islands act as obstacles.

In this work, the seasonal variability of the simulated wind waves is analyzed, associating it with events such as the CLLJ, EW and TC. The WAVEWATCH III model was implemented in a nested grid system; the global grid with a spatial resolution of 0.5° and the regional grid with resolution of 0.1° in the Caribbean Sea. The spectral frequency range used was 0.0412 s-1 to 0.4060 s-1, with 24 frequency bands and 36 spectral directions (10° resolution). WAVEWATCTH III were performed for the period 1979 to 1989, forced by CFSR wind data (Climate Forecast System Reanalysis) and processed for two Caribbean regions: the jet entrance (CLLJ acceleration area) and the jet exit (CLLJ deceleration area), analyzing the effect of this great spatial variability. The temporal and spatial distribution of wave height and its peaks frequencies was calculated, its annual cycle and its variability. Monthly average wind wave simulations are discussed, including extremes: 10th and in the 90th percentile and its seasonal variability. The implications of the impact are discussed in terms of the regional distribution of the observed wind and coastal wind waves, including extreme events, its seasonality and its annual and interannual variability.