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Stress above wind plus paddle waves: modelling of a laboratory experiment

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A Wind-Over-Waves Coupling (WOWC) model is used to simulate a laboratory experiment and to explain the observed peculiarities of the surface stress distribution above a combined wave field: wind plus monochromatic paddle waves. Observations show the systematic and significant decrease in the stress as the paddle wave is introduced into the pure wind waves field. With the increase of the paddle wave steepness the stress level returns back to the stress level characteristic for the pure wind waves, and with further increase in the steepness rapidly grows. The WOWC model explains this peculiarity of the stress distribution by the fact that the paddle waves significantly damp the wind waves in the spectral peak. The stress supported by these dominant waves rapidly falls when the paddle wave is introduced, and this decrease is not compensated by the stress induced by the paddle wave. With further increase in the steepness of the paddle wave the stress supported by dominant wind waves stays at the low level, while the stress supported by the paddle wave continue to grow proportional to the square of the steepness, and finally overcomes the stress level characteristic for the pure wind waves field.