



## Estimation of sensible and latent heat fluxes over a hilly agricultural catchment by scintillometry

Rim Zitouna, Laurent Prevot, Mark Rankin M. R. Irvine, Jean-Pierre Lagouarde, Frédéric Jacob, Marc Voltz

### ► To cite this version:

Rim Zitouna, Laurent Prevot, Mark Rankin M. R. Irvine, Jean-Pierre Lagouarde, Frédéric Jacob, et al.. Estimation of sensible and latent heat fluxes over a hilly agricultural catchment by scintillometry. Tübingen Atmospheric Physics Symposium "Scintillometers and Applications", Oct 2013, Tübingen, Germany. hal-02803177

**HAL Id: hal-02803177**

**<https://hal.inrae.fr/hal-02803177>**

Submitted on 5 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## **Estimation of sensible and latent heat fluxes over a hilly agricultural catchment by scintillometry**

Zitouna-Chebby, R. (1), Prévot, L. (2), Irvine, M. (3), Lagouarde, J.P. (3), Jacob, F. (4), Voltz, M. (2)

- (1) *INRGREF, LR GERE, Tunis, Tunisia*
- (2) *INRA, UMR LISAH, Montpellier, France*
- (3) *INRA, UR EPHYSE, Bordeaux, France*
- (4) *IRD, UMR LISAH, Tunis, Tunisia*

Monitoring land surface fluxes is of paramount importance in semi-arid and arid agricultural areas, since vegetation production and water balance are strongly influenced by evapotranspiration. Beside eddy covariance devices, scintillometers allow spatially integrated estimates of the sensible heat flux, a major component of the surface energy balance. Nevertheless, the effect of topography on scintillometer measurements is still under debate.

The experiment was set within the agricultural Kamech catchment, located in the Cap Bon, north-eastern Tunisia [1]. A LAS scintillometer was installed along a 968 meter long transect, perpendicular to the V-shaped valley of the catchment. The above ground altitude of the optical path varied between 2 meters at its extremities and 55 meters in its middle. Scintillometer measurements were conducted from April (maximum of vegetation development) to July 2006 (dry bare soils). Two eddy covariance stations installed on each side of the watershed and located below the optical path provided estimates of the energy balance components at the field scale [2]. Monitoring of vegetation state and soil moisture was conducted on the other fields located around the optical path.

The footprint of the scintillometer measurements was evaluated by integrating the Host and Weill [3] approach along the optical path of the scintillometer. The effect of the distance between the ground surface and the optical path was accounted for following Lagouarde [4]. Spatially integrated estimates of the sensible heat flux provided by the scintillometer measurements were found to be consistent with the local measurements given by the eddy covariance stations, during both vegetated and bare soil periods, respectively corresponding to high and low levels of the latent heat fluxes. Scintillometer estimates of the sensible heat flux were found to be highly sensitive to optical path altitude, calculated over the footprint. Both footprints and altitudes varied strongly with the wind direction.

### References :

- [1] Mekki, I., Albergel, J., Ben Mechlia, N. and Voltz, M., 2006, Assessment of overland flow variation and blue water production in a farmed semi-arid water harvesting catchment, *Phys. Chem. Earth*. 31 (17), pp. 1048-1061.
- [2] Zitouna-Chebby, R., Prévot, L., Jacob, F., Mougou, R. and Voltz, M., 2012, Assessing the consistency of eddy covariance measurements under conditions of sloping topography within a hilly agricultural catchment, *Agricultural and Forest Meteorology*, 164, pp. 123-135.

[3] Horst, T.W. and Weil, J.C., 1992, Footprint Estimation for Scalar Flux Measurements in the atmospheric surface-layer, *Bound. Layer Meteorol.* 59 (3), pp. 279-296.

[4] Lagouarde, J.-P., McAneney, J. and Green, A.E., 1996, Scintillometer measurements of sensible heat flux over heterogeneous surfaces. In: J.B. Stewart, E.T. Engman, R.A. Feddes and Y. Kerr (Editors), *Scaling up in hydrology using remote sensing*. Wiley & Sons, Institute of Hydrology, Wallingford G.B., pp. 147-160.