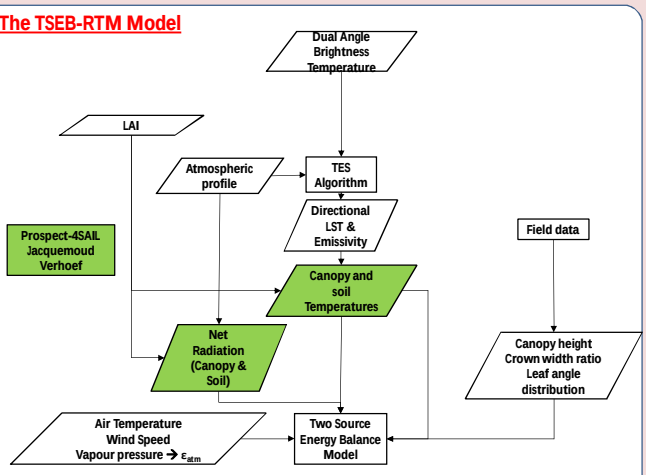
Applying TSEB-RTM on multiangular airborne hyperspectral imagery for evapotranspiration retrieval in a Mediterranean ecosystem at Las Majadas del Tietar Fluxnet site, Spain, and orchard in California.

G. Mendiguren (gorka.mendiguren@cchs.csic.es), H. Nieto, M. Pilar Martín, D. Riaño

Introducction

Two Source Energy Balance (TSEB) and a canopy Radiative Transfer model (4 SAIL RTM) TSEBRTM has been applied to estimate evapotranspiration at Las Majadas del Tietar Fluxnet site in Spain using images acquired by the Airborne Hyperspectral Scanner (AHS) sensor and MASTER. AHS sensor has 80 spectral bands, measuring information from the visible to the thermal regions. MASTER is an airborne sensor that simulates ASTER and MODIS. The airborne flight configuration consisted on three different flights with different configurations. One with overpasses at orientations SE-NW, S-N and SW-NE which produced an overlapped area centered in the Eddy Covariance (EC) tower located in the site which was observed from different viewing angles in 2011. In 2012 the flight configuration was changed to produce a bigger overlap over the EC flux tower and the footprint and repeated with MASTER in California. Simultaneously to aircraft overpass, vegetation samples and spectral measurements were collected on the ground in the study area. Spectral information was collected using an ASD FieldSpec 3 spectro-radiometer.

The TSEB-RTM Model

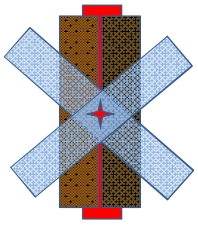


Flights campaigns and configuration and data collection

Flight configuration in 2011

1. Simultaneous field spectroscopy with flight overpass.
2. Vegetation destructive sampling to measure LAI, EWT, FMC and CWC
3. **Portable TDR measurements where destructive sampled was done**
4. White and black target
5. Eddy Covariance flux tower

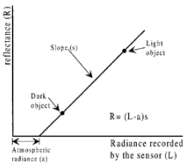
Flight configuration in 2012



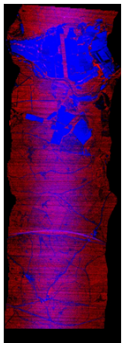
1. Simultaneous field spectroscopy with flight overpass.
2. Vegetation destructive sampling to measure LAI, EWT, FMC and CWC
3. White and black target
4. Eddy Covariance flux tower
5. **Scintillometer**
6. **MASTER flight repeated in an orchard in California with 2 EC flux towers**

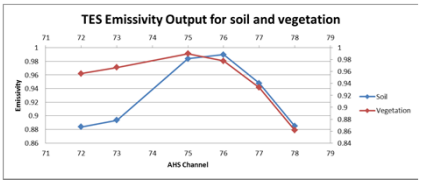
Imagery processing

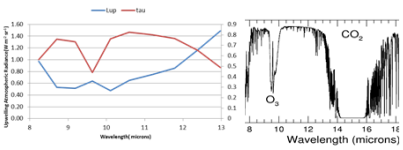
- **Optical domain**
- Using the reference black and white targets located in the field during the flights the "empirical line method" was applied to correct the optical domain region of the images.



- **Thermal domain**
- MODTRAN 5 was used to obtain the atmospheric transmisivity, downwelling sky irradiance and upwelling path irradiance for thermal region correction
- Temperature Emissivity Separation Algorithm (TES) was used to obtain the Land Surface Temperature (LST) and Emissivity at the study site





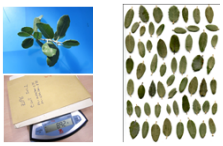


Input parameters for TSEB-RTM from field data

- **TREES**

Leaf Area Index is obtained from Hemispherical photos

Chlorophyll content and leaf spectral signature is measured in the field



Leaf samples are collected by destructive sampling, weighted in the field and scanned in the laboratory for leaf water content

- **Grassland**

Grassland is collected in the field, weighted and stored in zip lockbags. Then samples are scanned and FMC, EWT, CWC and LAI are obtained

Expected results

1. This study will give the opportunity to validate the TSEBRTM model at different ecosystems.
2. The results will be validated at different locations with EC flux towers. Additionally in one of the flights an scintillometer was located over the grassland which allows us to distinguish between grassland, tree and ecosystem fluxes