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Supplement of

Compound warm–dry and cold–wet events over the Mediterranean

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1 Supplementary Data

To improve the robustness of our results we make use of two additional reanalysis datasets from the European Centre for Medium-Range Weather Forecasts (ECMWF) over the 1979-2018 period. These are: ERA-Interim with horizontal resolution of 0.75° (Dee et al., 2011) and ERA5 10-member ensemble (0.5°) (C3S, 2017), hereafter termed "ERA5 ensemble". The Mediterranean (MED) domain follows the "Full Mediterranean (FMED)" region described in Giorgi and Lionello (2008). For ERA-Interim, we use 27.75–48.00 °N, 9.75 °W–39.00 °E, whereas for the ERA5 ensemble we use 28.00–48.00 °N, 9.50W–39.00 °E. To study compound events, we compute daily Tmax, Tmin and P, based on 6- and 3-hourly data from ERA5 ensemble respectively for Tmax (Tmin) and P, and 12-hourly data from ERA-Interim. We also use daily-mean SLP values, computed by averaging 6-hourly ERA-Interim and ERA5 ensemble data. For ERA5 ensemble, we compute the 10-member ensemble mean for all the dynamical systems metrics and variables of interest. It is important to note that the dynamical systems metrics are first computed on the individual ensemble members and then their values averaged for the trend analyses, whereas for the composite maps we first compute the composite for each ensemble member and then we average them. Lastly, we also use ERA5 daily mean convective available potential energy (CAPE, JKg^{-1}) and ERA5 daily snowfall (mm), the former computed by averaging daily 6-hourly steps and the latter by summing the 1-hourly time-steps as for P. We note that Tmax (Tmin), SLP and CAPE are obtained from instantaneous values, whereas P and snowfall from forecasted fields.

2 Supplementary Figures

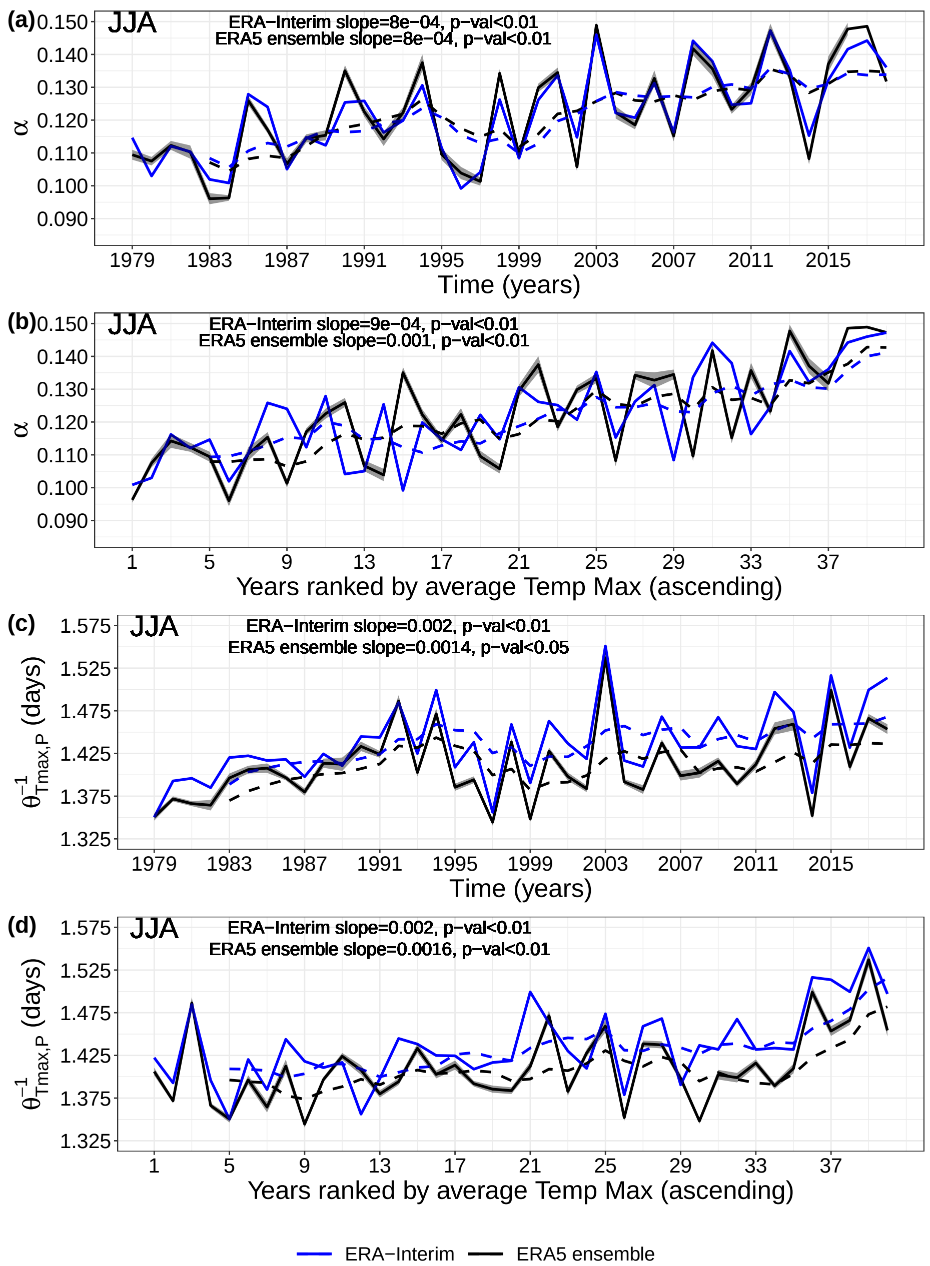


Figure S1. As Figure 1 but for ERA-Interim (blue) and ERA5 ensemble mean (black). Grey shaded lines represent the 95% confidence intervals of the ERA5 ensemble mean.

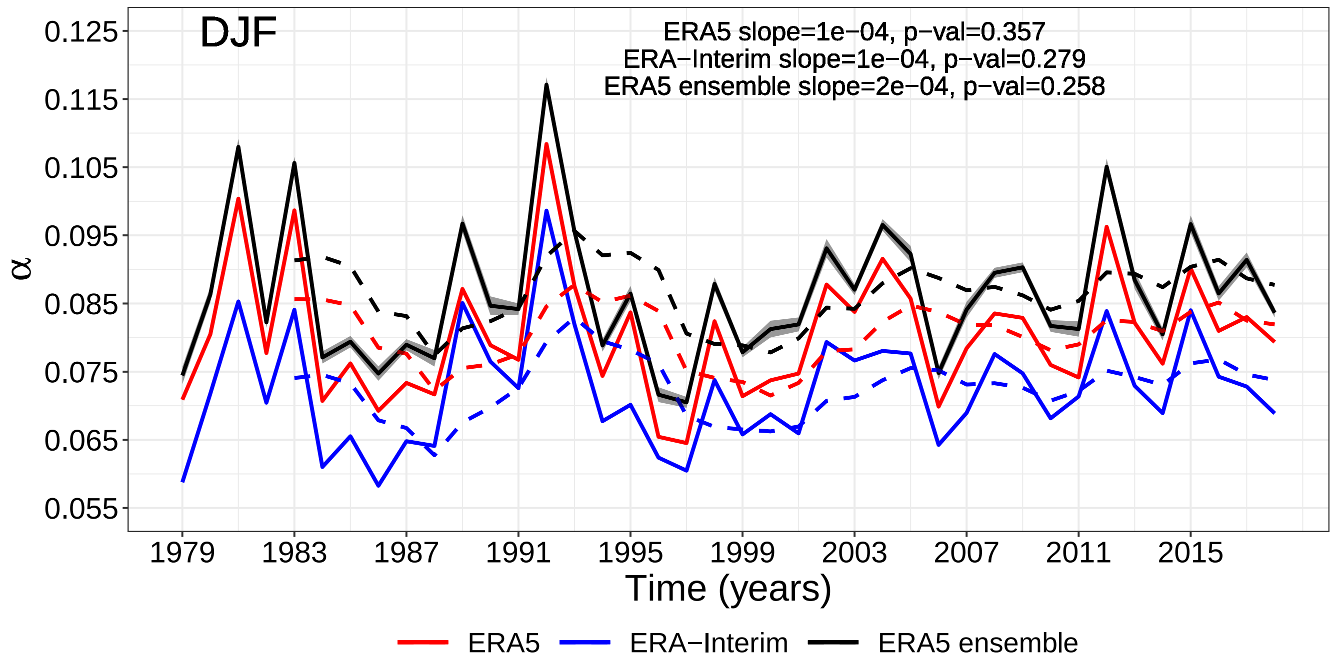


Figure S2. As Figure 1a but for winter December-January-February (DJF) and α computed from Tmin and P.

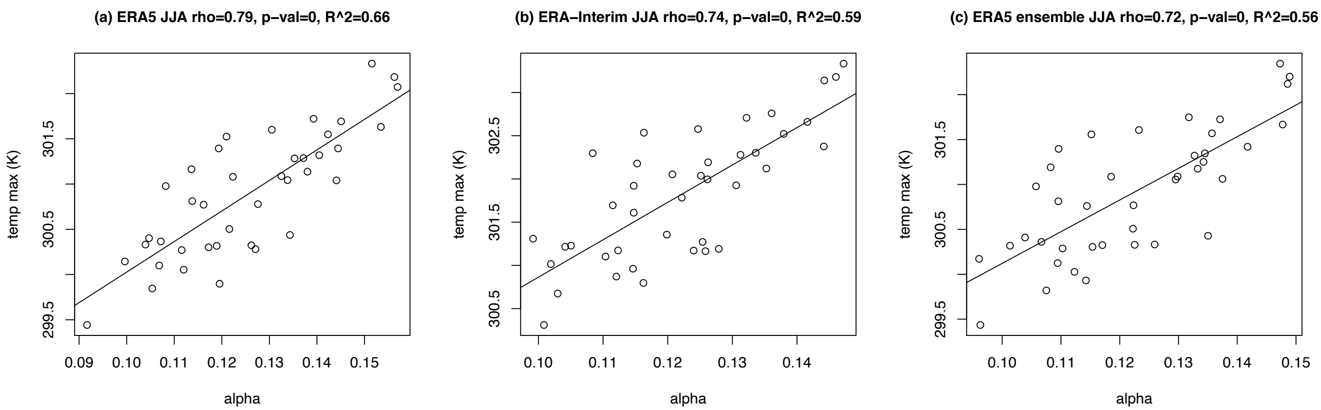


Figure S3. Linear regressions and Spearman's correlation tests between JJA mean Tmax and JJA co-recurrence ratio (α) within the 1979-2018 period over the MED. (a) ERA5; (b) ERA-Interim; and (c) ERA5 ensemble mean. The Spearman's rho correlation coefficient, relative p-value and coefficient of determination (R^2) are shown for each reanalysis product.

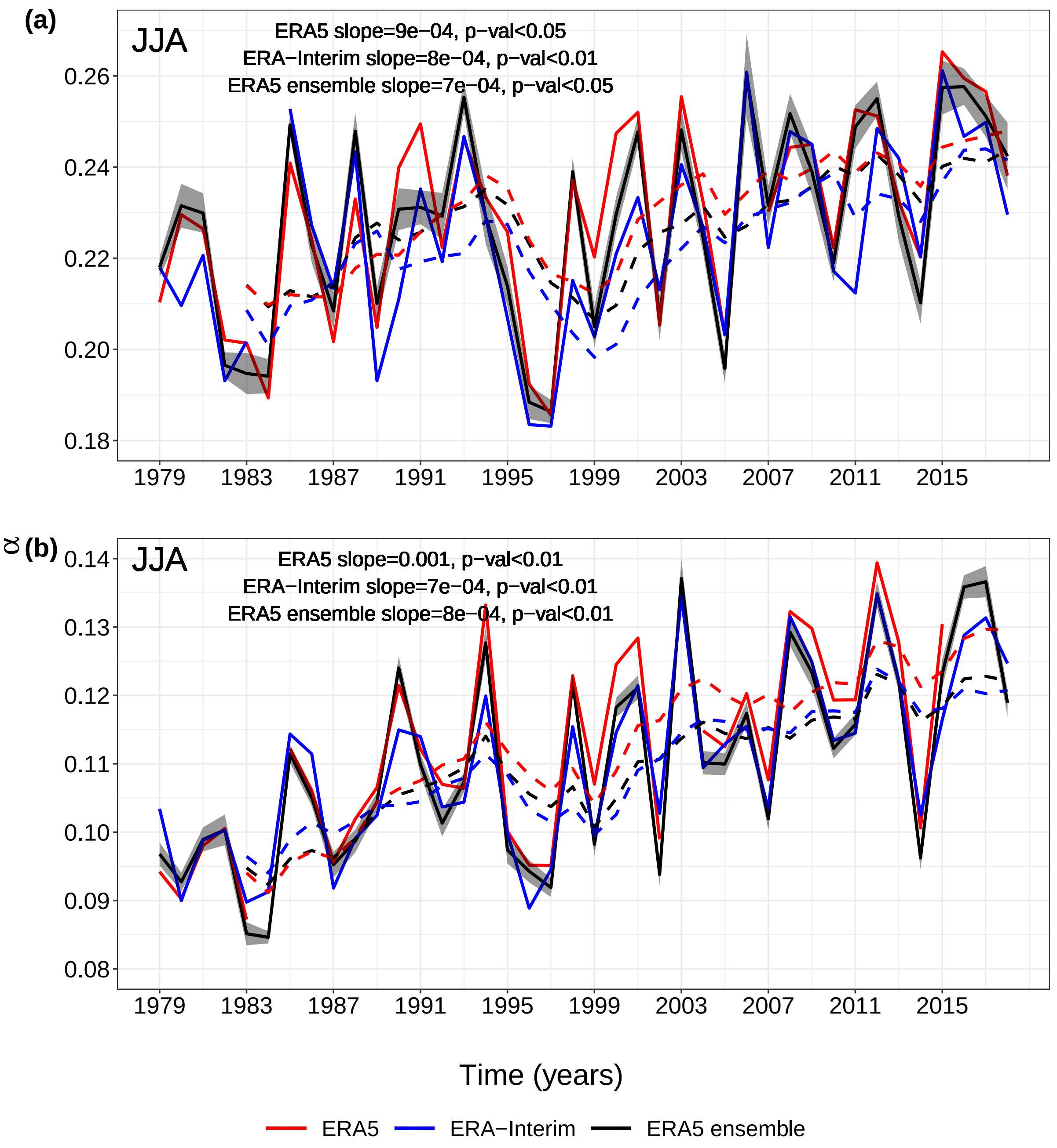


Figure S4. As Figures 1a and S1a but for (a) CDEs ($\alpha > 90^{th}$ quantile) and (b) non-CDEs ($\alpha \leq 90^{th}$ quantile).

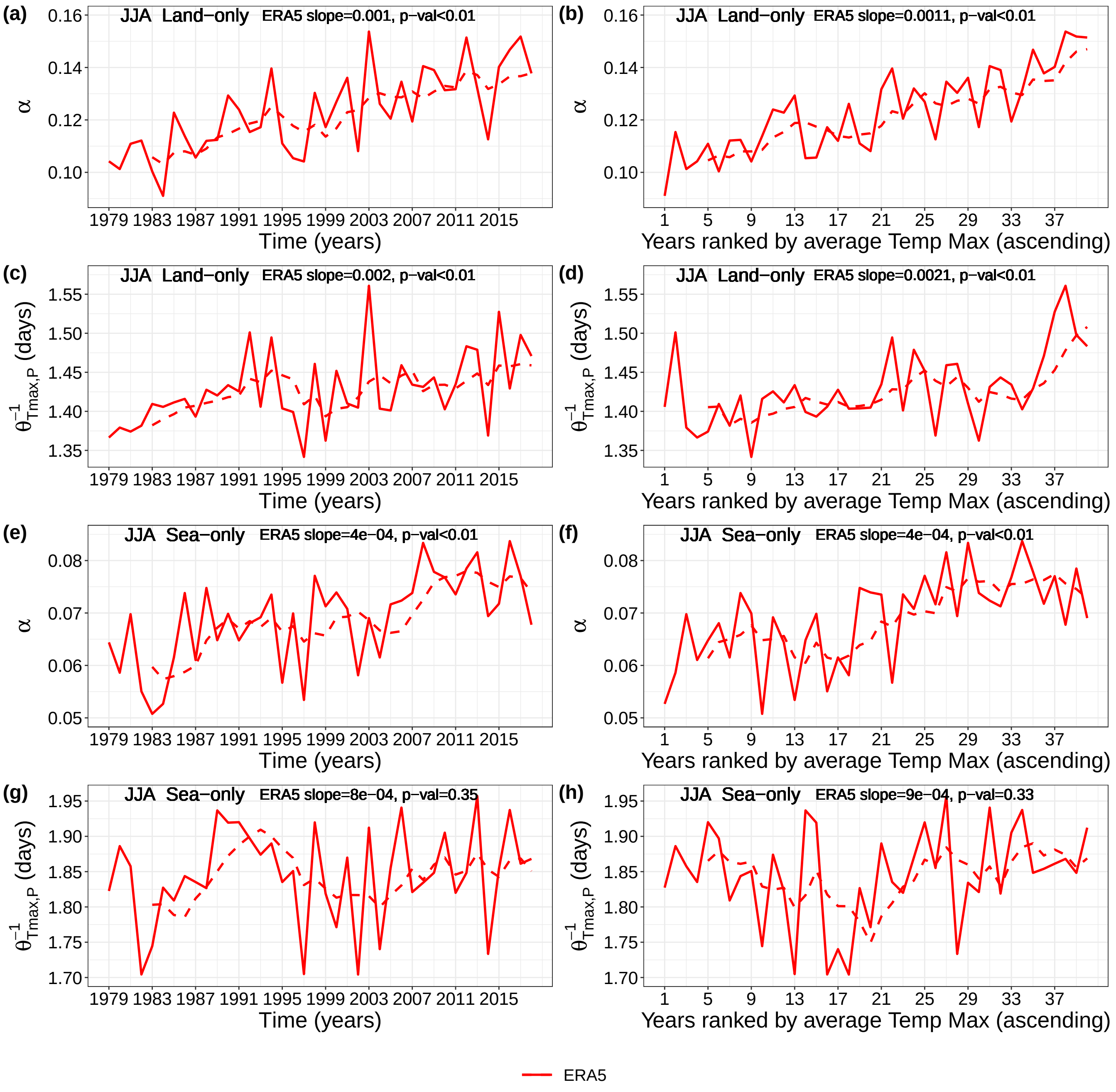


Figure S5. As Figure 1 but for ERA5 grid-points over (a)-(d) land- and (e)-(h) sea-only.

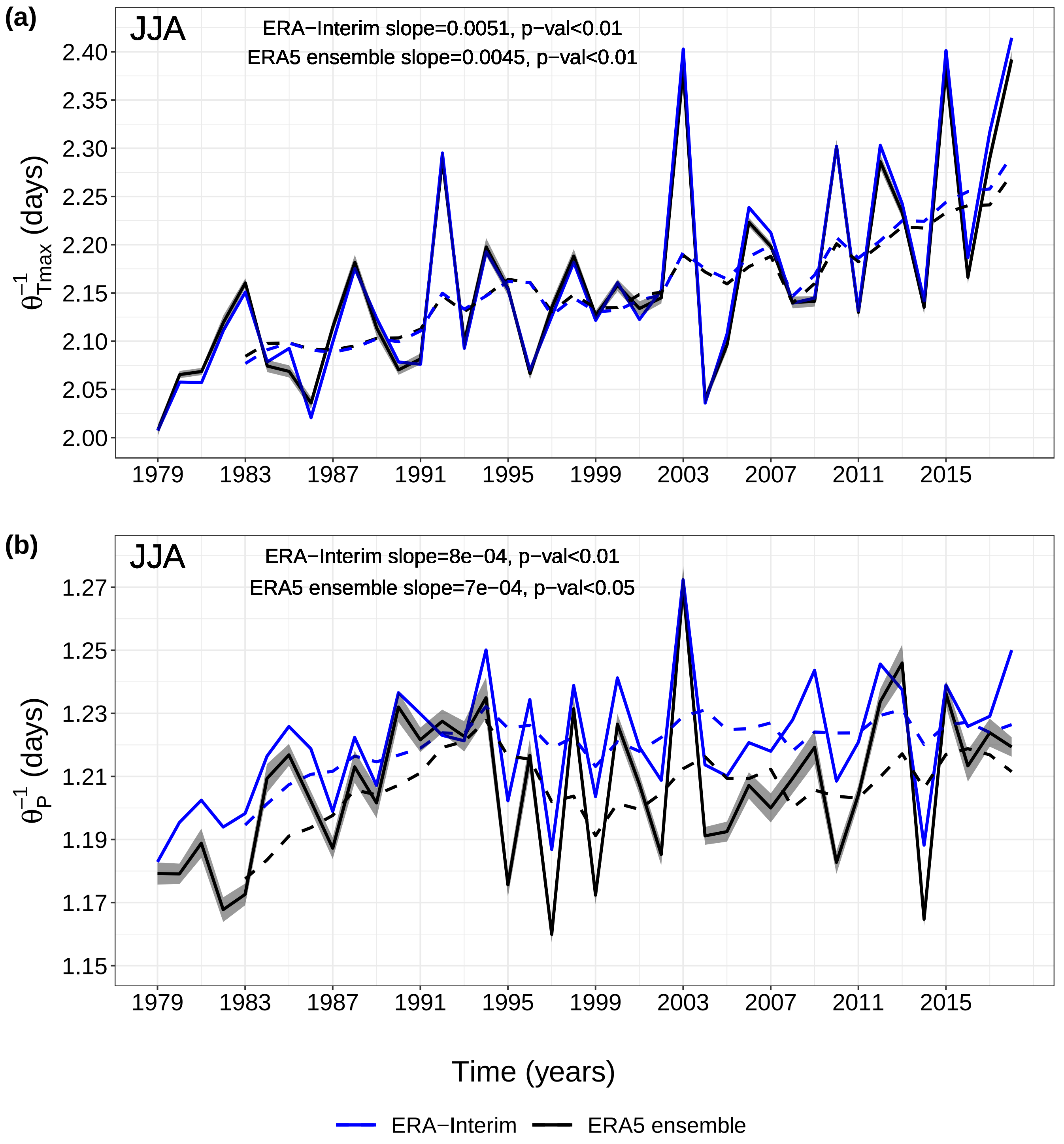


Figure S6. As Figure 2 but for ERA-Interim (blue) and ERA5 ensemble mean (black).

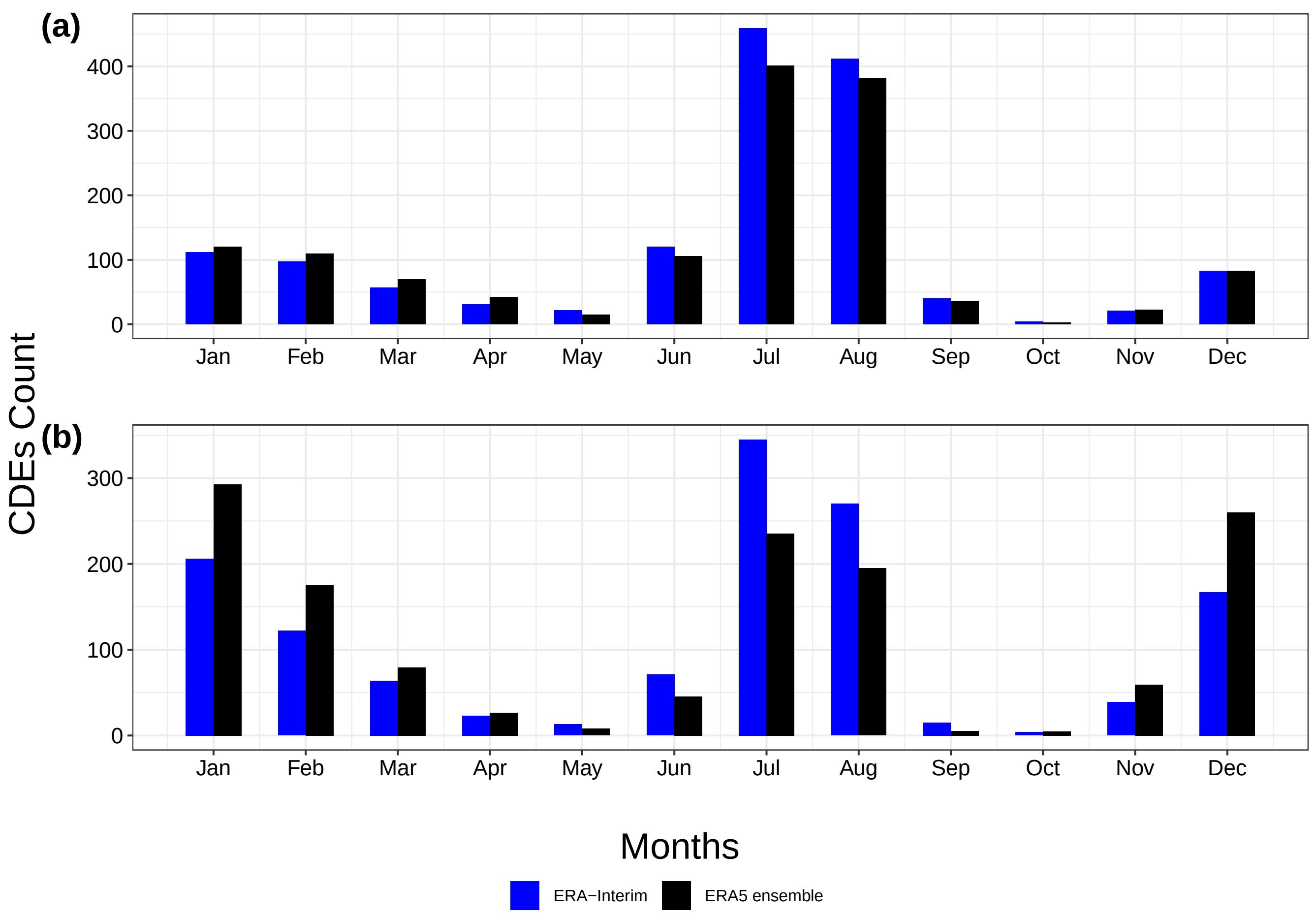


Figure S7. As Figure 3 but for ERA-Interim (blue) and ERA5 ensemble mean (black).

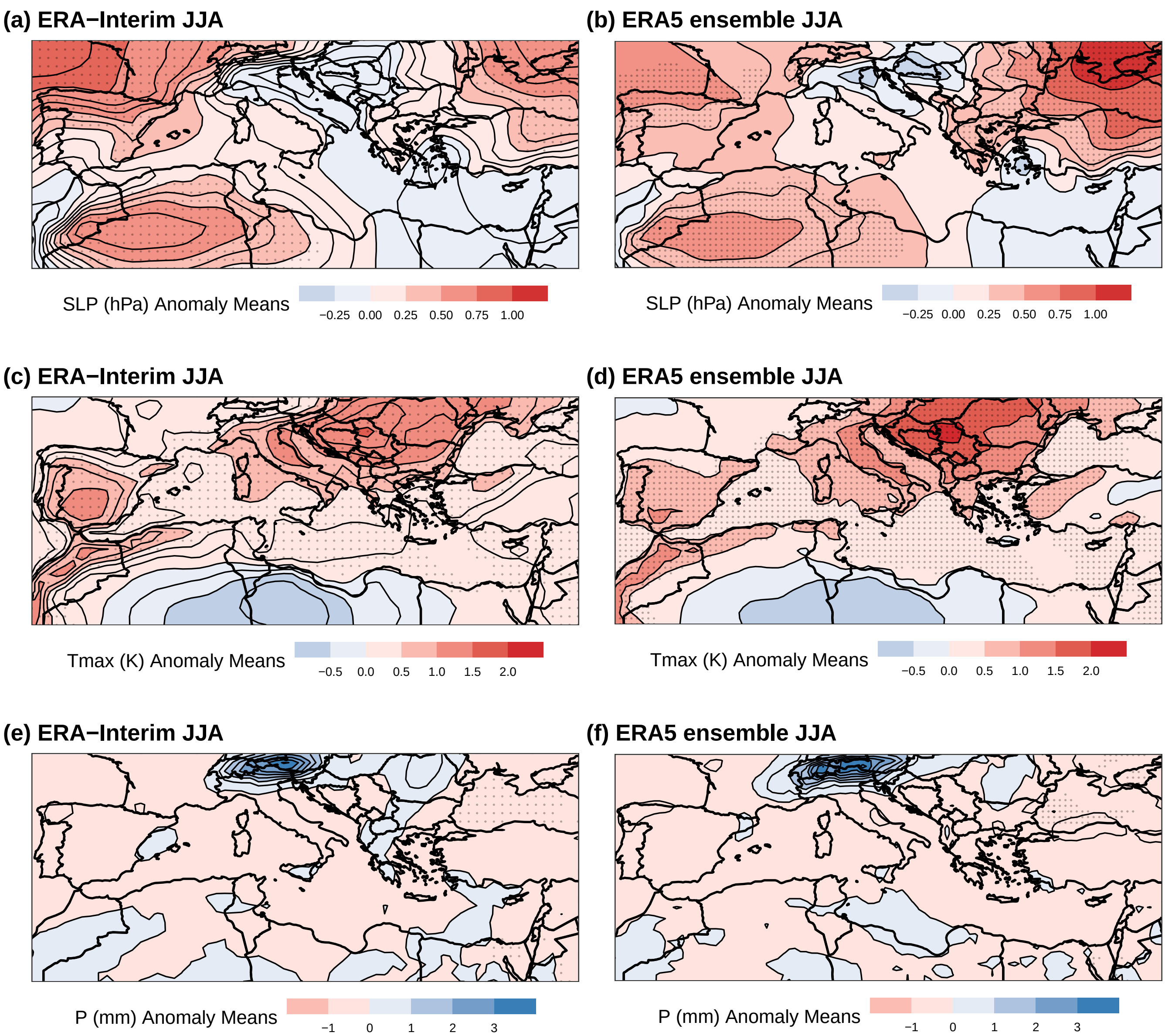


Figure S8. As Figure 4a,c,e but for (a), (c), (e) ERA-Interim and (b), (d), (f) ERA5 ensemble mean.

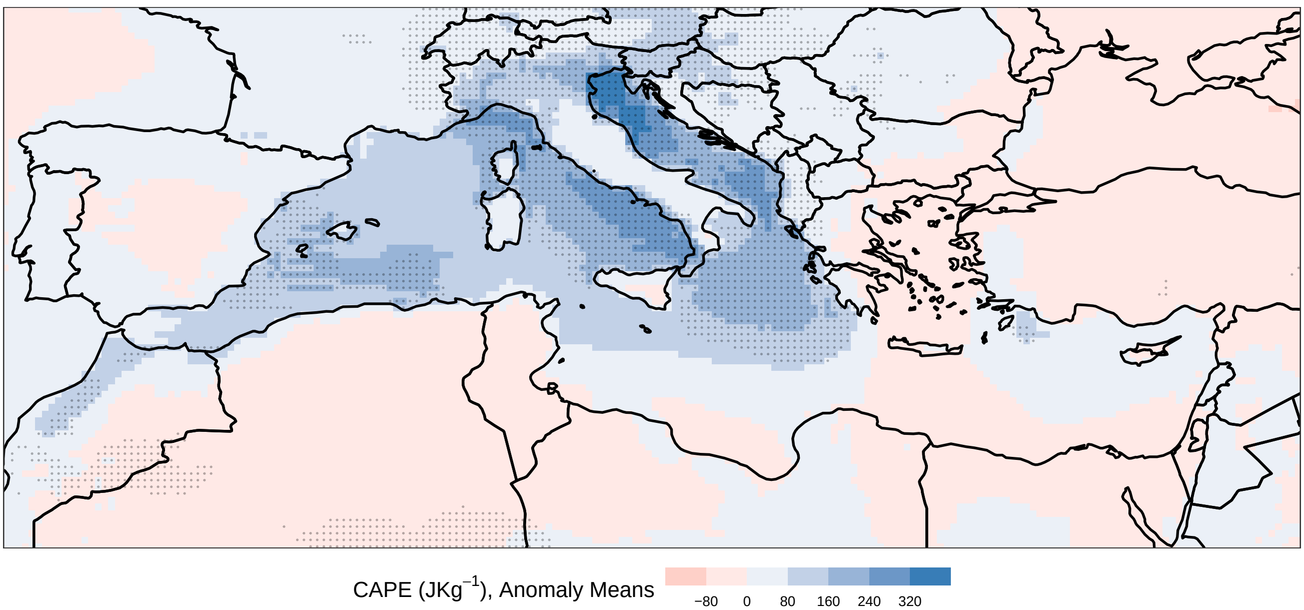


Figure S9. As Figure 4e but for ERA5 daily mean convective available potential energy (CAPE, JKg^{-1}).

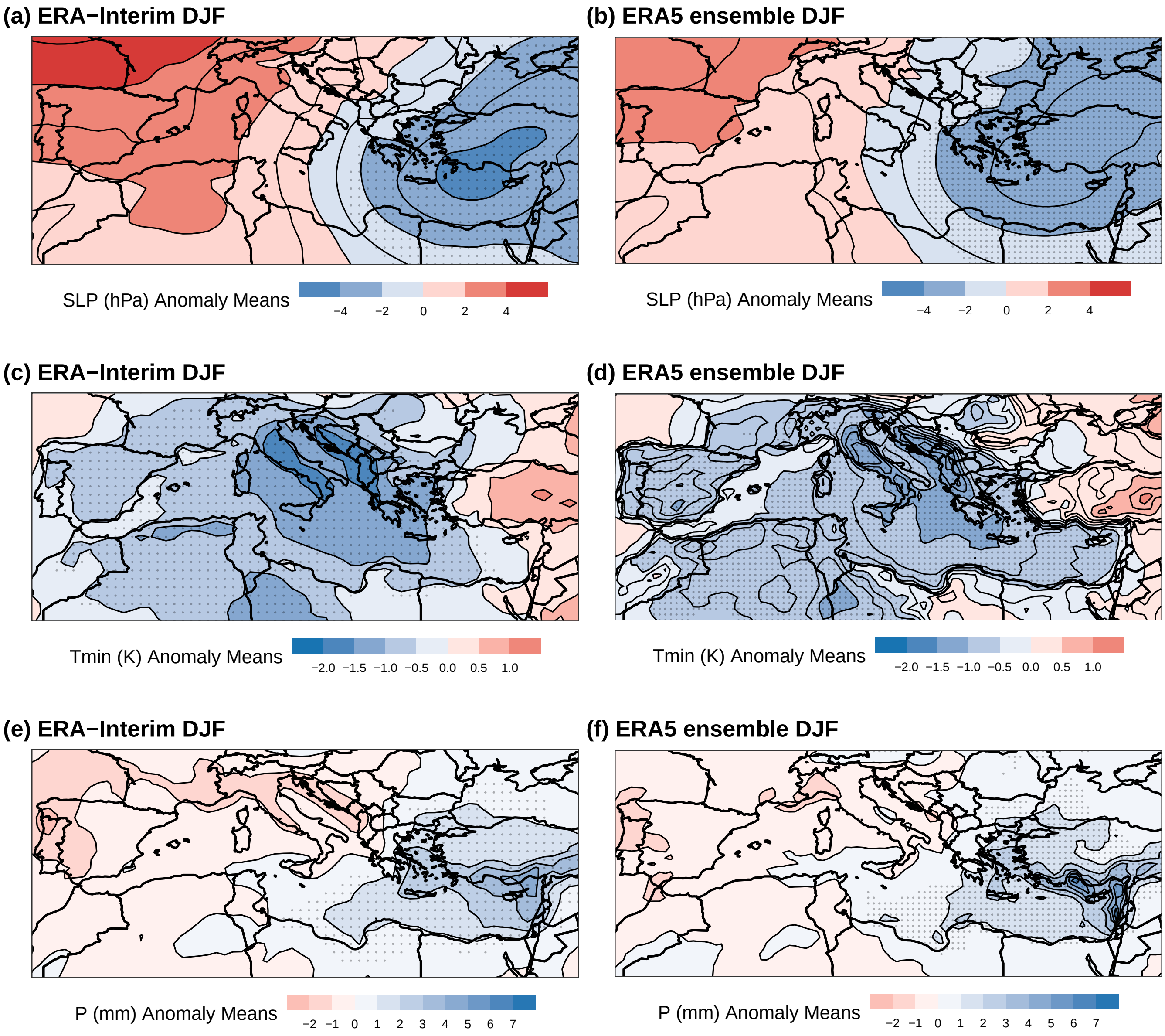


Figure S10. As Figure 4b,d,f but for (a), (c), (e) ERA-Interim and (b), (d), (f) ERA5 ensemble mean.

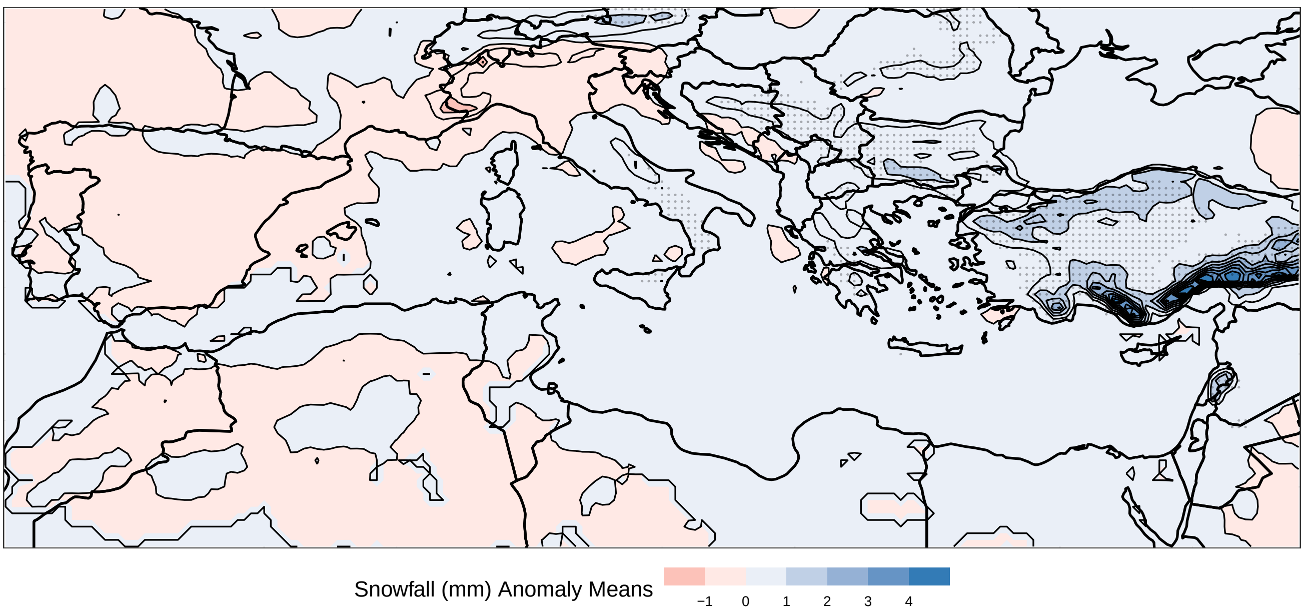


Figure S11. As Figure 4f, but for snowfall anomaly means (mm).

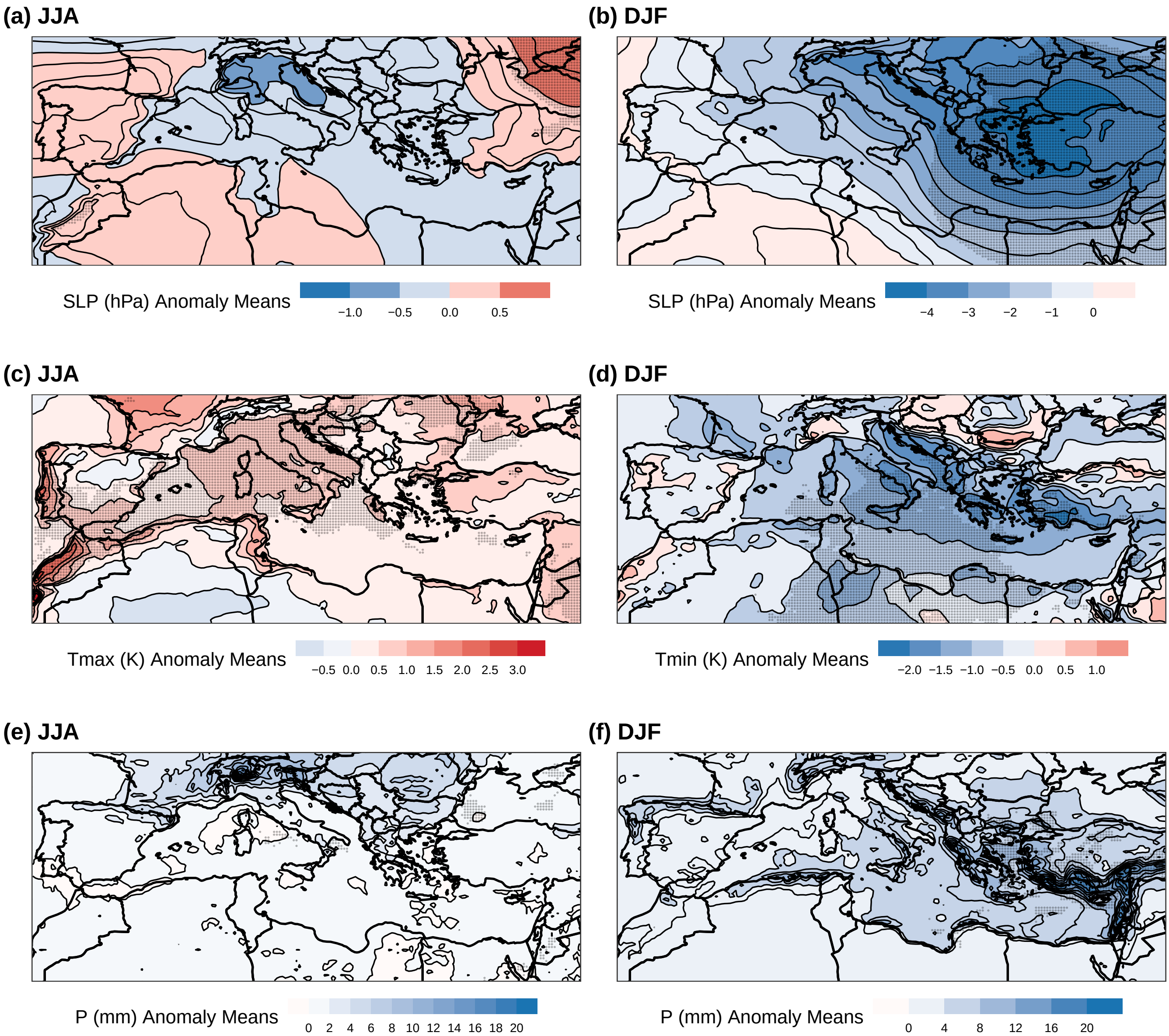


Figure S12. As Figure 4 but for anomalies $> 90^{th}$ and $< 10^{th}$ quantiles.

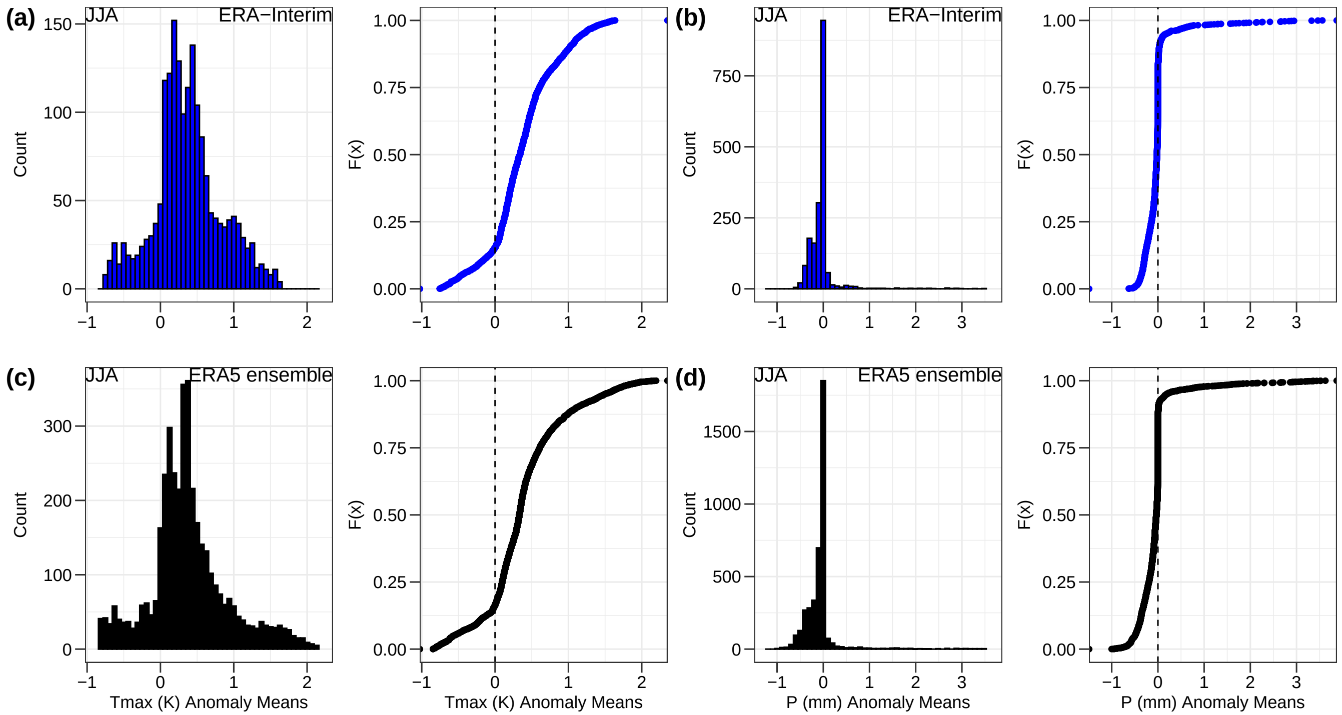


Figure S13. As Figure 5a-b but for (a)-(b) ERA-Interim (blue) and (c)-(d) ERA5 ensemble mean (black). The anomaly means correspond to the ones in Figure S8c-f.

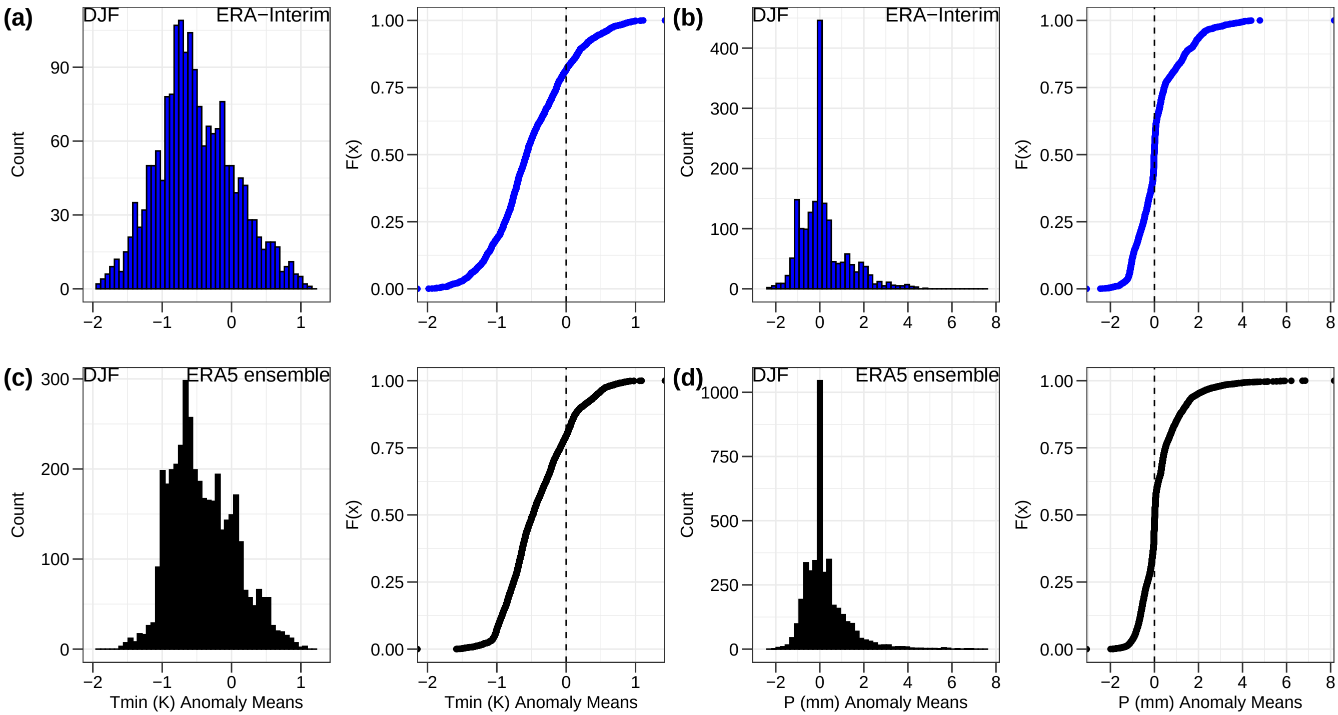
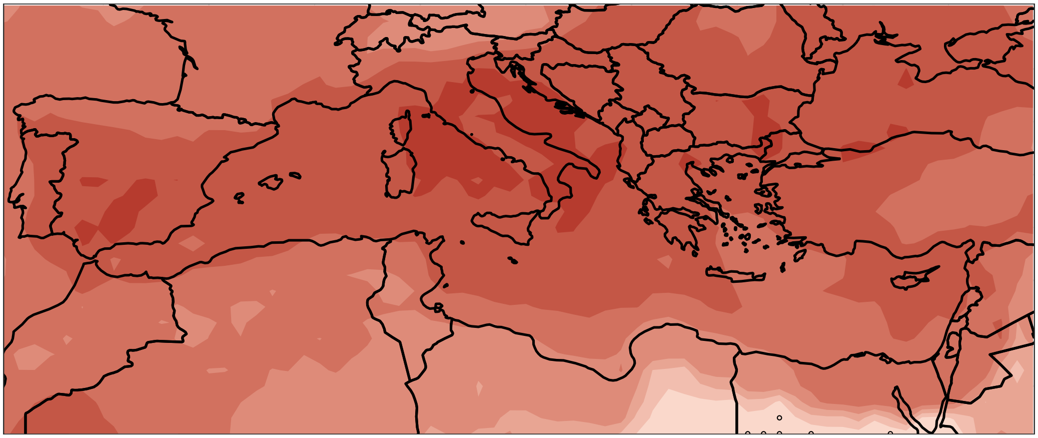


Figure S14. As Figure 5c-d but for (a)-(b) ERA-Interim (blue) and (c)-(d) ERA5 ensemble mean (black). The anomaly means correspond to the ones in Figure S10c-f.

(a) ERA−Interim



(b) ERA5 ensemble

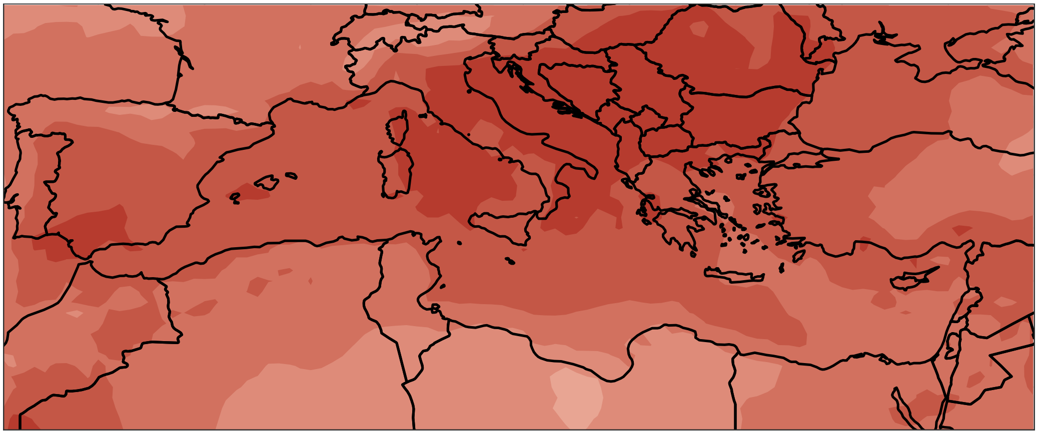
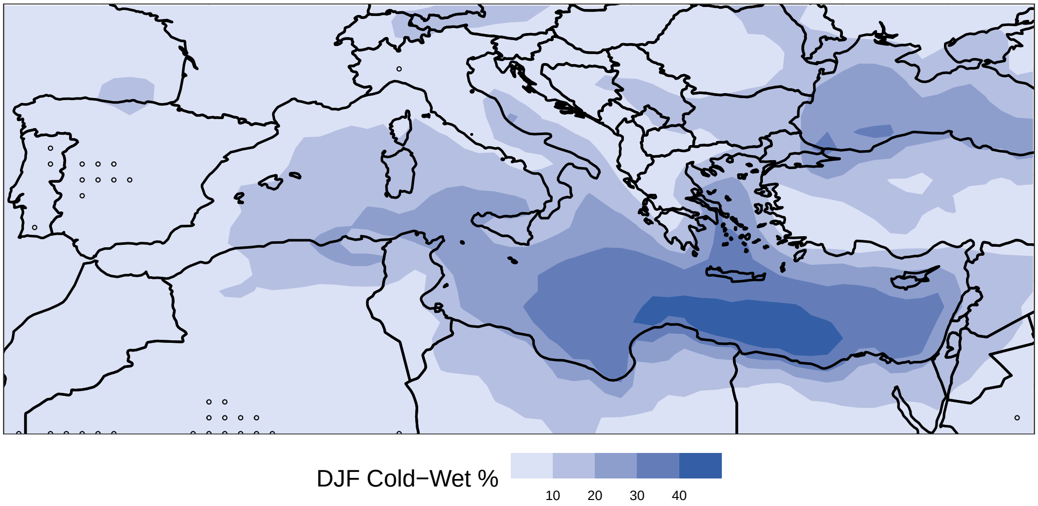


Figure S15. As Figure 6a but for (a) ERA-Interim and (b) ERA5 ensemble mean.

(a) ERA−Interim



(b) ERA5 ensemble

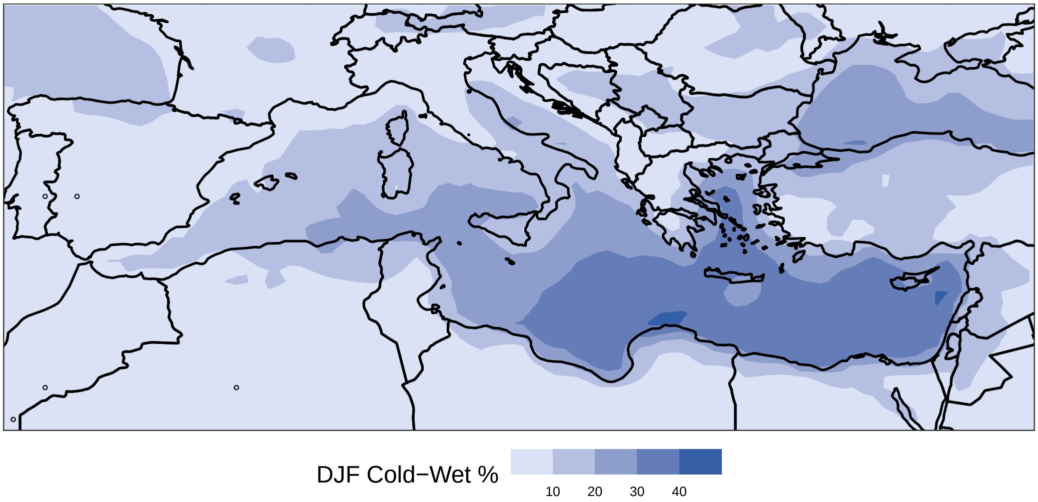


Figure S16. As Figure 6b but for (a) ERA-Interim and (b) ERA5 ensemble mean.

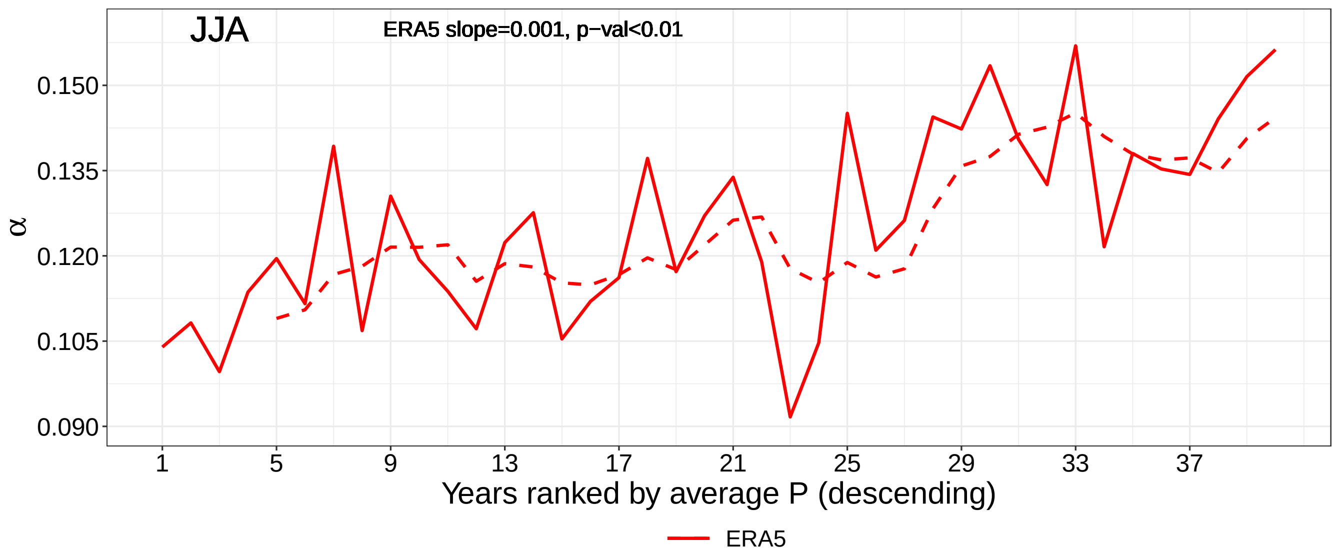


Figure S17. As Figure 1b but for average P years ranked in descending order.

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