Monitoring Vegetation Fraction Cover of French Mediterranean Forests for Evapotranspiration and Water Stress Mapping

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***Evapotranspiration* (ET),** which is a fundamental variable of the hydrological cycle, is still not know with precision over forested area in Mediterranean areas. Remote sensing data, that inform on vegetation coverage and meteorological reanalysis can be used to improve our knowledge on the distribution of ET in space and time.

A simple model using remote sensed fraction cover, meteorological data and soil AWC from various source is presented. When considering spatially available information, uncertainties in model inputs (fcover, ETo, precipitation and soil information) strongly impact the simulation of evapotranspiration

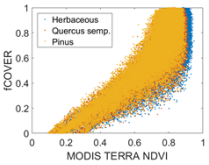
Fraction of Vegetation Cover *fcover*

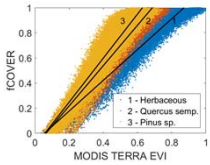
Fcover was obtained from remote sensing data:

1. **Copernicus** fcover products at 1 km (1999-2018) and 300 m (2014-2018). [fcover is estimated from SPOT-VEGETATION and PROBA-V reflectances using neural networks trained on a large amount of ground data (BELMANIP databases)]
2. fcover calculated from **MODIS VI** thanks to a linear relation established on PROSAIL simulations (varying LAI, leaf inclination, leaf chlorophyll, leaf dry matter and leaf water content).

$$f_{cover} = \frac{EVI - EVI_m}{EVI_x - EVI_m}$$

	Leaf dry matter content (g . m^{-2})	EVImin	EVImax	RMSE
Herbaceous	0.003 – 0.011	0.056	0.872	0.065
Quercus illex type	0.020 – 0.025	0.065	0.687	0.077
Pinus alepensis type	0.025 – 0.035	0.059	0.629	0.088



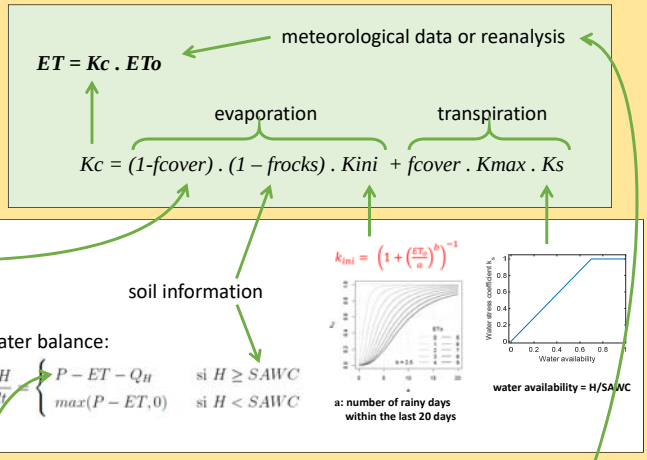


NDVI presents a saturation effect after fcover 0.6

EVI presents linear relations with fcover. They are different depending on leaf dry matter content

ET Model

SimpKcET was developed as a simplified form of the crop coefficient – reference evapotranspiration approach that is classically used for monitoring evapotranspiration and water requirements for agricultural covers (ex: FAO56)



ET: daily evapotranspiration (mm)
P: daily precipitation (mm)
H: water level of the soil reservoir (in mm)
frocks: rocks and stone fraction in the superficial soil layser
ETo: the daily reference evapotranspiration (mm)
Q_H: daily infiltration and runoff (in mm)
SAWC: soil water level at field capacity (in mm)

Precipitation and reference evapotranspiration ETo

ETo calculated with the Penman-Monteith model (assuming albedo 0.2 and rs = 60 m.s^{-1}). Meteorological data from SAFRAN reanalysis (MétéoFrance), ERA5 reanalysis (ECMWF) and MSWEP precipitation product.

Fontblanche experimental site:

Pinus halepensis – Q. illex mixed forest, 20 km east of Marseille, France. 50 % rocks in top soil layers. Maximum available water content around 150 mm.

Puechabon experimental site:

Quercus ilex forest, 35 km north-west Montpellier, France. Soil is characteristics of calcareous epikarst: shallow with a high proportion of stone and rocks in the top layers (75%). Maximum available water content is around 120 mm.

Simulations: from random values of ***Kmax***, ***b***, ***frocks*** and ***SAWC*** around local values (+/- 20% to +/- 100% depending on the level of knowledge), all different ***fcover*** estimations, ERA5, SAFRAN and MSWEP reanalysis data

Results

- mean simulated ET are in good agreement with measurements;
- variability in simulations is mainly driven by rain products followed by ***Kmax***, ***fcover*** and soil maximum available water content ***SAWC***
- ***frocks*** has a strong impact on soil evaporation, whis is particularly visible in winter