Figure S1: Spatial distribution of the 500 most intense cyclones in the 4 seasons for CPL (a, d, g, l), STD (b, e, h, m) and ERA5 (c, f, i, n).

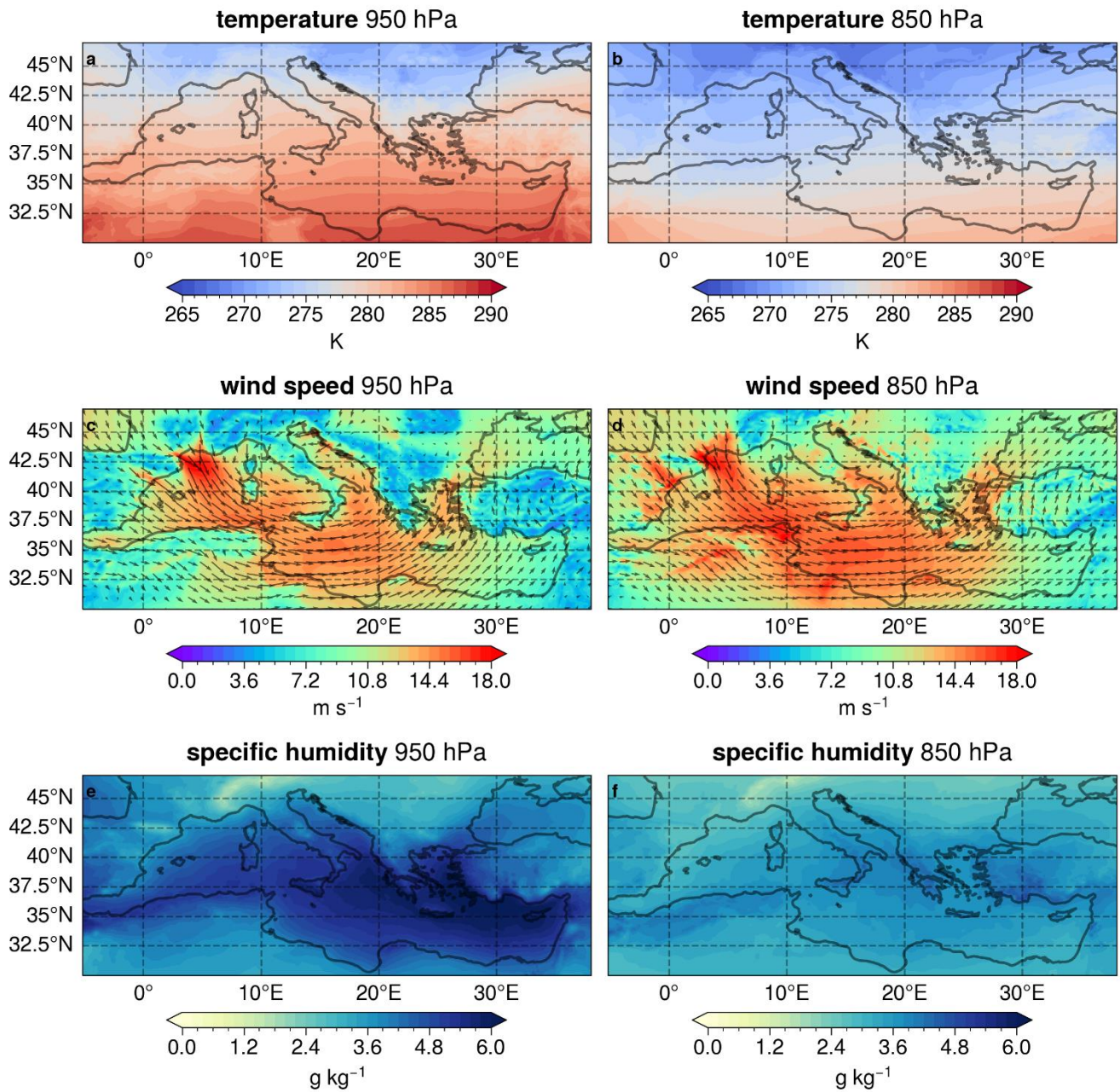



Figure S2: Maps for temperature (a,b), specific humidity (c,d) and wind speed at 950 hPa and 850 hPa from the STD simulation during extreme winter cyclones in common with CPL.

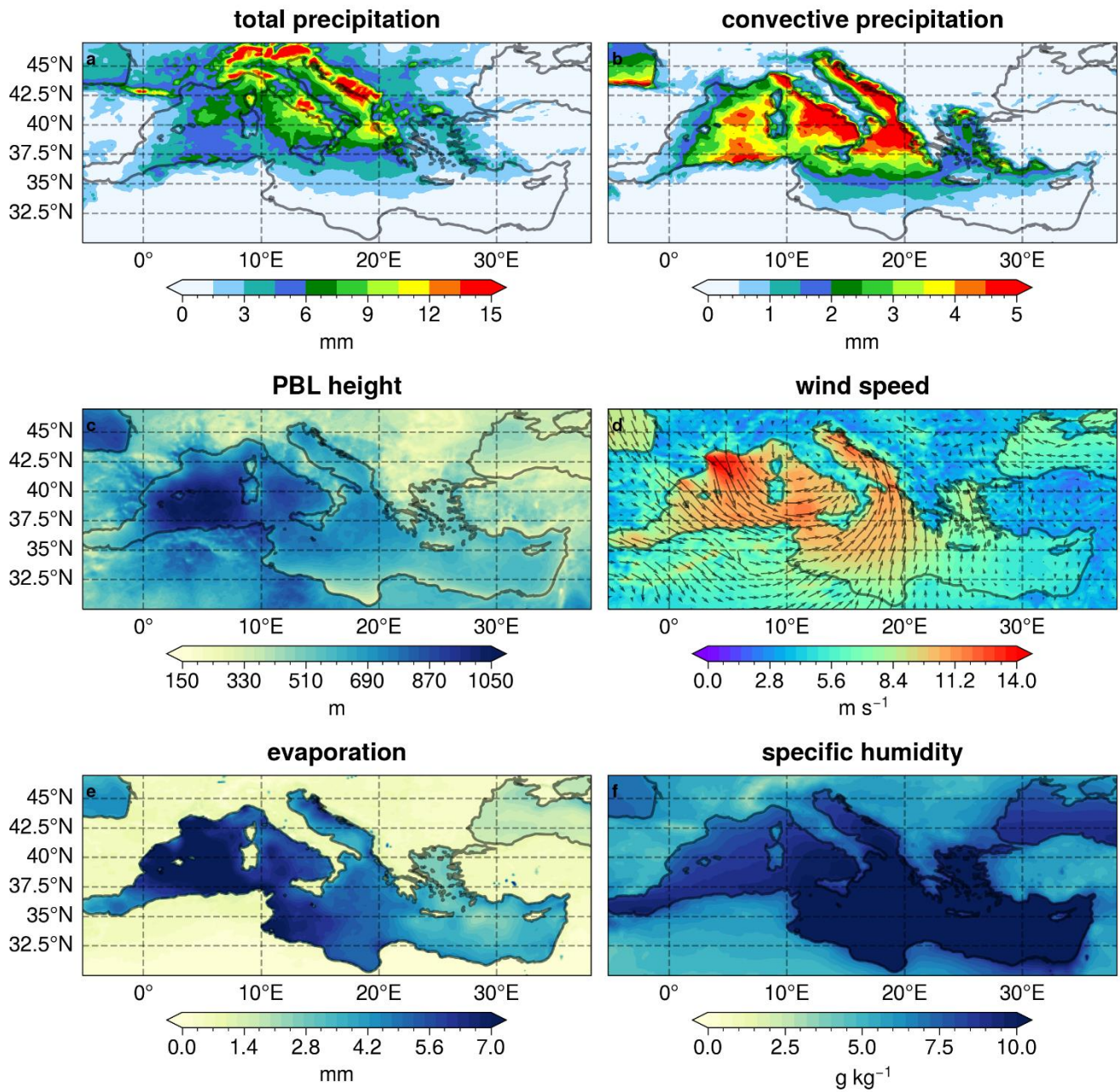



Figure S3: Same as figure 4, but for SON.

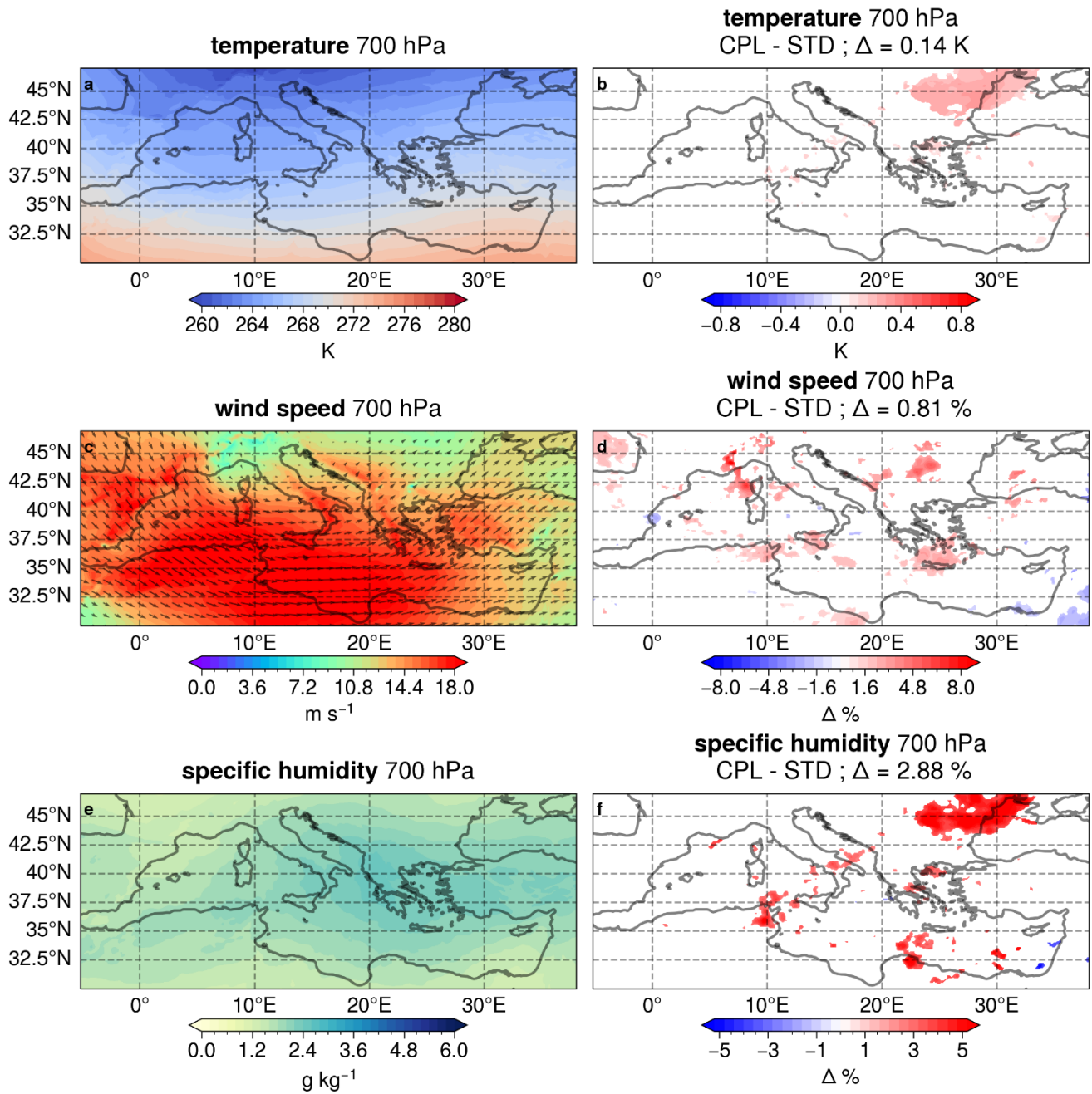
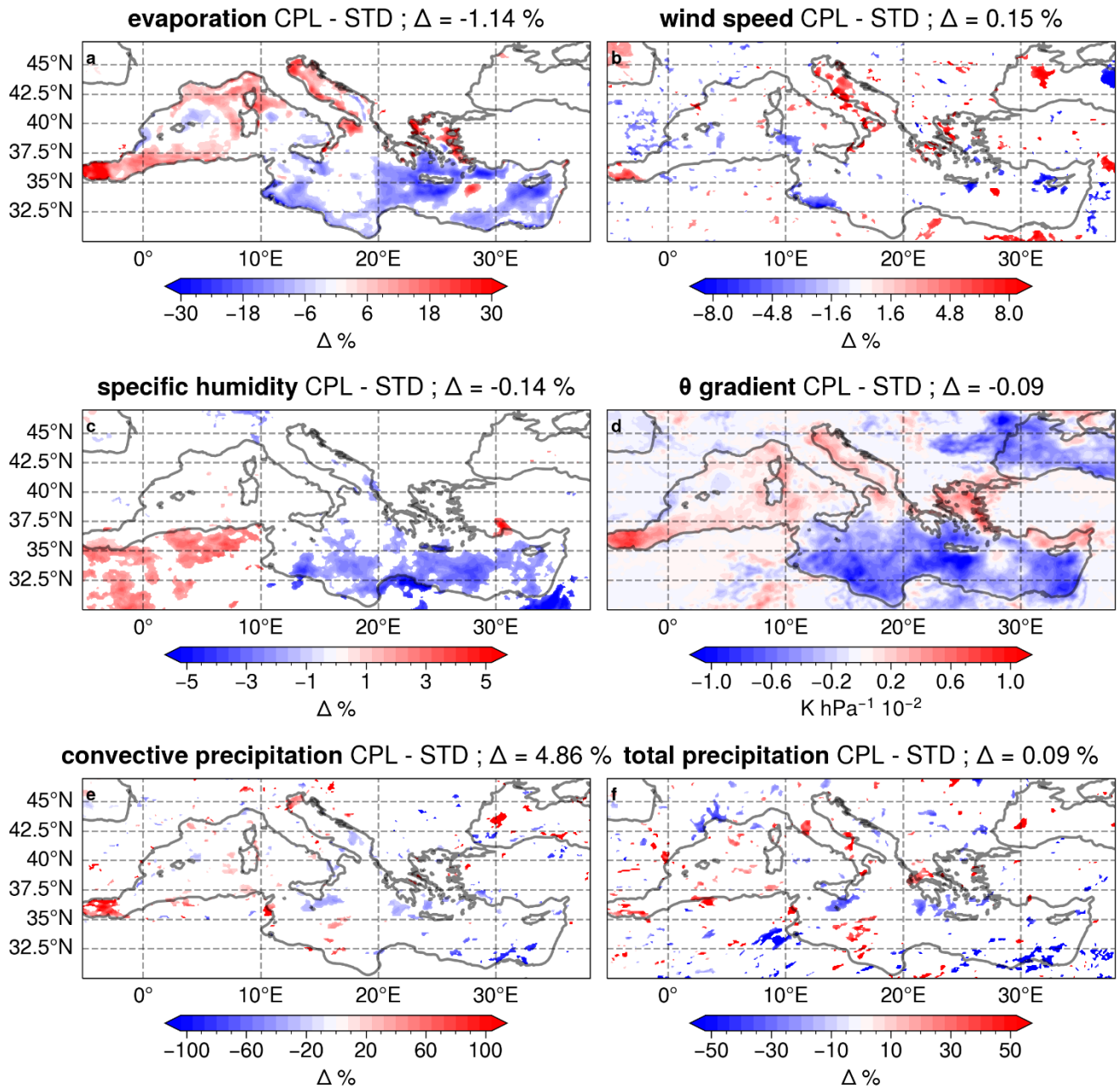



Figure S4: Maps of temperature (a, b), specific humidity (c, d) and wind speed (e, f) at 700 hPa from the STD simulation, together with the differences between CPL and STD, during the common extreme winter cyclones. The white colour in Fig. (b), (d) and (f) indicates no significant differences at 5% confidence level.

15 **Figure S5: Same as figure 7, but for SON.**

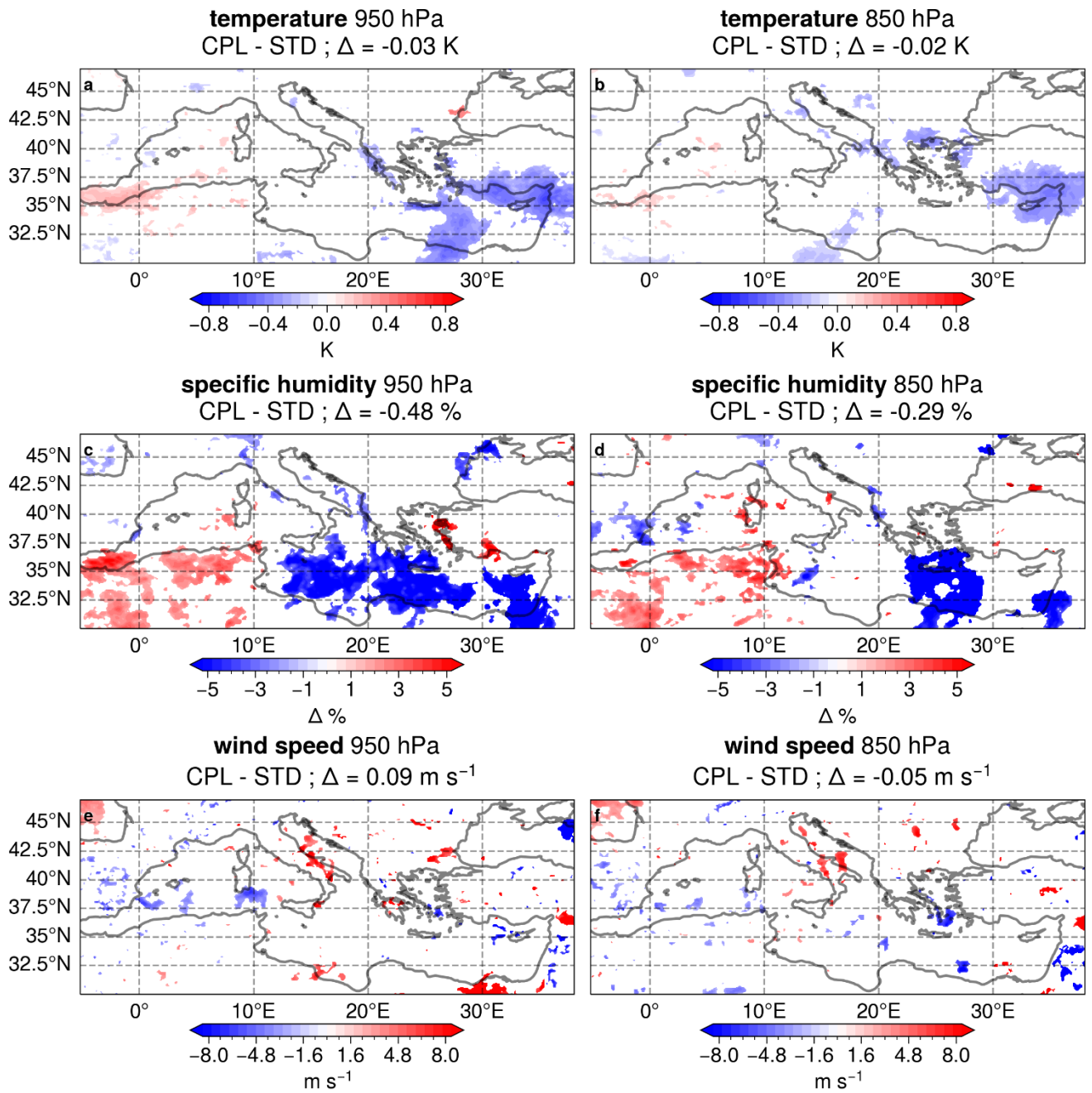



Figure S6: Same as figure 8, but for SON.

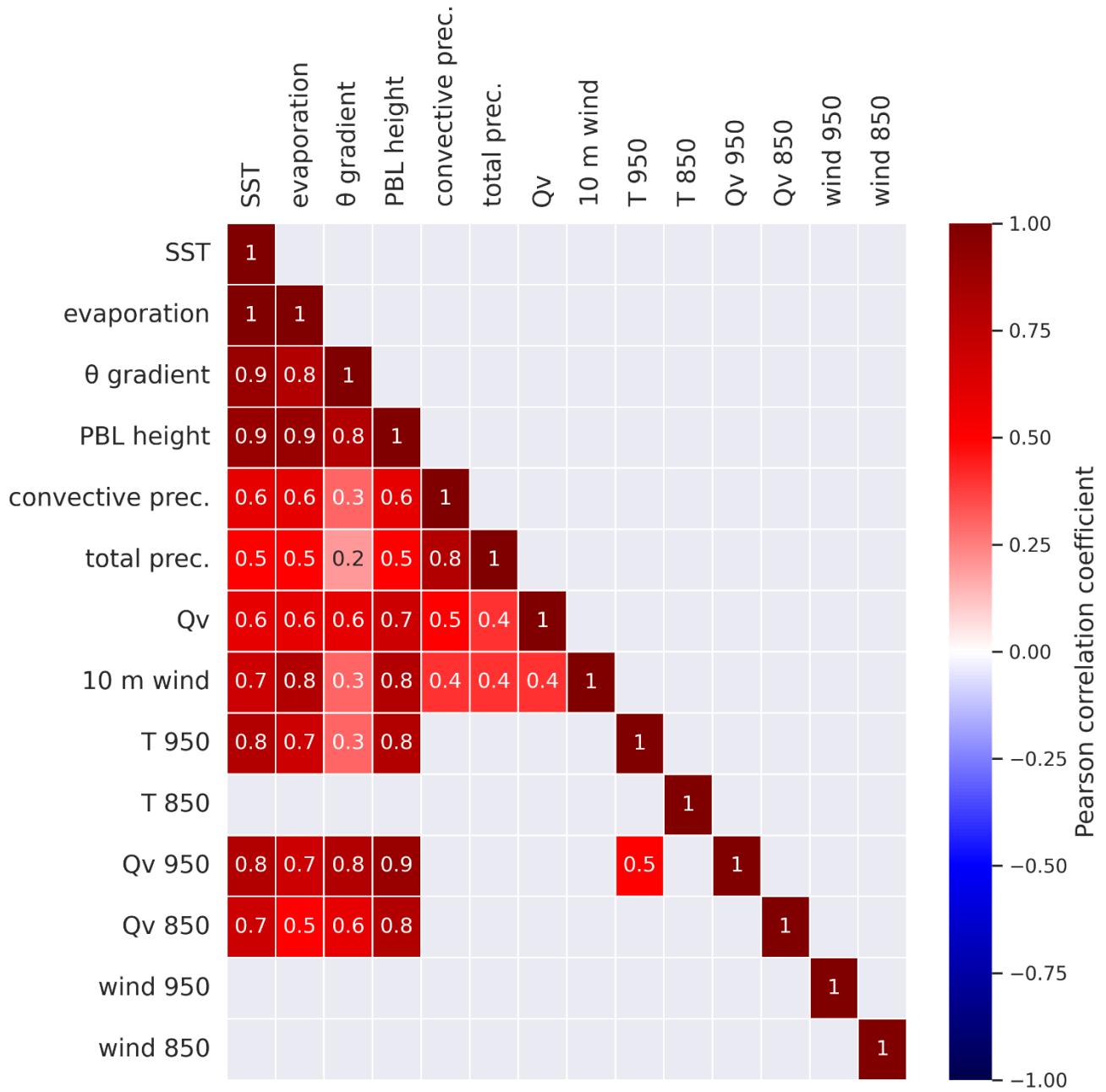



Figure S7: Same as figure 9, but for SON.

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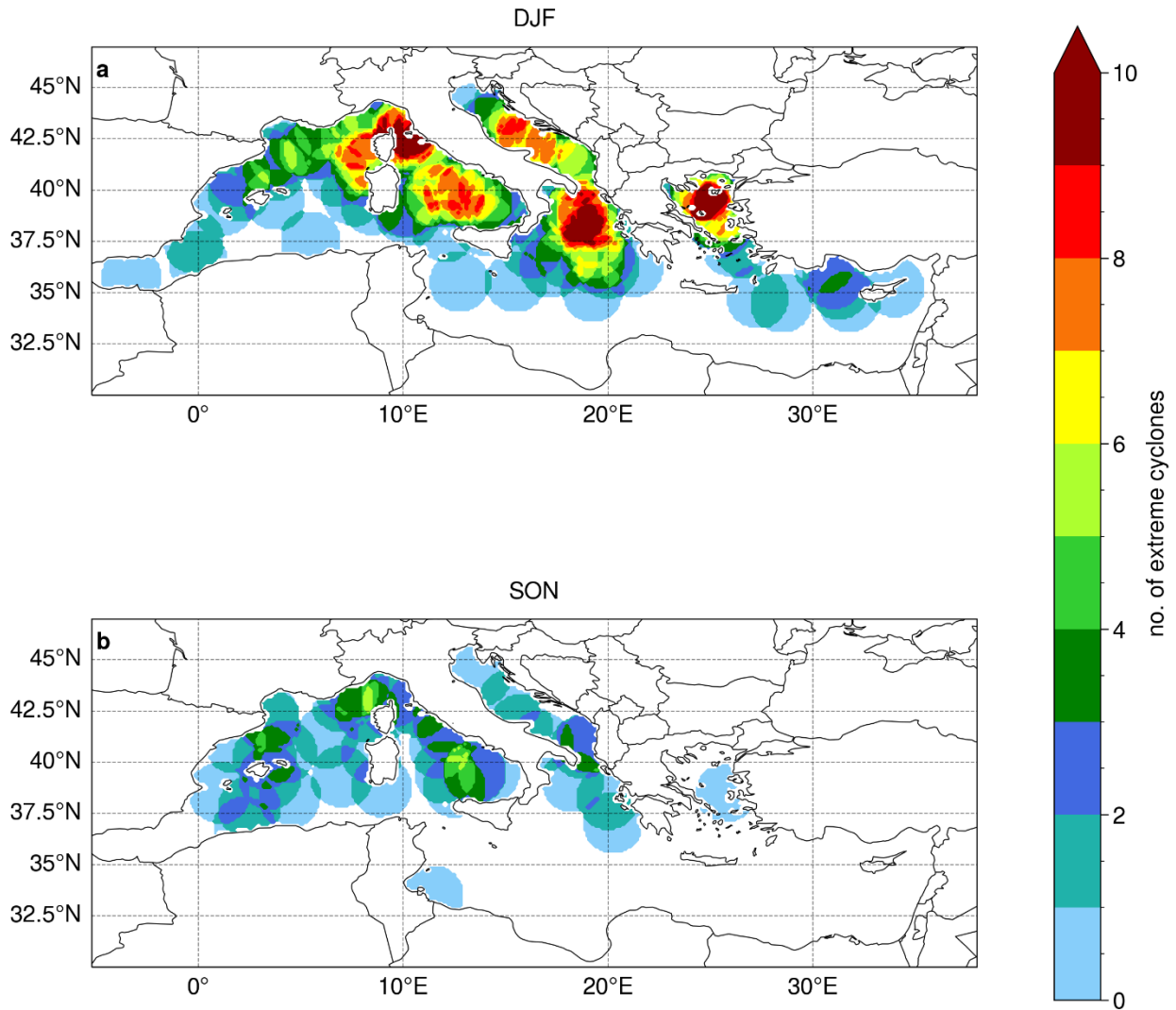
Figure S8: Distribution of winter (a) and autumn (b) cyclones within the extreme cyclones of the CPL model in common with STD, that present their minimum SLP point over the sea. Each cyclone is represented by a circular area, only over the Sea, with a radius of 1.5°, around its minimum SLP tracking point.

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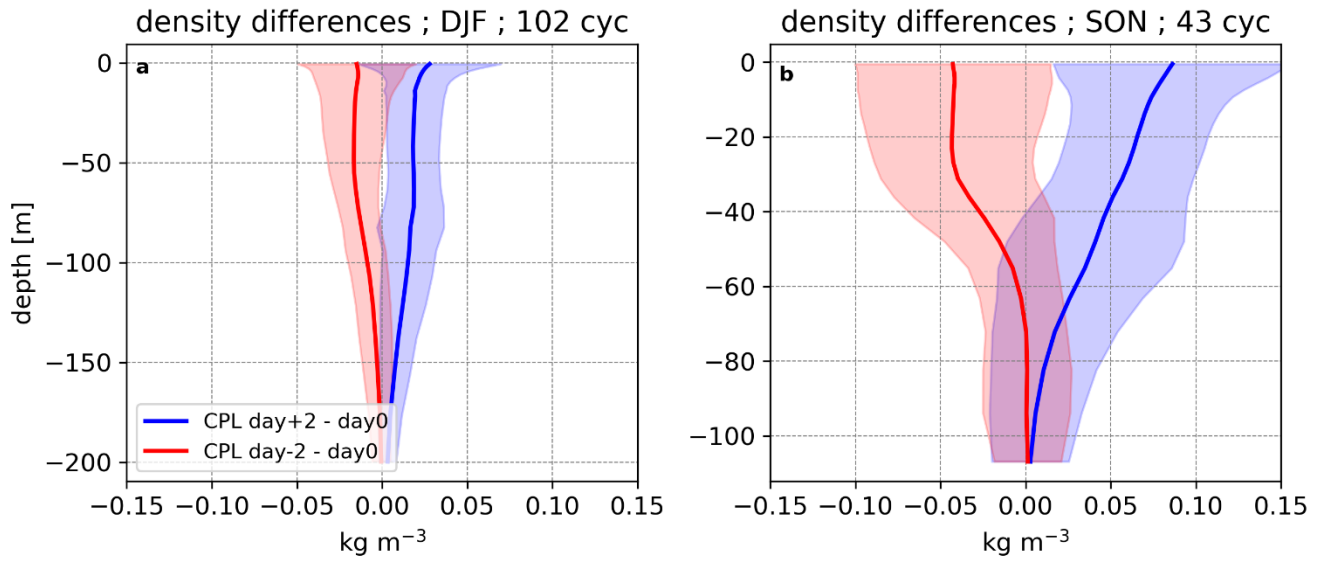
Figure S9: Same as Fig. 10c and d, but for density and only for the CPL model.
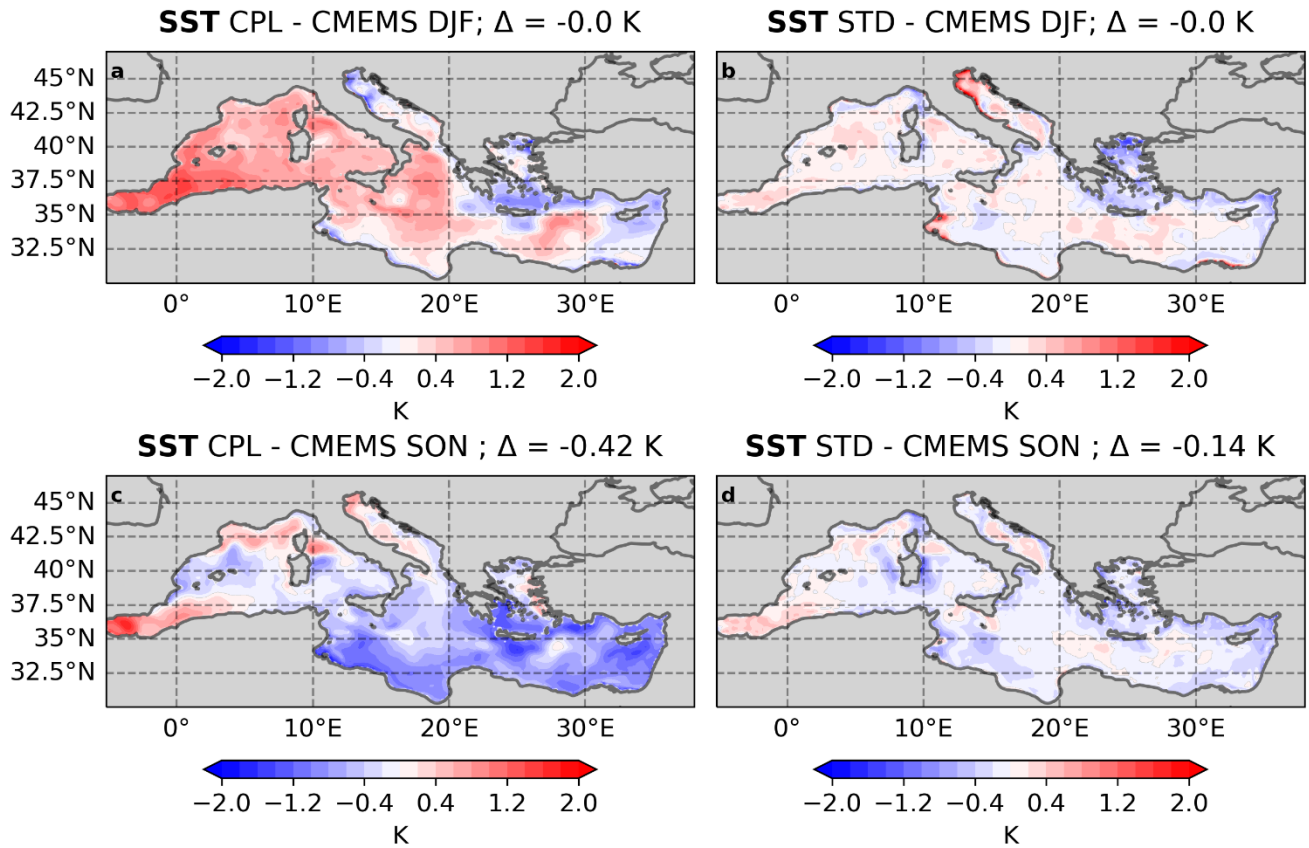
Figure S10: Maps of the climatological difference in SST between CPL and CMEMS MED-Currents in DJF (a) and SON (c) and between STD and CMEMS MED-Currents in DJF (b) and SON (d).