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Scintillometry, Eddy Covariance and Remote Sensing for Evapotranspiration Mapping in West-Africa

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Evapotranspiration (ET) mapping from remotely sensed satellite images is critical for water management since the estimation of spatial and temporal ET distributions over large areas is impossible using only ground measurements. A major difficulty for the calibration and validation of operational ET remote sensing algorithms is the ground measurement of ET at a scale similar to the spatial resolution of the remote sensing image.

The spatial length scale of remote sensing images covers a range from 30 m (Landsat) to 1000 m (MODIS). Direct methods to measure the latent heat flux (W/m2) –i.e. the evapotranspiration rate (mm/day) multiplied by the latent heat for vaporization– such as eddy covariance (EC) only provide measurements at a spatial scale that may be considerably smaller than the estimate obtained from a remote sensing method. The Large Aperture Scintillometer (LAS) flux footprint area is larger (here about 1 km^2) and its spatial extent better constraint than that of EC systems. Nevertheless, it is only an indirect method for estimation of ET.

The objective of this contribution is to present our experience with the analysis of ET mapping using ground observations and the Surface Energy Balance Algorithms for Land (SEBAL). Our focus here is especially on the differing spatial and temporal scales of observation methods and the assessment of footprints of measured and modeled ET. Two years of continuous data from LAS as well as EC systems are used for analysis and comparison to modeled estimates of ET using remote sensing. Meteorological and biophysical boundary conditions of West African climate are highly variable between dry and rainy season and lead to seasonal differences in the time series and energy balance closure. This is analyzed with regard to applicability of the different approaches to estimate ET.

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