Modelling evapotranspiration at the watershed scale using a multi-local approach

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Actual evapotranspiration (ET_a) in semi arid regions is a major component of the hydrological balance, hence, there is a strong interest in spatially estimating it at the watershed scale. Integrated ET_aestimation on heterogeneous watersheds is not straightforward due to a great spatial variability in soil hydrodynamic properties and canopy structure. On the other hand, spatially integrated fluxes can now be continuously measured using the eddy correlation method for sensible and latent heat flux measurements or scintillometers that allow the estimation of the sensible heat flux over there optical path. ET_a is then deduced from the surface energy balance. Both methods measure fluxes integrated over a surface according to a specific "footprint". Many studies have verified and compared those measurements on homogeneous surfaces. However, in composite landscapes, the "footprint" conditions the contribution of each surface component to the total measured flux, and recent work is aiming at defining the measurements reliability over such surfaces. Within the same framework, this paper aims at validating a one-dimensional "multi-local" approach for spatial estimation of ET_a over a heterogeneous watershed with an irregular topography by comparing to eddy correlation and scintillometer measured integrated fluxes taking into account their respective footprints. The study was conducted in the framework of the MOBHYDIC project devoted at observing and modelling all the components of the hydrological balance of a small agricultural watershed. The study site is the Roujan experimental watershed (1 km^2) located near Montpellier, southern France. The main land occupations over this watershed are vineyards, cereals, fallow land and bare soil, forming a complex patch of small fields. In addition to eddy correlation and scintillometer measurements, several net radiometers were installed over different canopies. Additionally, the soil moisture profile evolution of different parcels was measured using the neutron probe method. In a first step, local evapotranspiration fluxes were estimated using a validated one-dimensional water balance approach on the different watershed fields. Second, the footprint areas of each the eddy correlation and the scintillometer measured fluxes were defined, taking into account the topographic irregularity of the terrain. Then, local fluxes were weighted according to the parcel location within the footprint. Finally, the "multi-local" approach was applied by adding up the weighted local fluxes, neglecting lateral fluxes between neighbouring fields, and comparing the sum respectively to eddy correlation and scintillometer measured

fluxes. Results strongly support the validation of the “multi-local” approach for spatial estimation of ET_a on both daily and hourly time steps basis.