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Some aspects of the two-wavelength Scintillometer method to measure Regional Sensible and Latent Heat Fluxes

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In the last decade some field experiments have been performed to test the operational applicability of the 2-wavelength scintillometer approach allowing the measurement of sensible and latent heat fluxes on km scales and over heterogeneous terrain. It concerns the combination of a so-called optical scintillometer (OS) operating at a wavelength of about 1 micron and a millimeter-wave scintillometer (MWS). Use is made of the fact that at 1 micron scintillations caused by atmospheric turbulence are primarily due to temperature fluctuations, whereas at millimeter waves also water vapor fluctuations play a role. Recent studies reveal different features of the method, such as the experimental determination of the correlation coefficient between water vapor and temperature, the determination of the path-averaged effective height for slanted paths or non-flat terrain and the effects of non-uniform cross-wind, absorption by water vapor and non-Kolmogorov structures, on the spectrum of the MWS. In first publications on the method the absolute humidity was used to express the water vapor content of air. We found recently that this leads to errors in the latent heat flux, in particular under dry conditions. Moreover, it appears that, mathematically, the method yields two solutions at these dry circumstances, i.e. Bowen ratios greater than 2. Consequently, additional information is needed, such as an estimate of the available energy. We will discuss whether or not the latent heat flux can be determined also with a stand-alone OS and this additional information. Plans for future field campaigns will be discussed.