Supplementary material
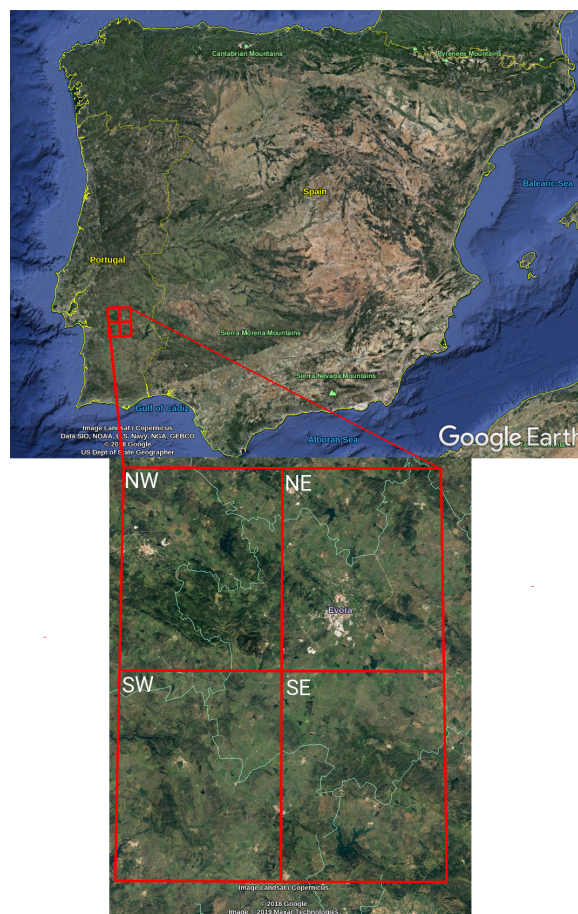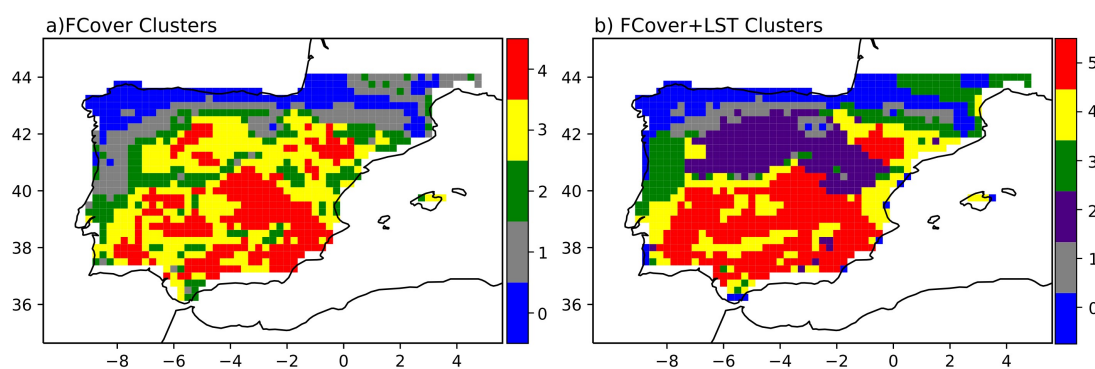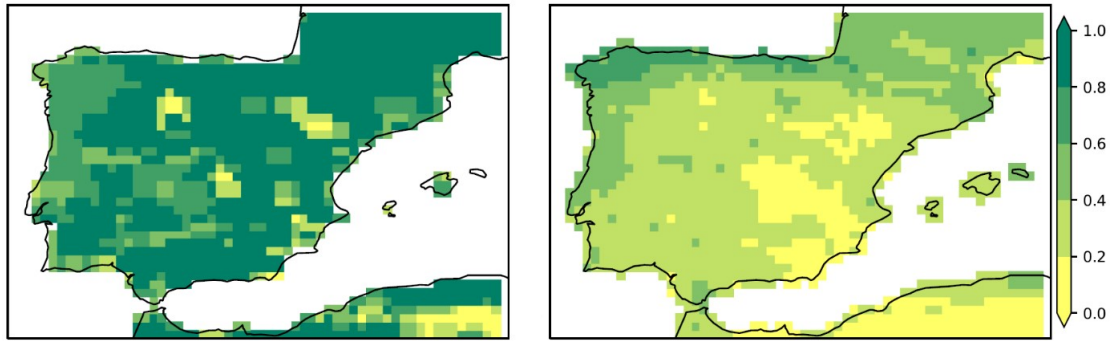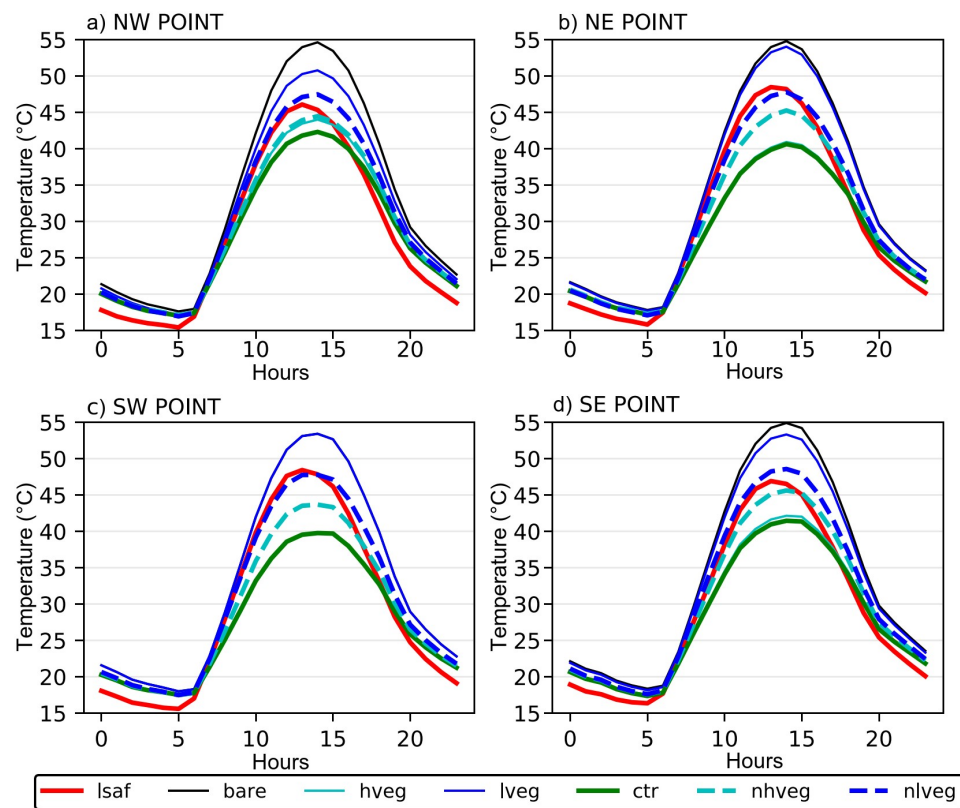

Figure S1. Google-Earth view of Iberian Peninsula (**top**) and location of the 4 grid-points of the Southern Portugal domain (**bottom**).
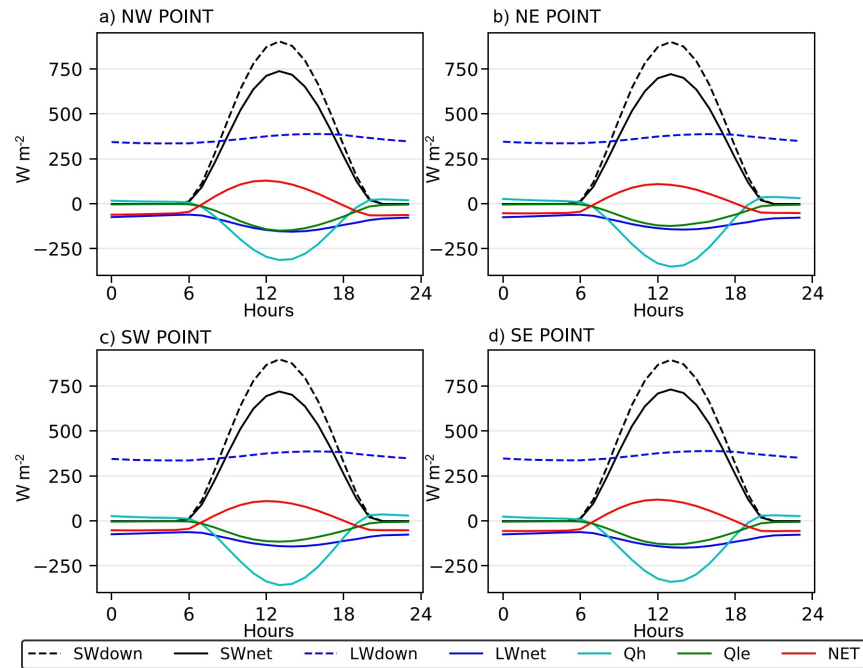

Figure S2. Clusters determined by the K-Means Algorithm using as input: (**a**) CGLS-FCover and (**b**) both LST and CGLS-FCover.
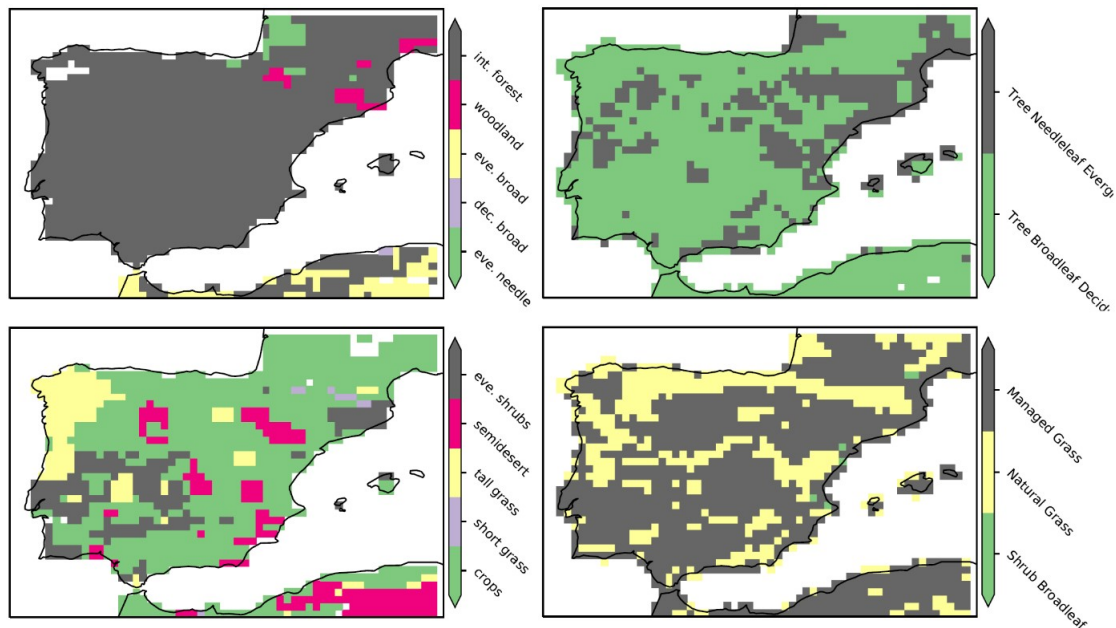
Figure S3. ERA5 Total Vegetation Cover (TVC, **left**) and the mean 1999-2018 CGLS FCover (**right**).

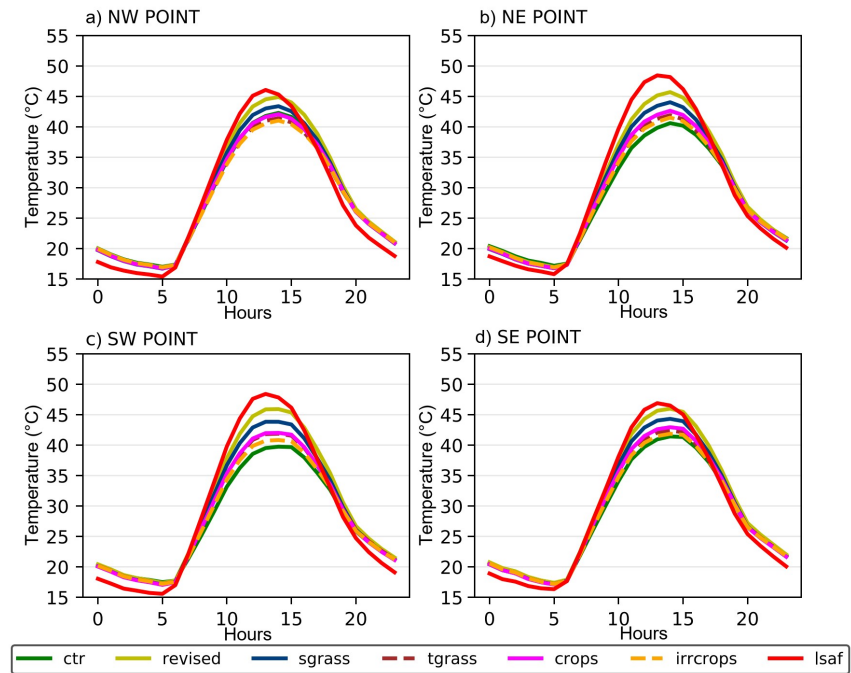**Figure S4.** Mean diurnal cycle of temperature (2010 Summer) in the 4 points of the Southern Portugal domain (**a**) North West, (**b**) North East, (**c**) South West (**d**) South East comparing the satellite LST (red), and the LST in the control simulation (green), with several sensitivity experiments (see Table 2): bare (black), hveg (cyan), lveg (blue), nhveg (dashed cyan) and nlveg (dashed blue).

Figure S5. Surface energy balance in the 4 points of the Southern Portugal domain (**a**) North West, (**b**) North East, (**c**) South West (**d**) South East of the control simulation (W m⁻²): shortwave downward radiation (SWdown, dashed black), shortwave surface net radiation (SWnet solid black), longwave downward radiation (LWdown, dashed blue), longwave net surface radiation (LWnet, solid blue), sensible heat flux (Qh, solid cyan), latent heat flux (Qle, solid gree) and the net flux (NET=SWnet+LWnet+Qh+Qle, solid red). The fluxes sign conventions indicate fluxes to the surface as positive and fluxes leaving the surface as negative.

Figure S6. ERA5 (default IFS) type of high vegetation (**top left**) and type of low vegetation (**bottom left**) and ESA-CCI derived dominant type of high vegetation (**top right**) and dominant type of low vegetation (**bottom right**).

Figure S7. Mean diurnal cycle of temperature (2010 Summer) in the 4 points of the Southern Portugal domain (**a**) North West, (**b**) North East, (**c**) South West (**d**) South East comparing the satellite LST (red), and the LST in the control simulation (green), revised (dark yellow) and several different types of low vegetation: short grass (sgrass, blue), tall grass (tgrass, dashed brown), crops (magenta) and irrigated crops (irrcrops, dashed yellow). and nlveg (dashed blue).