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On the early stages of wind wave under non-stationary wind conditions.

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Most efforts in the study of the generation and evolution of wind waves have been conducted under constant wind. The balance of the transfer of different properties has been studied mainly for situations where the wave has already reached the equilibrium with the constant wind conditions. The purpose of these experiments is to study the early stages of the generation of waves under non-stationary wind conditions and to determine a balance in the exchange at the air-water interface for non-equilibrium wind conditions. A total of 16 experiments with a characteristic acceleration and deceleration rate of wind speed were conducted in a large wind-wave facility of Institut Pythe´as (Marseille-France). The wave tank is 40 m long, 2.7 m wide and 1 m deep. The air section is 50 m long, 3 m wide and 1.8 m height. The momentum fluxes were estimated from hot wire anemometry at station 7. Also, the free surface displacement was measured along the channel tank at 11 stations where resistance wires were installed, except at stations 1, 2, and 7 where capacitance wires were installed. The sampling frequency for wind velocity and surface displacement measurements was 256 Hz. During experiments the wind intensity was abruptly increased with a constant acceleration rate over time, reaching a constant maximum intensity of 13 m/s. This constant velocity remains some time until the intensity is again reduced suddenly. We observed that wind drag coefficient values are higher for the experiments that present the lower acceleration rate; some field data from previous studies is presented for reference (Large and Pond 1981; Ocampo-Torres et al. 2011; Smith 1980; Yelland and Taylor 1996). The empirical grow curves show that in the experiments with lower acceleration, the wave field is more developed, showing higher dimensional energy and lower dimensional peak frequency. In the evolution of the spectral wave energy, there is first high frequency energy saturation, followed by a downshift of the wave-spectral peak frequency. Under the same wind speed, these two processes are more developed when the acceleration is low. Therefore, the acceleration rate has a direct impact in controlling how the energy and momentum transfer take place from the wind to the wave field. This work represents a contribution of RugDiSMar Project (CONACYT 155793), and of project CONACYT CB-2015-01 255377.