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On the effect of accelerated winds on the wave growth through detailed laboratory measurements.

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The possible influence of accelerated winds on air-water momentum fluxes is being studied through detailed laboratory measurements in a large wind-wave flume. Wind stress over the water surface, waves and surface drift are measured in the 40m long wind-wave tank at IRPHE, Marseille. While momentum fluxes are estimated directly through the eddy correlation method in a station about the middle of the tank, they provide information corresponding to rather short non-dimensional fetch not previously reported. Wave evolution along the tank is determined through a series of wave gauges, and the wind-induced surface drift is obtained at one of the first measuring stations at the beginning of the tank. At each experimental run very low wind was on (about 1m/s) for a certain period and suddenly it was constantly accelerated to reach about 13 m/s (as well as 8 and 5 m/s during different runs) in about 15 sec to as long as 600 sec. The wind was kept constant at that high speed for 2 to 10 min, and then suddenly and constantly decelerate to 0. Data from the constant high winds provided us with reference equilibrium conditions for at least 3 different wind speed. We, nevertheless, focus in the recordings while wind was being constantly accelerated expecting some contribution to the understanding of gustiness, the implied wind wave growth and the onset of surface drift. Wind-wave growth is observed to lag behind the wind stress signal, and furthermore, a two regime wind stress is noticed, apparently well correlated with a) the incipient growth and appearance of the first waves and b) the arrival of waves from the up-wind section of the tank. Results of non-dimensional wave energy as a function of non-dimensional fetch represent an extension of at least 2 decades shorter non-dimensional fetch to the wave growth curves typically found in the literature. The linear tendency of wave growth compares very well only when wind is reaching its maximum, while during the accelerated wind period a lower non-dimensional wave energy is found. Details on the onset of wind-induced surface drift at the beginning of the tank will be addressed within the context of accelerated wind conditions. This work represents a RugDiSMar Project (CONACYT 155793) contribution. The support from ANUIES-ECOS M09-U01 project, CONACYT-187112 Estancia Sabática, and Institute Carnot, is greatly acknowledged.