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Measuring momentum transport directly at the air water interface from active infrared thermography

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In this contribution, we present a novel technique for measuring the wind induced momentum transport from air to water, based on active thermography. The viscous shear stress is measured directly in the viscous sublayer. For this technique, a patch of water is heated up by a CO_2 laser. Due to the finite penetration depth of IR radiation of both the laser and that of the IR camera, the heated water parcels deform due to the velocity profile in the viscous sublayer. This velocity profile can be approximated linearly. From this assumption and from the knowledge of the penetration depth of IR radiation, the intensity change and deformation of water parcels can be modeled. Using novel digital image processing techniques, an accurate velocity field at the water surface can thus be measured, as well as the viscous shear stress. In this presentation, this novel technique will be detailed and laboratory measurements will be presented. This non-invasive technique is equally applicable in the laboratory as it will be in the field.