

Supporting Information

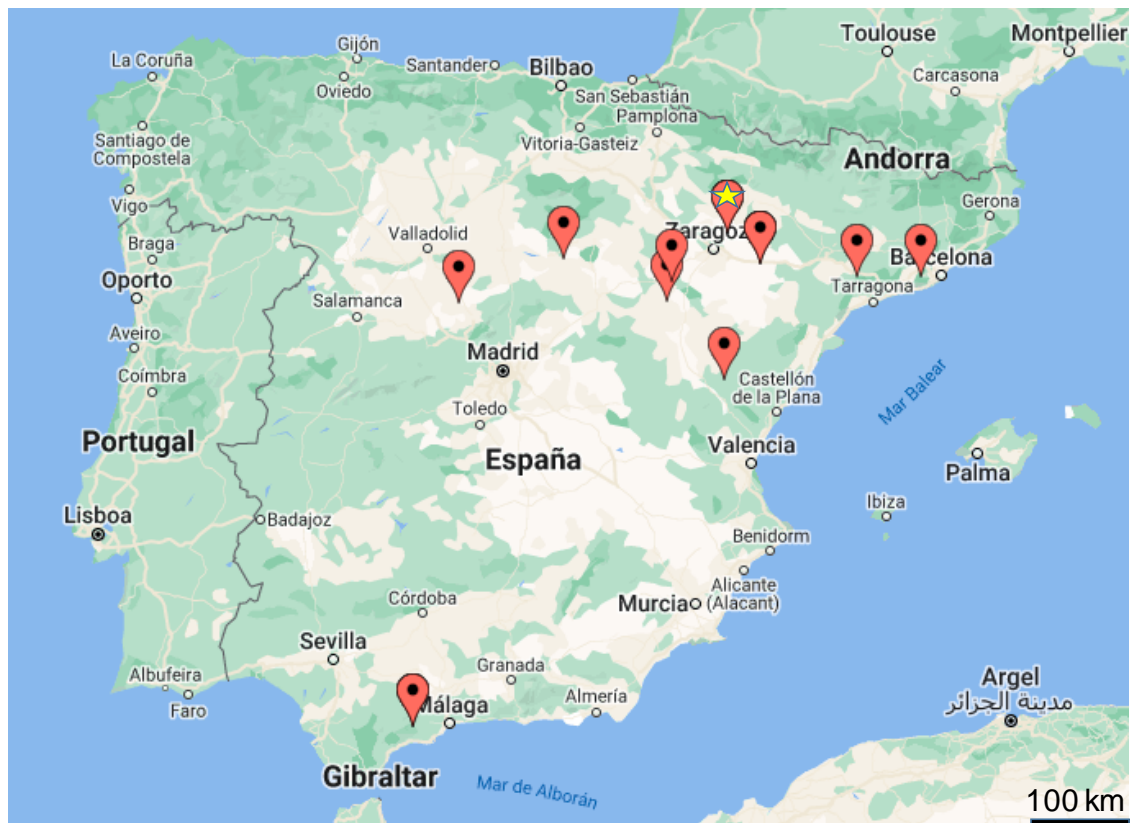


Figure S1. Map showing the location of the study sites in Spain (see also Table1). The star indicates the site with dendrometer data.

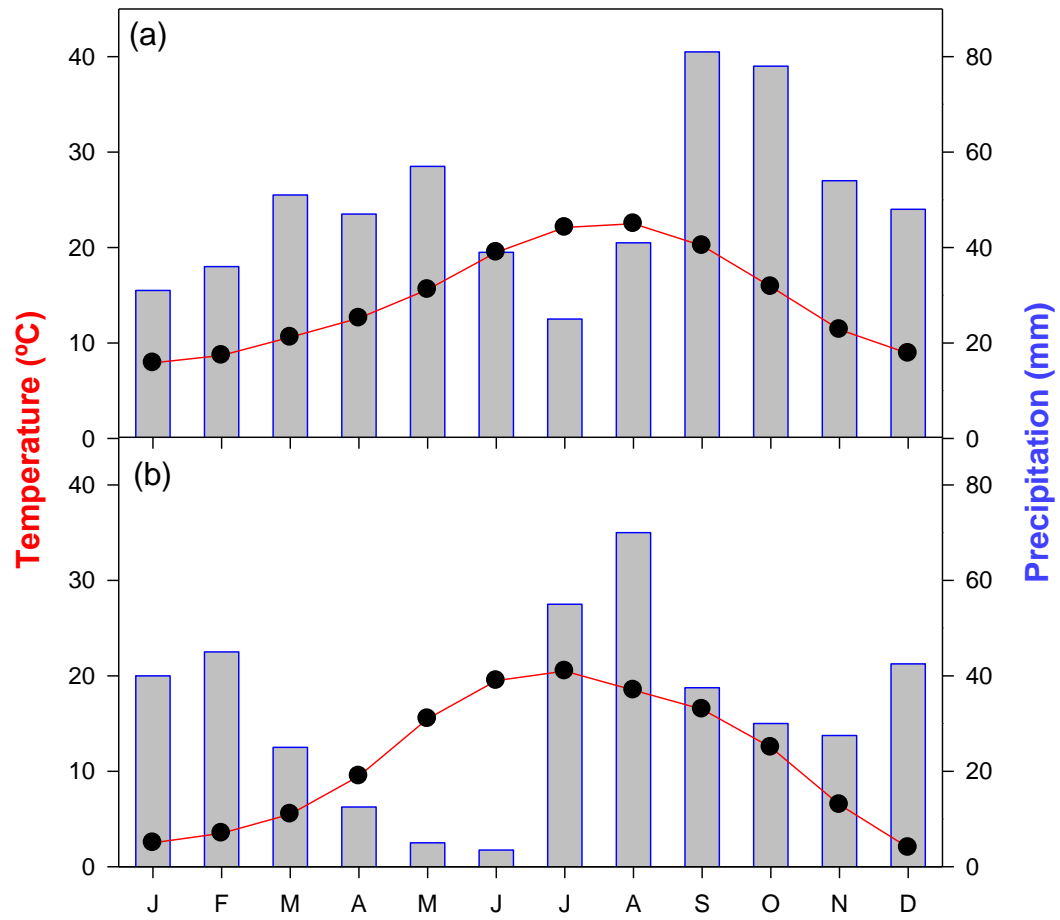


Figure S2. Climate conditions in the two compared sites and tree species forming latewood IADFs and potentially showing growth bimodality: **(a)**, *Pinus halepensis* in NE Spain; **(b)**, *Pinus edulis* in SW USA.

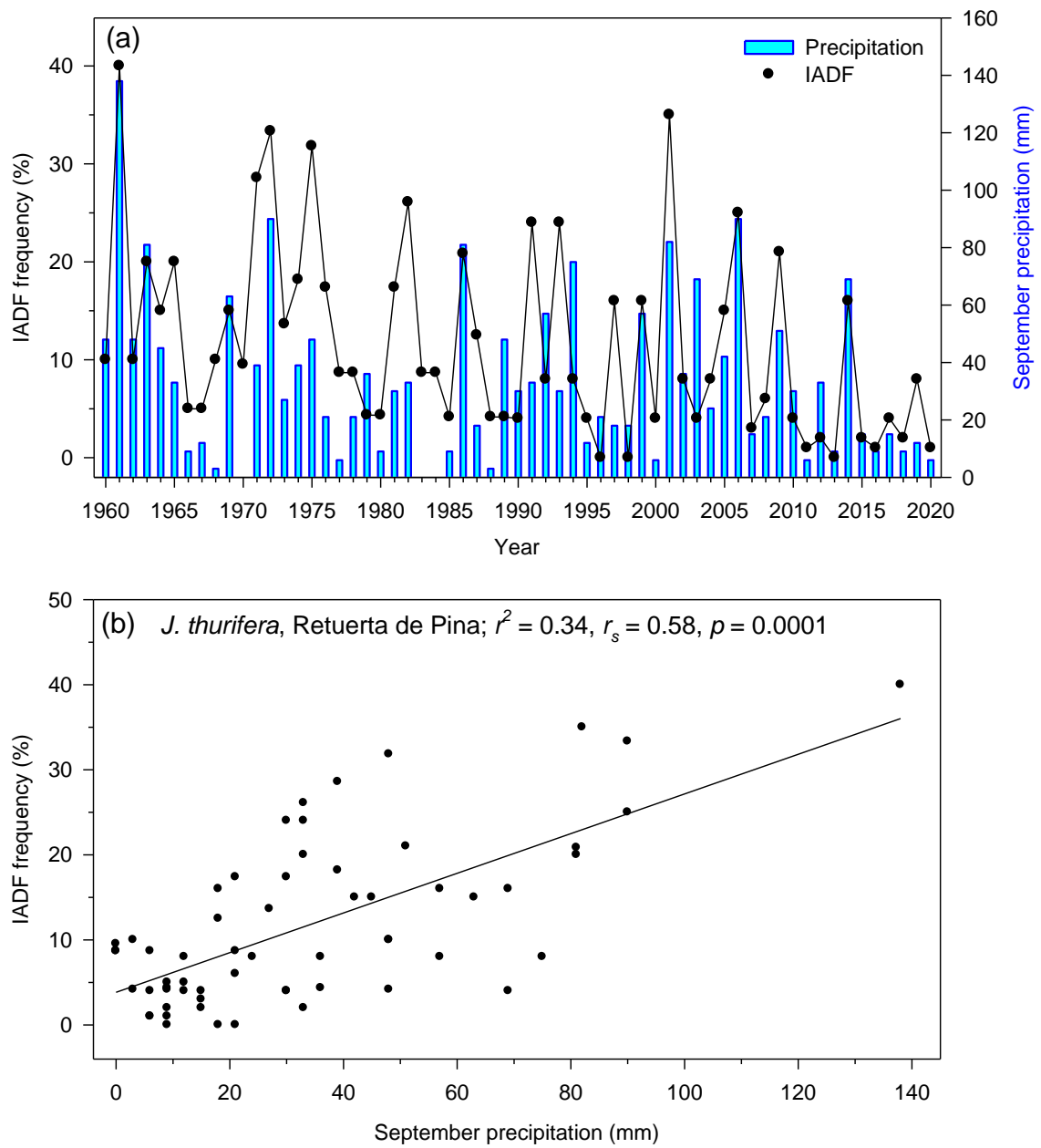


Figure S3. An example of climate-IADF relationships observed in the case of the Retuerta de Pina *Juniperus thurifera* site and September precipitation. (a) September precipitation and IADF production are positively related through time, and (b) about 34% of the IADF production variance can be predicted as a function of September precipitation.

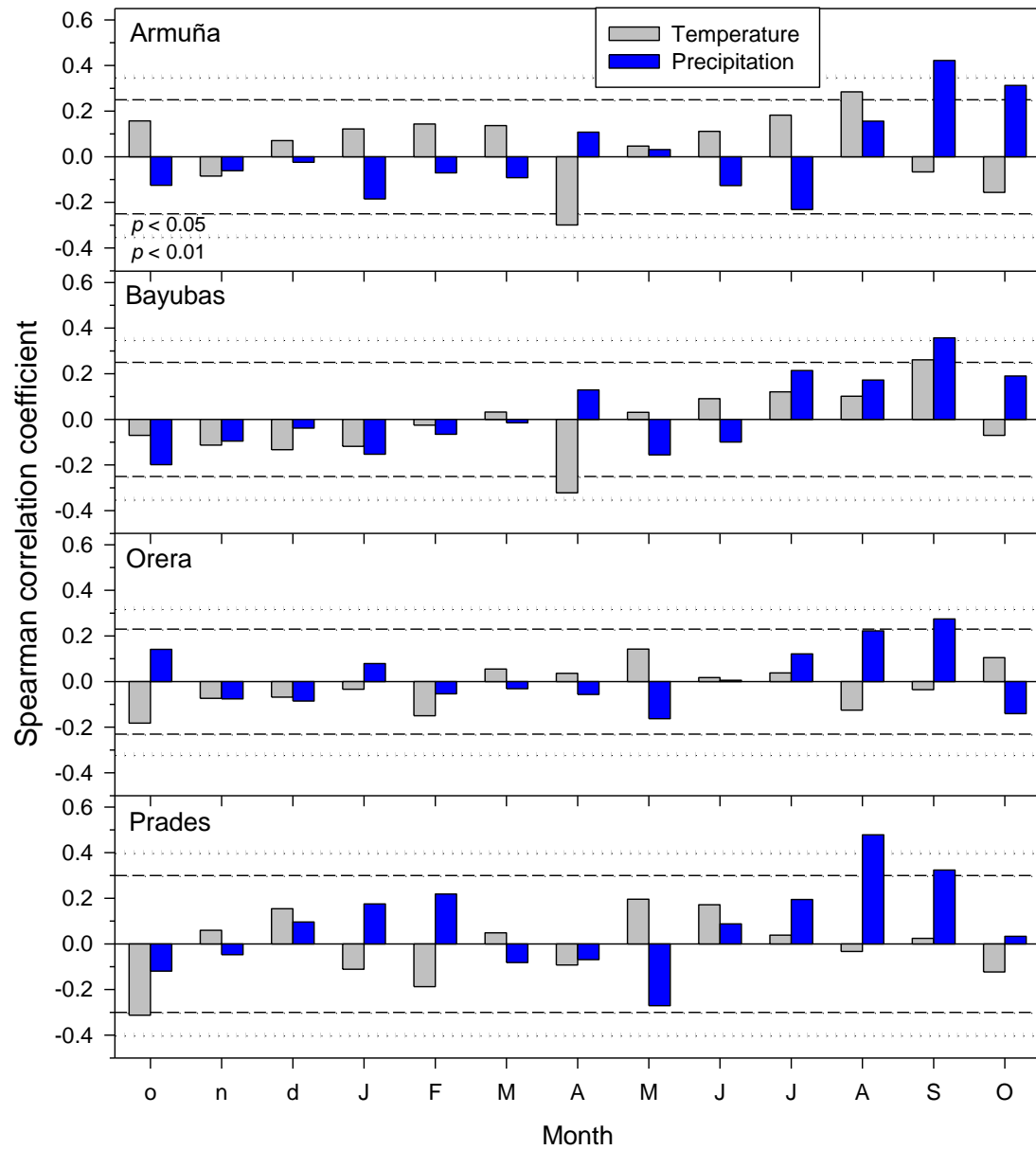


Figure S4. Climate-IADF relationships observed in the *Pinus pinaster* sites. Bars are Spearman correlation coefficients calculated by relating monthly temperature or precipitation and the frequency of latewood IADFs. Months abbreviated by lowercase and uppercase letters correspond to the previous and current years, respectively. Dashed and dotted horizontal lines show the 0.05 and 0.01 significance levels, respectively.

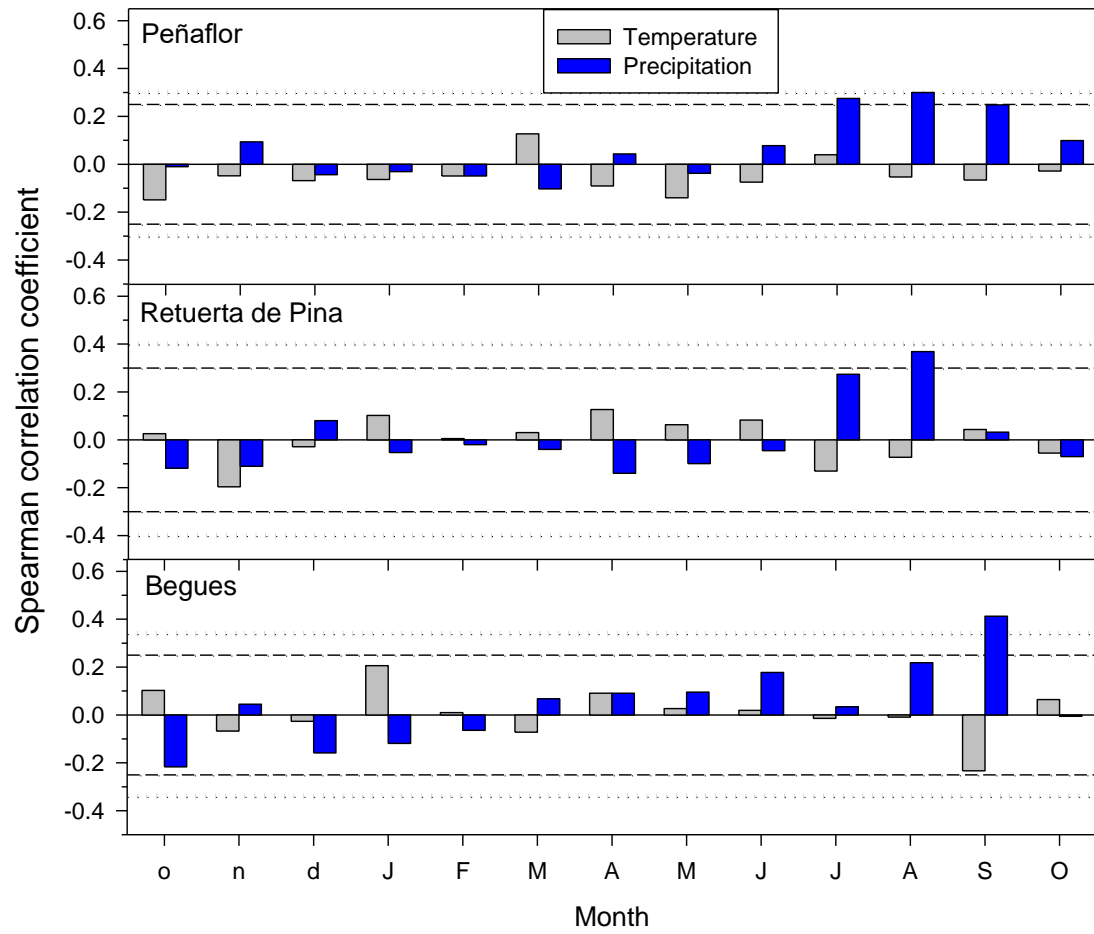


Figure S5. Climate-IADF relationships observed in the *Pinus halepensis* sites. The rest of explanations are as in Figure S4.

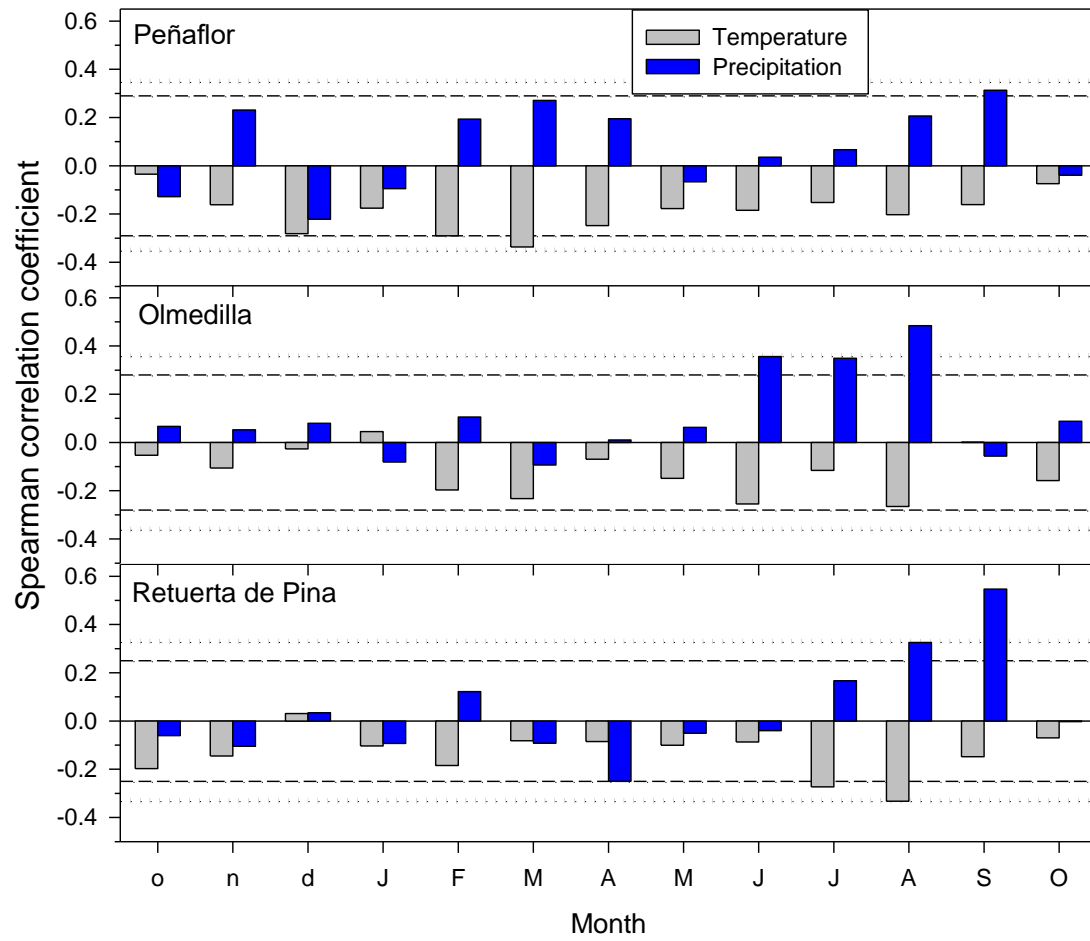


Figure S6. Climate-IADF relationships observed in the *Juniperus thurifera* sites. The rest of explanations are as in Figure S4.

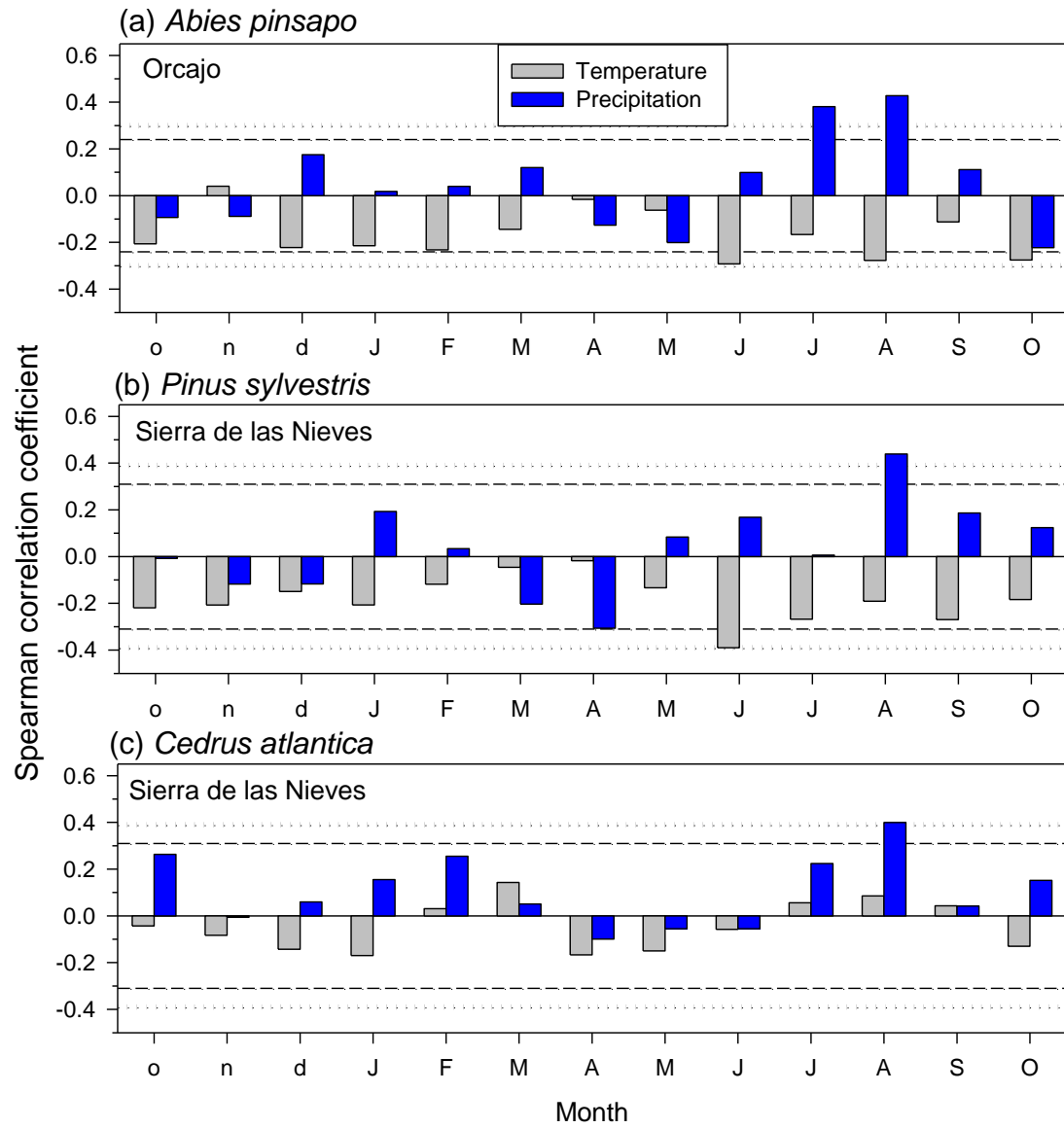


Figure S7. Climate-IADF relationships observed in species with only one site sampled per species (a, *Abies pinsapo*; b, *Pinus sylvestris*; c, *Cedrus atlantica*). The rest of explanations are as in Figure S4.

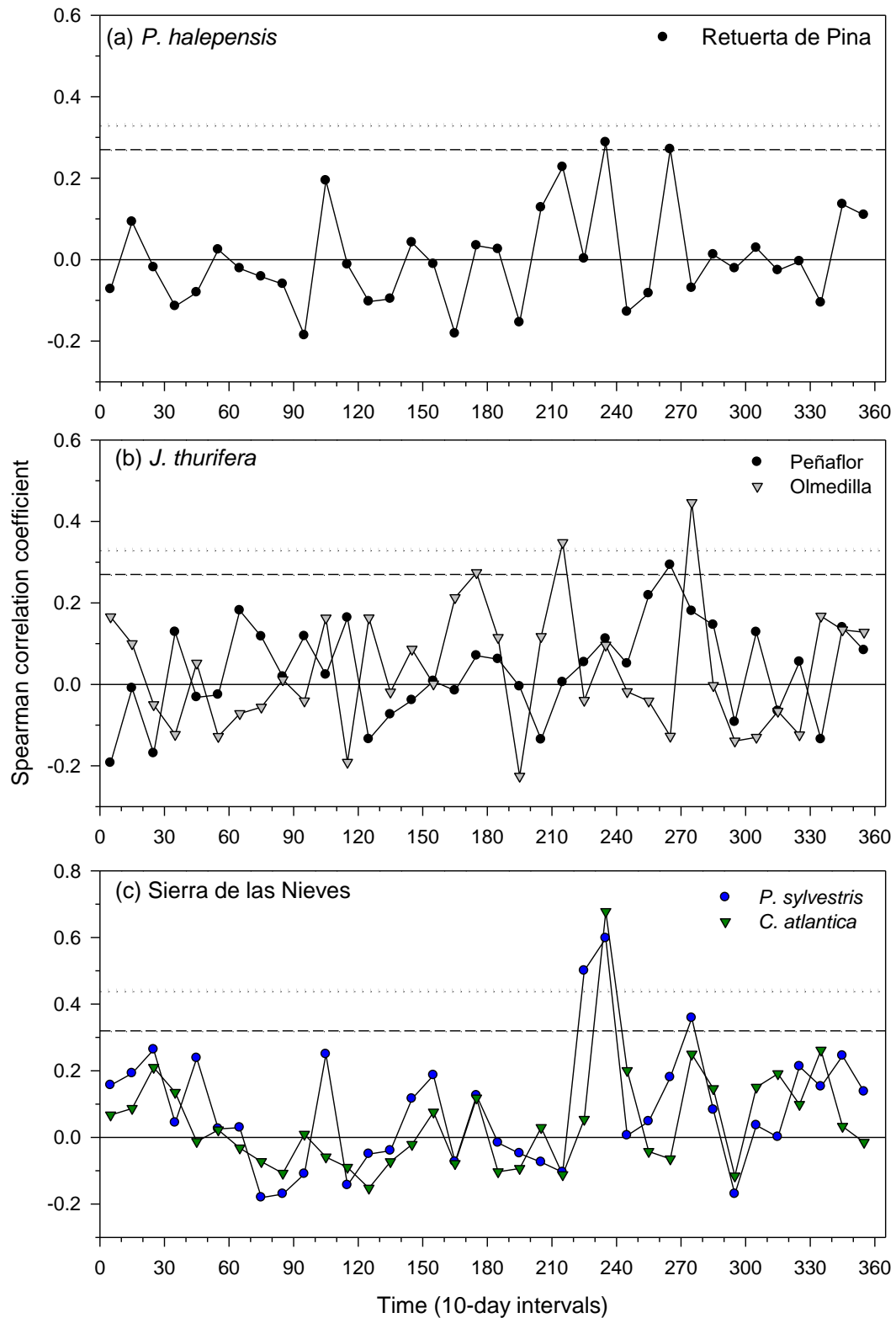


Figure S8. Climate-IADF relationships calculated with 10-day long precipitation windows in the six study tree species. These correlations were calculated for sites where meteorological stations with long-term (> 30 years) precipitation records which were located more than 20 km away from sampled stands. Horizontal dashed and dotted lines show the 0.05 and 0.01 significance levels, respectively.

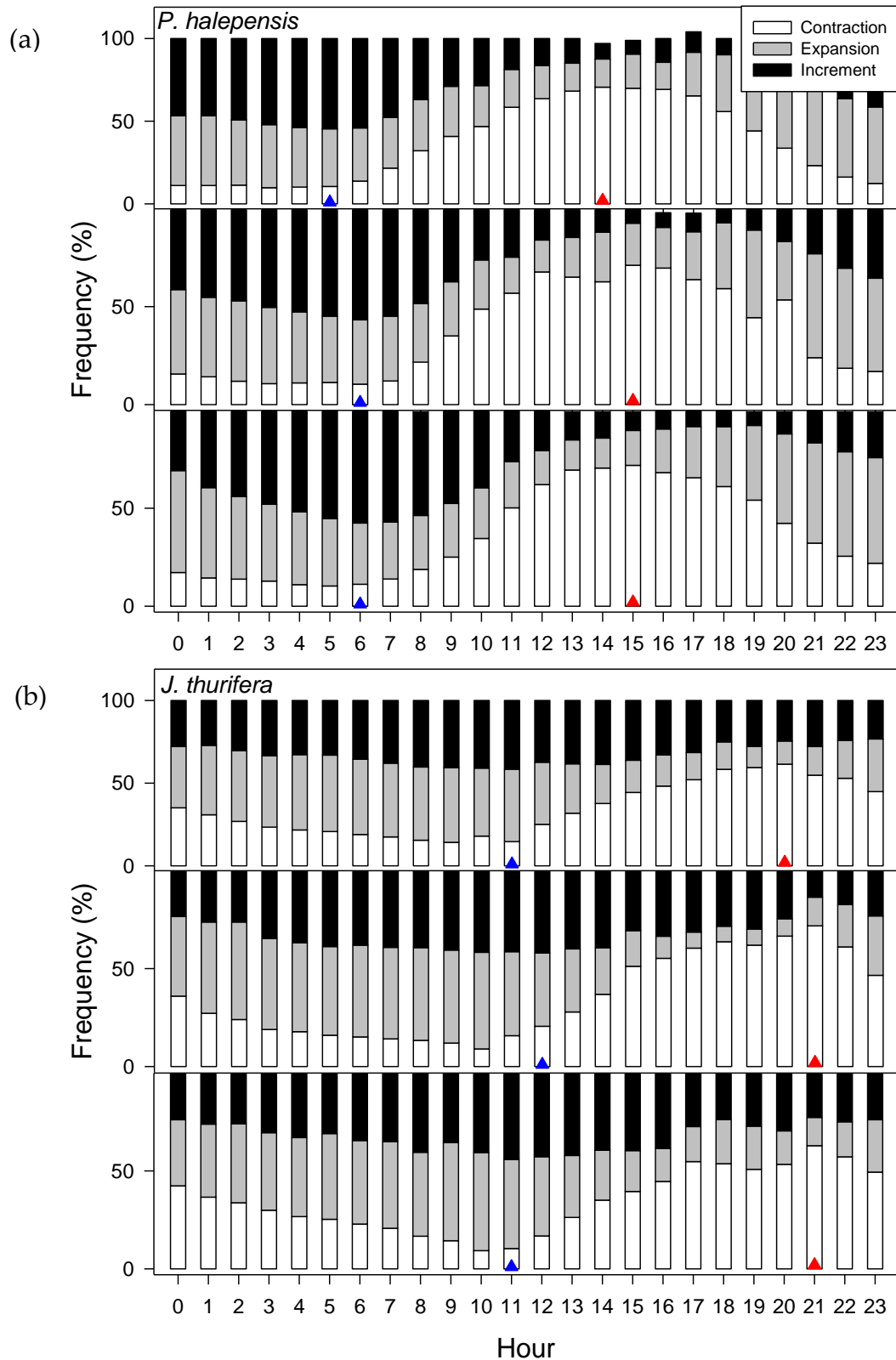


Figure S9. Frequency of the phases of stem contraction (empty part of bars), expansion (grey-filled part of bars) and increment or growth (black-filled part of bars) at hourly scales obtained from dendrometers attached to (a) *P. halepensis* and (b) *J. thurifera* trees in the Peñaflor site (period 2009-2011). Each plot is a different tree. The blue and red triangles indicate the hours with highest frequency of radial growth and contraction, respectively.

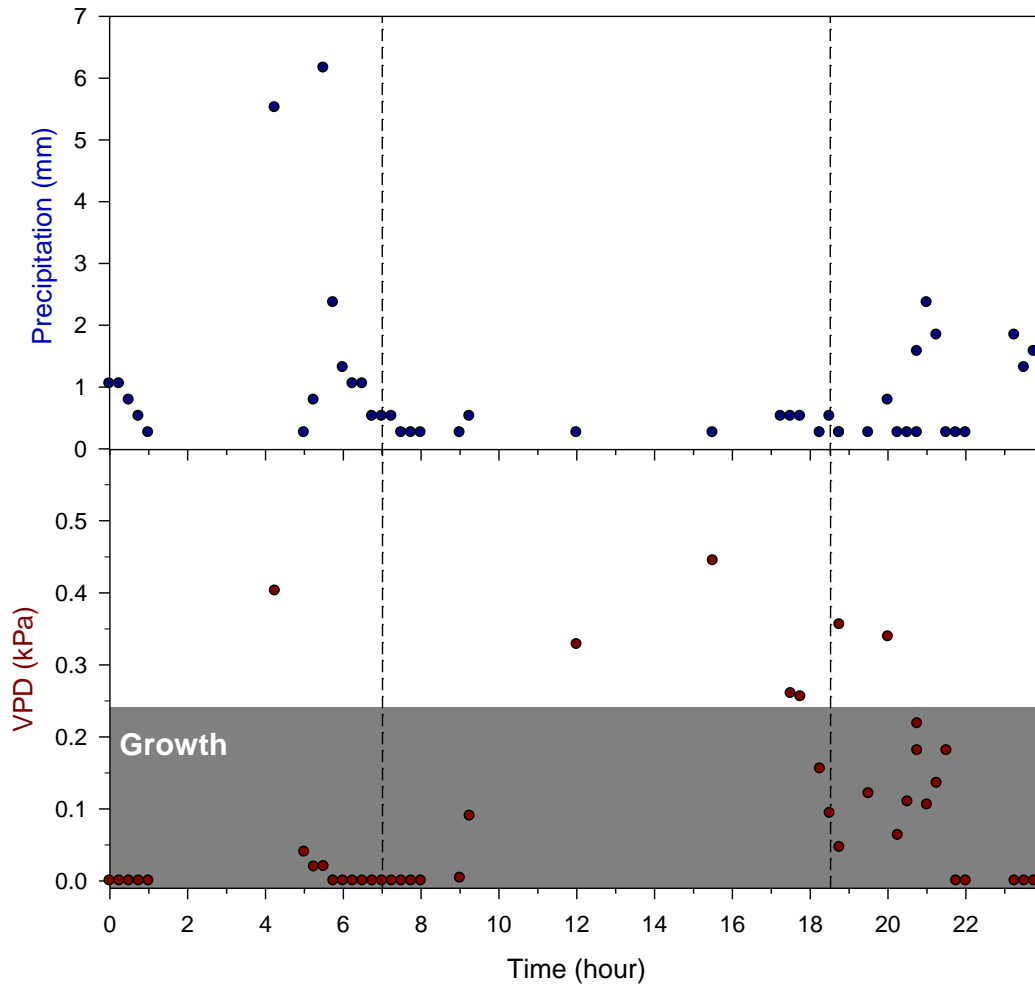


Figure S10. Hourly precipitation and VPD data corresponding to August and September, when most IADFs are formed. Climate data correspond to 2010. In the lowermost plot, the grey box encloses VPD values below 0.24 kPa when tree growth would occur according to [9]. The vertical dashed lines go from dawn (7 h) to sunset (18:30 h).

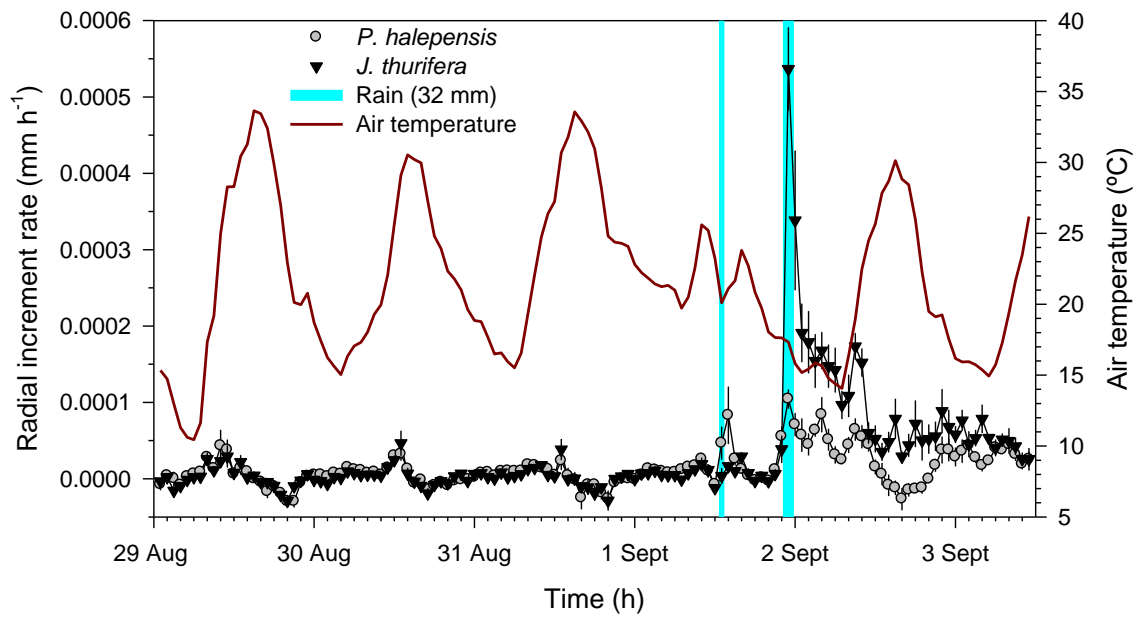


Figure S11. Hourly changes in stem radial increment rates measured in *Pinus halepensis* and *Juniperus thurifera* (mean \pm SE) at the Peñaflor study site between late August and early September 2021. Note the sharp radial increment, particularly in the case of *J. thurifera*, when a summer storm (blue lines) occurred between 23 and 24 h the 1st of September 2021 (fallen precipitation was 5.4 mm). There was another increase of radial increment rates after a smaller night storm (0.8 mm) between 18 and 19 h. The brown line (right y axis) shows air temperature with evident drops during storms.

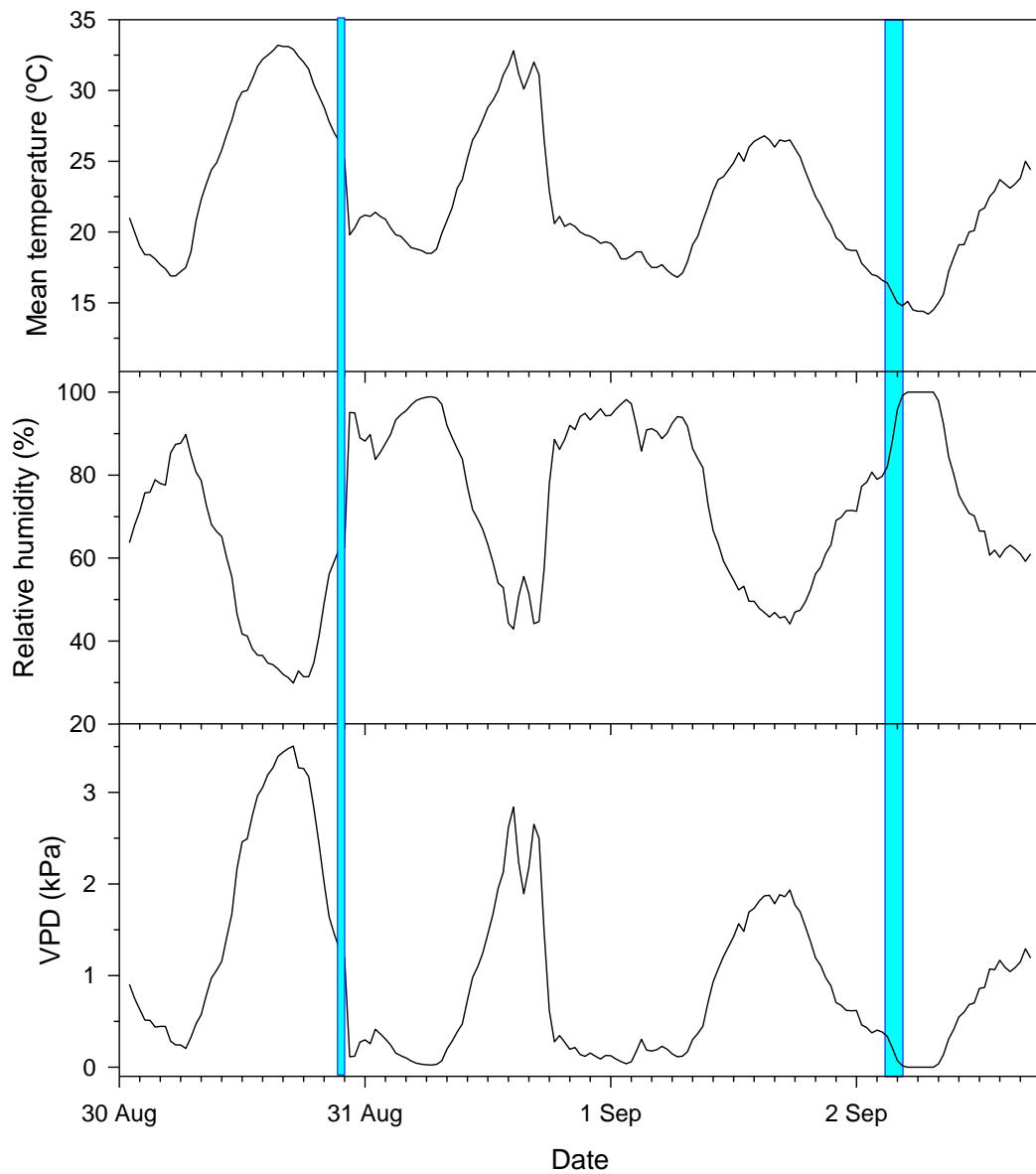


Figure S12. Hourly changes of temperature, relative air humidity and vapour pressure deficit (VPD) during three days in late summer 2015 at the Peñaflor site. The blue bars indicate two precipitation events or storms of 7.5 (19:30 h, 31 August) and 17.9 (4:00 h, 2 September) mm, respectively. Air temperature and VPD decreased and relative humidity increased after such rainy events.