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Scintillometry: a new tool to retrieve sensible heat fluxes over sea and lakes

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Direct measurements of the sensible and latent heat fluxes over water (sea, lakes) are still challenging due to platform and instrumental constraints (platform motion, flow distortion, high frequency observations). Obtaining accurate fluxes imply either carefully checking experimental conditions and applying numerous rows of corrections, or measuring on a stable platform, which is tremendously expensive at sea. In 2009, we experimented recording sensible heat fluxes over the Thau lagoon (South of France) for a few months using an indirect method: a very large aperture scintillometer (XLAS, Kipp & Zonen) was providing continuous measurements of the fluctuations of refraction index of the infrared light along a 4800 m optical path.
Scintillometry has been widely used during the last decades over various surfaces mostly for hydrology purposes (irrigation monitoring over cultivated lands). The fluctuation of the refractive index may be converted into temperature and humidity structure functions (2 wavelength scintillometry) or only temperature structure function (one wavelength, our case here). From this temperature structure function, the sensible heat flux averaged over the scintillometer path may be assessed provided surface meteorological measurements are available. As a major advantage in such an aquatic environment, this method does not introduce any flow distortion and is independant on the platform motion, as the instruments can logically be installed on the coast, only robust meteorological station on buoy is necessary. This Thau lagoon experiment being the first scintillometry operation over a lake, the validity of the method has been checked using a collocated eddy-covariance station. We present here the experiment, the scintillometry software developments made to adapt the processing to the air-water conditions, and the results - sensible heat fluxes in comparison with eddy covariance and bulk heat fluxes. The agreement between the sensible heat flux measured by scintillometry, estimated by eddy covariance and computed from a bulk method (using the reference COARE 3.0 software) is very good over the 4 months of measurements.