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Large Aperture Scintillometer measurements above a large green roof to assess the evapotranspiration flux

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The challenges induced by the continuous urbanization and the climate change effects, such as extreme events (e.g. flooding or heat waves) or the intense increase of the urban temperatures (Urban Heat Island), encourage the implementation of Blue and Green Solutions (BGS). These solutions are inspired by the nature, favouring natural process in the cities like water infiltration or evapotranspiration (ET), reducing air temperature during heatwaves events.

Characterize the thermal behavior governing a BGS is necessary to promote their implementation. Consequently, this research studies the energy fluxes –and particularly the evapotranspiration one- of a 1 ha wavy-shape green roof located in Champs-Sur-Marne (France), called Blue Green Wave (BGW). Therefore, a Large Aperture Scintillometer MKI, a CNR4 radiometer and 4 Type K thermocouples were installed on the BGW to measure the sensible heat flux of convection, the net radiation and the heat conduction into the soil substrate. The latent heat flux of ET was deduced from the energy balance.

Each LAS unit was placed on the highest locations of the roof with about 100 m of distance between them. Diaphragms for short-range applications were placed in front of the units. The measurements were conducted on sunny and randomly days during the 2019 summer over an average time period of 7 hours.

It appears that LAS sensible heat flux measurements on completely sunny days follow the net radiation flux trend. However, on cloudy days important flux fluctuations are noticed. Therefore, a sensitivity analysis was carried out to illustrate the significant correlation between the wind and the sensible heat flux during short time periods. In parallel, the heat conduction was analysed through a thermal gradient of temperature and a Fourier analysis demonstrating a poor conduction rate mainly on drier conditions of the BGW.

Finally, the deduced latent heat was compared with the measurements of a dynamic evaporation chamber, confirming a significant over estimation of the latent heat computed from the energy balance. This can be explained by the sum of uncertainties related to each energy flux component, in addition to the restraint conditions of LAS measurement operation on the BGW (application

over the limits of MOST theory). A multifractal analysis to determinate the temporal and spatial scaling behaviour of latent heat flux is ongoing.