Comparison of different methods for estimating the evapotranspiration of a vineyard

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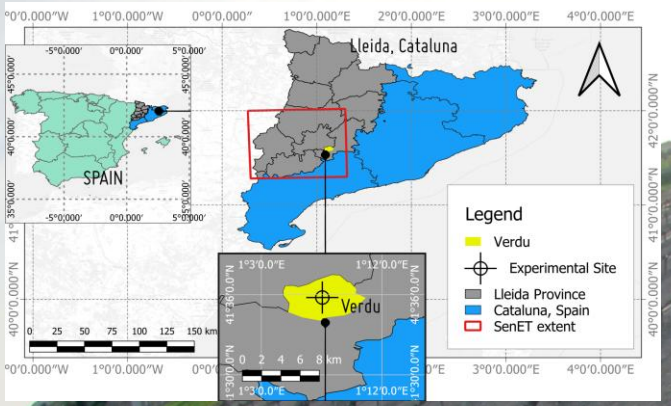
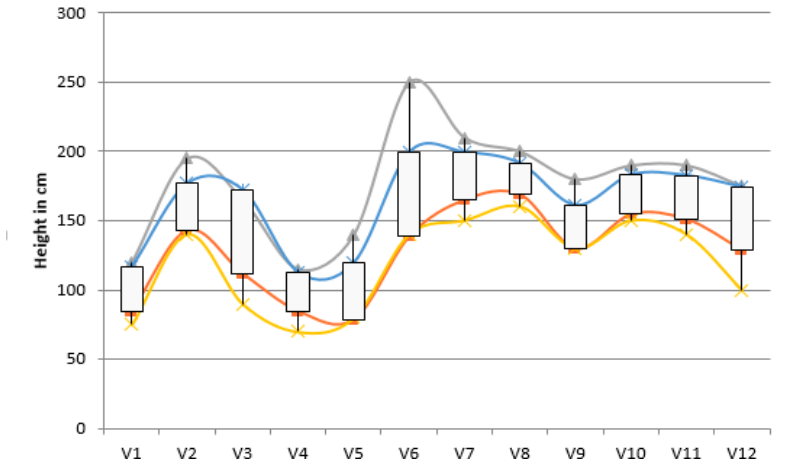
WineEO project



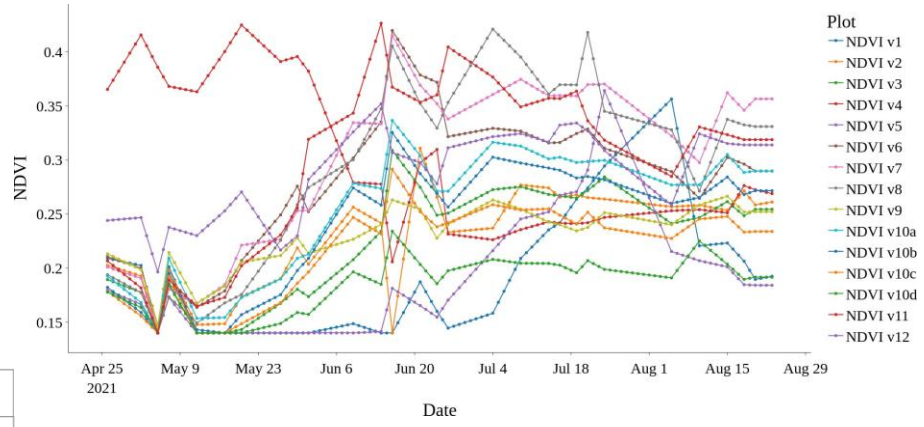
Location	Lon= 1.1 deg, Lat= 41.6 deg
Plot size	4 hectares
Irrigation	Drip irrigation spaced by 75 cm with a water flow rate of 1.6 l/h
Rootstock	Rithler 110
Variety	Tempranillo
Efficiency	12-14 T per plot per season

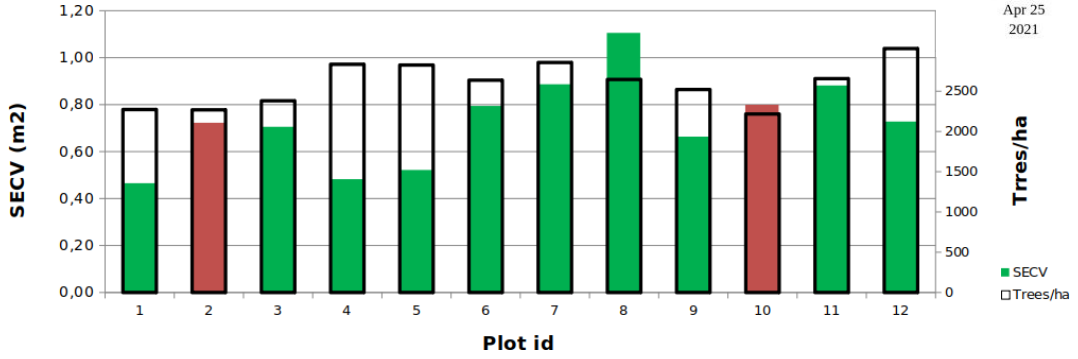
Spatial variability

Canopy height (27 of July 2021)



Mean NDVI (Sentinel-2)

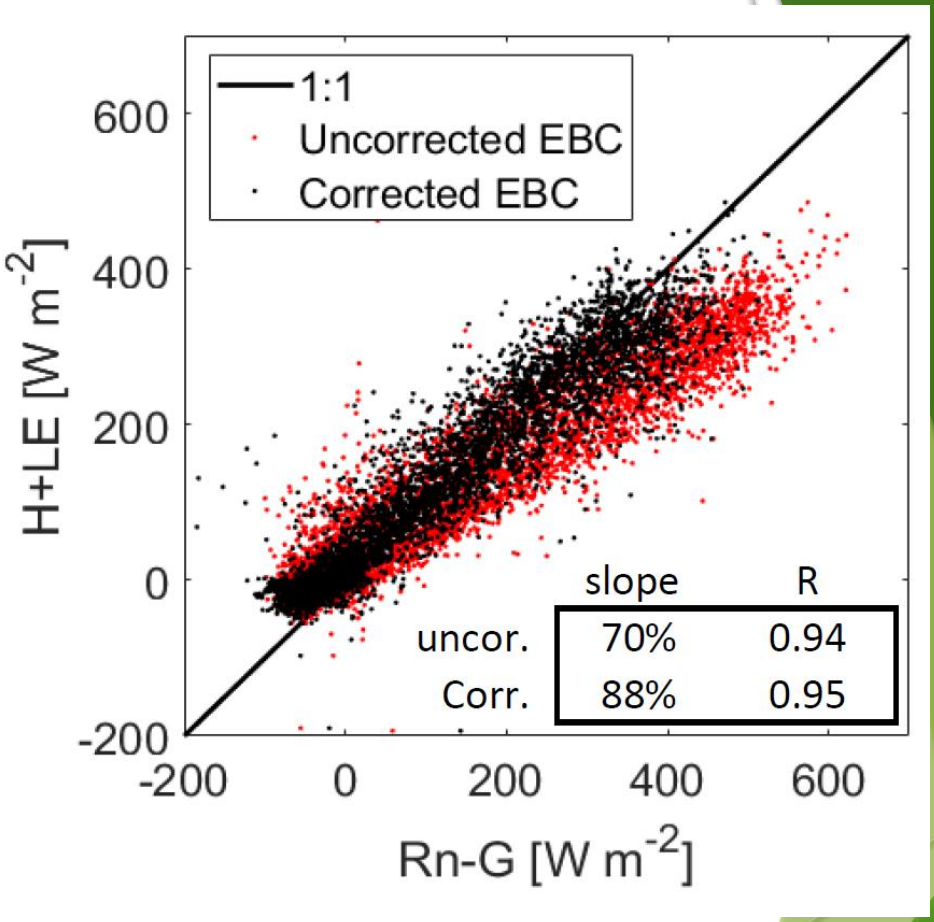




green exposed canopy and trees/hectare (27 of July 2021). Plots 10 and 2 in red correspond to the eddy-covariance station.

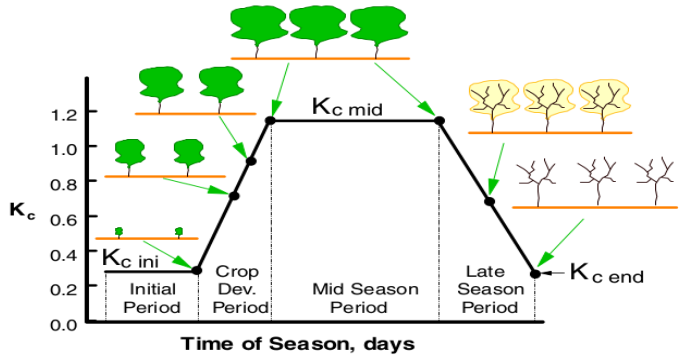
Instrumentation

Energy budget



Corrections applied:
- radiance measurements from the net radiometer
- heat stored in the soil above the heat plate

Methods: NDVI-Kcb based methods



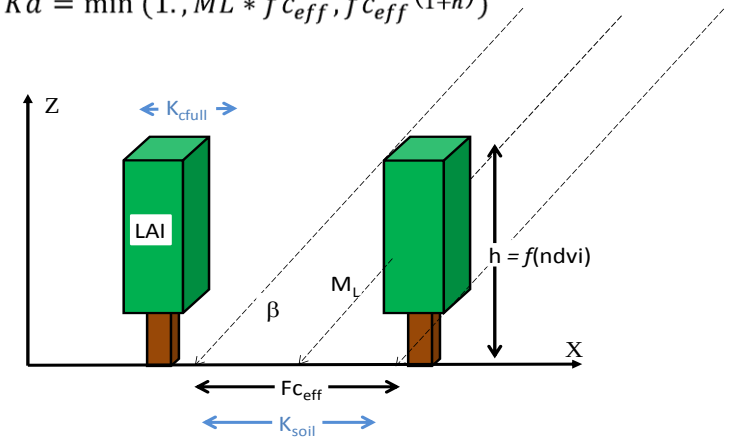
Allen et al. 1998

$$k_{cb} = a.\,NDVI + b$$

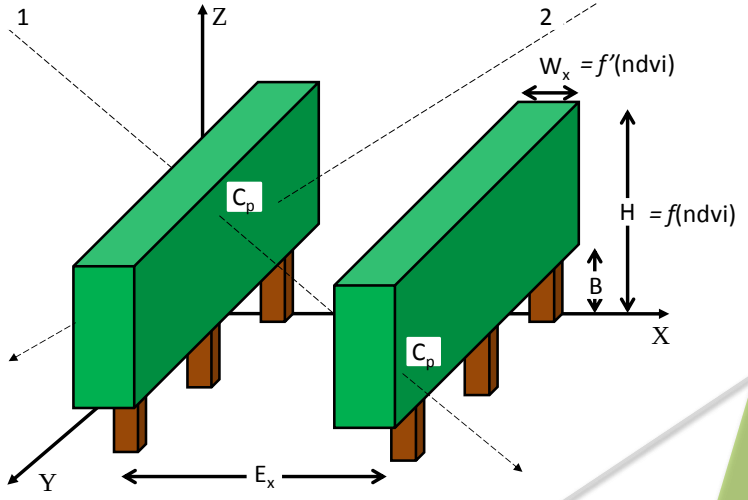
Campos et al. 2010

$$k_{cb} = kcb_{cover} + Kd * \max(kcb_{MAX} - kcb_{cover}\,,\,(kcb_{MAX} - kcb_{cover})/2)$$

$$Kd = \min(1.,\, ML * fc_{eff}\,,\, fc_{eff}^{\left(\frac{1}{1+h}\right)})$$



Allen et Pereira. 2009

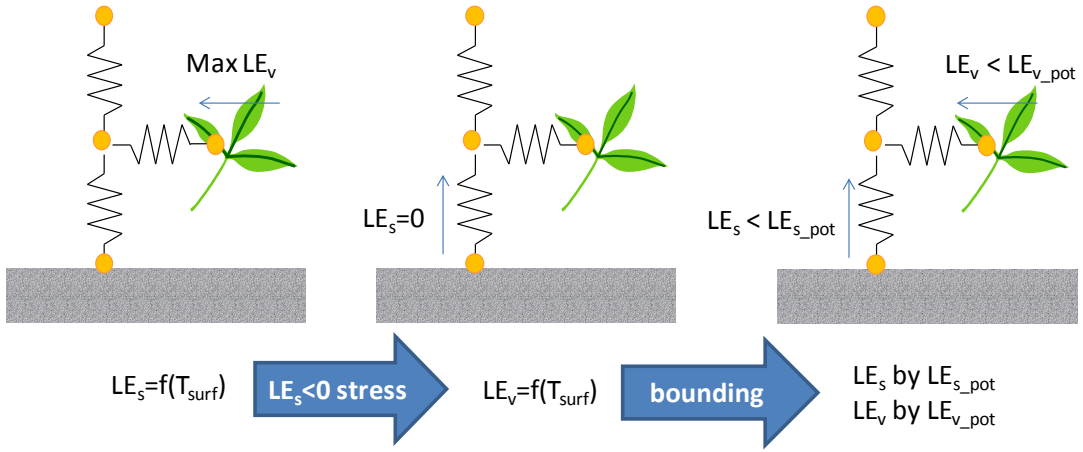


Oyarzun et al. 2006, Lebon, 2003, Picon-Toro et al., 2012

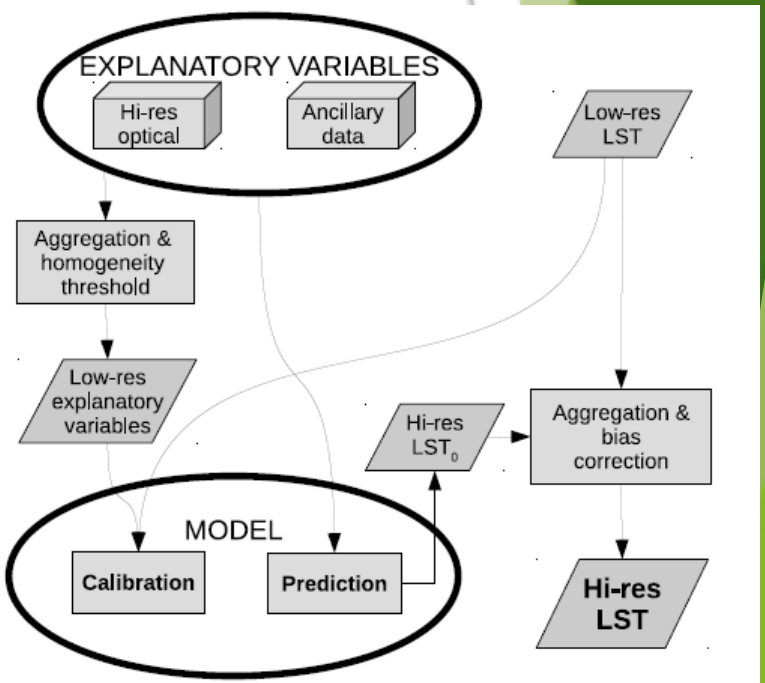
Methods: Energy balance based methods

SPARSE (Boulet et al.,2015),
SPARSE4 (Mwangi et al., 2022)

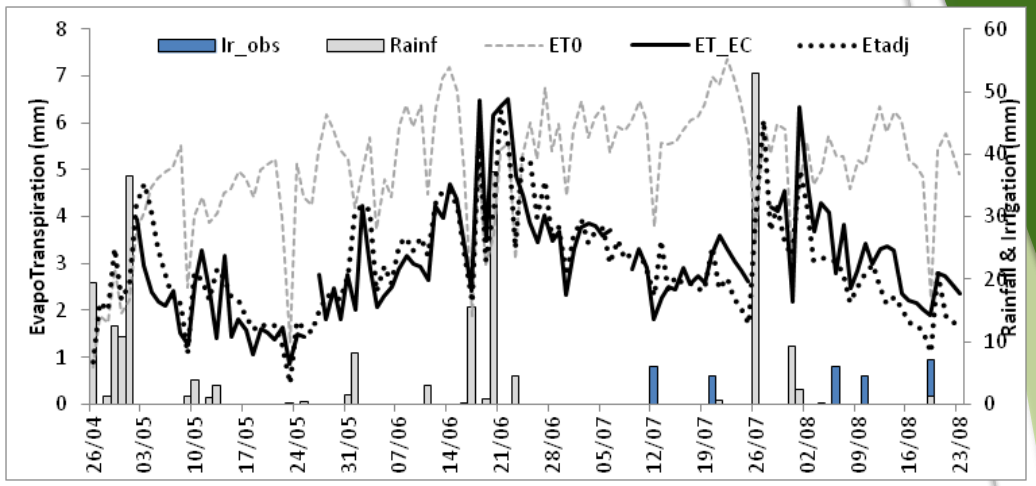
Based on the same rationale as the popular TSEB model (Kustas et al.) >
How one gets **2 unknowns** (evaporation LE_s, Transpiration LE_v) from **1 data source** (T_{surf}) ?



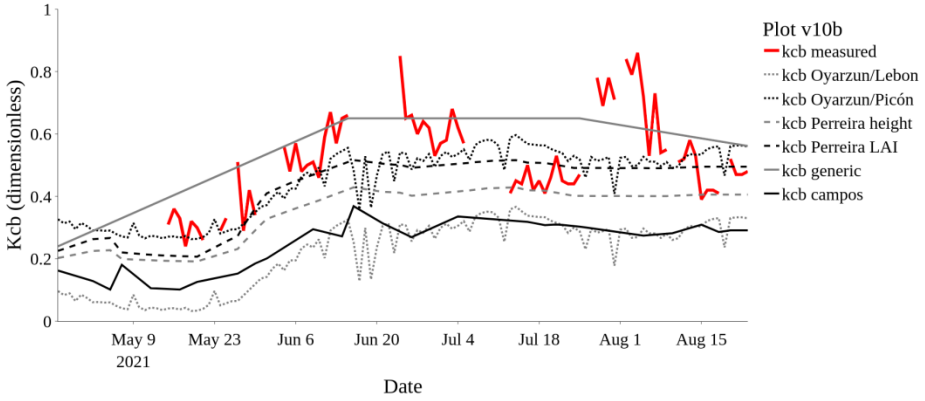
TSEB (Norman et al.,1995),
SEN-ET (Nieto et al., 2020)



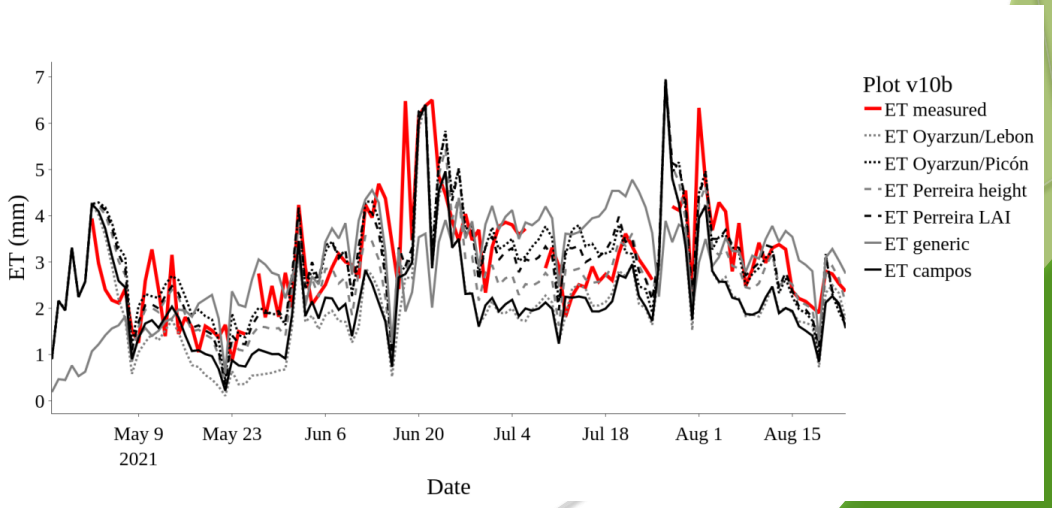
Results : NDVI based approaches



Estimation of actual evapotranspiration with a water budget according to the Oyarzun-Picon method

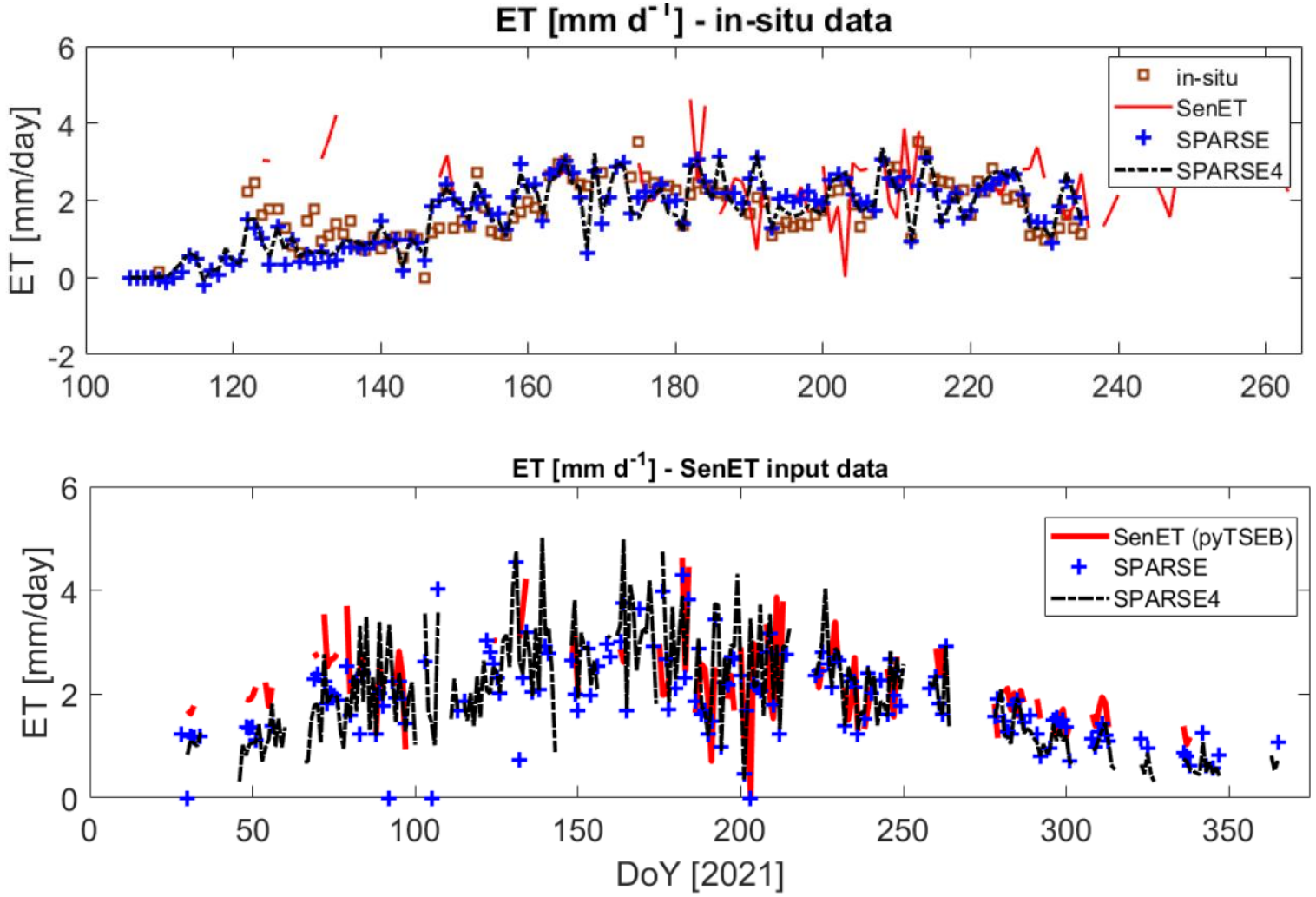


Comparison of measured and estimated Kcb



Comparison of measured and estimated ET

Results: Energy balance based approaches



Comparison

	RMSE (mm/day)	R^2	Slope	Offset	Sum ET (mm)
Oyarzun-Picon	0.62	0.54	0.74	0.79	212
Oyarzun-Lebon	1.13	0.52	0.66	0.03	140
Generic	0.83	0.43	0.58	1.68	244
Pereira LAI	0.60	0.57	0.76	0.70	210
Pereira Height	0.66	0.53	0.62	0.79	188
Campos	1.06	0.50	0.53	0.46	146
EC					209

	SPARSE			*SPARSE4*		
	RMSD	*r*	*bias*	*RMSD*	*r*	*bias*
LE	39	0.80	3	37	0.82	2
H	50	0.95	-5	52	0.94	-3
G	49	0.78	17	49	0.77	11
Rn	32	0.99	14	33	0.99	15

Thank you for your attention