Geophysical Research Abstracts
Vol. 12, EGU2010-1273, 2010
EGU General Assembly 2010

Measurements of the airflow in the viscous sublayer above wind-waves

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The viscous sub-layer above the wind water waves plays a crucial role in the air-sea fluxes of momentum providing important boundary conditions for ocean atmosphere interactions. During the mechanical energy transfer from the wind to the waves, one part of the energy contributes to amplifying the waves through the form drag, whilst the other part contributes to the drift current through the viscous stress.
The viscous stress can be determined from wind profile characteristics in the viscous layer. We present an original experimental investigation of the determination of the air flow characteristics within the first millimeters above wind waves. The experiments were conducted in the large IRPHE air-sea interaction in Luminy France.
An electromechanical device-diver facilitates the passing of a hot wire anemometer through the viscous sub-layer which allows the measurement of shear stress at the surface. These measurements provide a thorough description of the local structure of the wind in all the zones very close to the water surface.
We show that the viscous stress's contribution to the total stress is a decreasing function of the wind speed and of the dominant wave slope. We also show that the viscous stress presents modulations of intensity along the wave profile. These modulations depend on wave slope and wave age.