

Supplement of Weather Clim. Dynam., 3, 977–1001, 2022
<https://doi.org/10.5194/wcd-3-977-2022-supplement>
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Supplement of

Quantifying stratospheric biases and identifying their potential sources in subseasonal forecast systems

Zachary D. Lawrence et al.

Correspondence to: Zachary D. Lawrence (zachary.lawrence@noaa.gov)

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BoM*

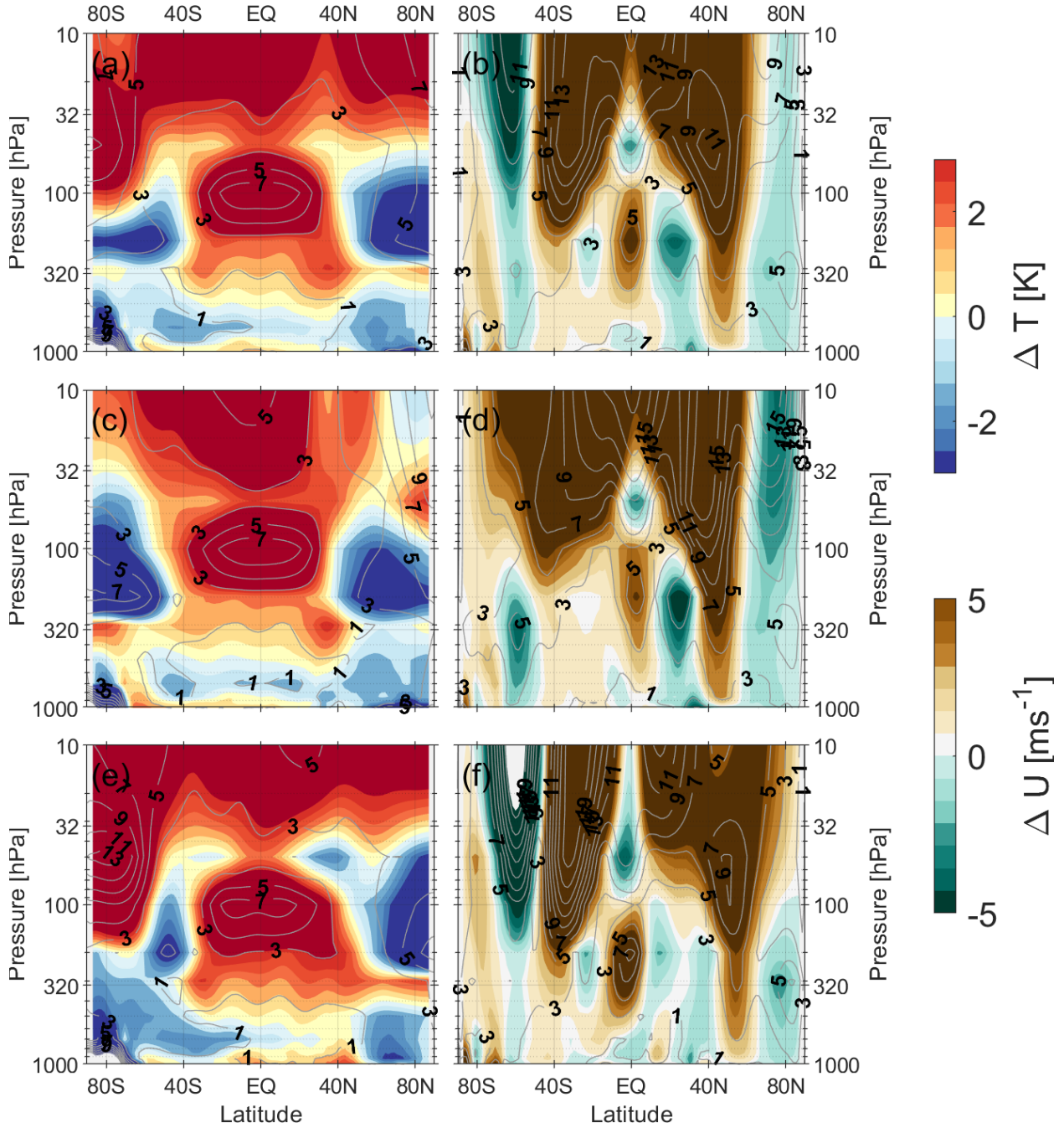


Figure S1. The week-4 zonal mean biases computed from the BoM hindcasts for (left column) temperatures and (right column) zonal winds. The top row represents the annual mean biases, while the middle and bottom rows are for DJF and JJA, respectively. The grey line contours represent the mean absolute errors (MAE) composited for these seasons.

CESM2CAM

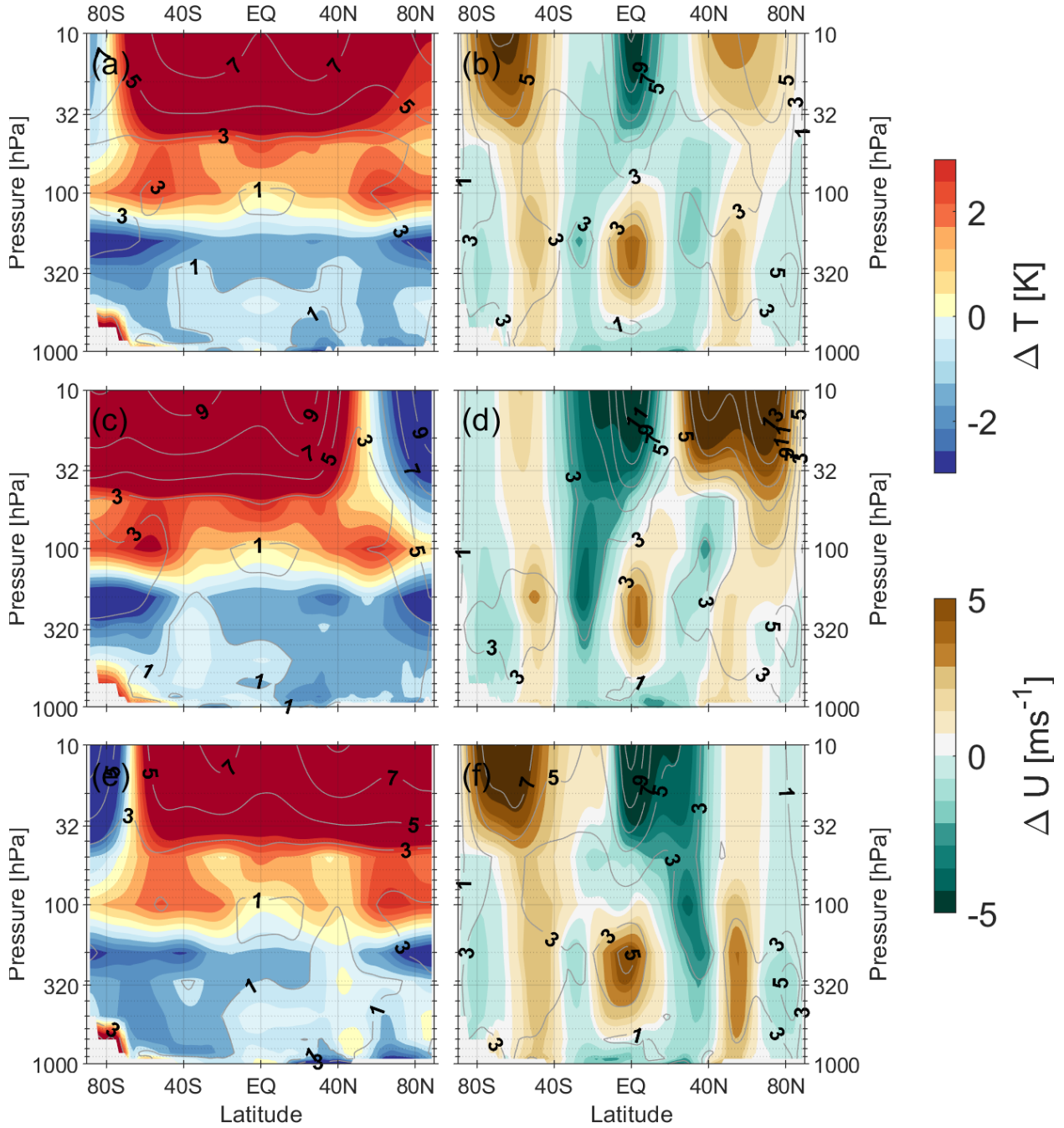


Figure S2. As in Figure S1, but for the CESM2-CAM system.

CESM2WACCM

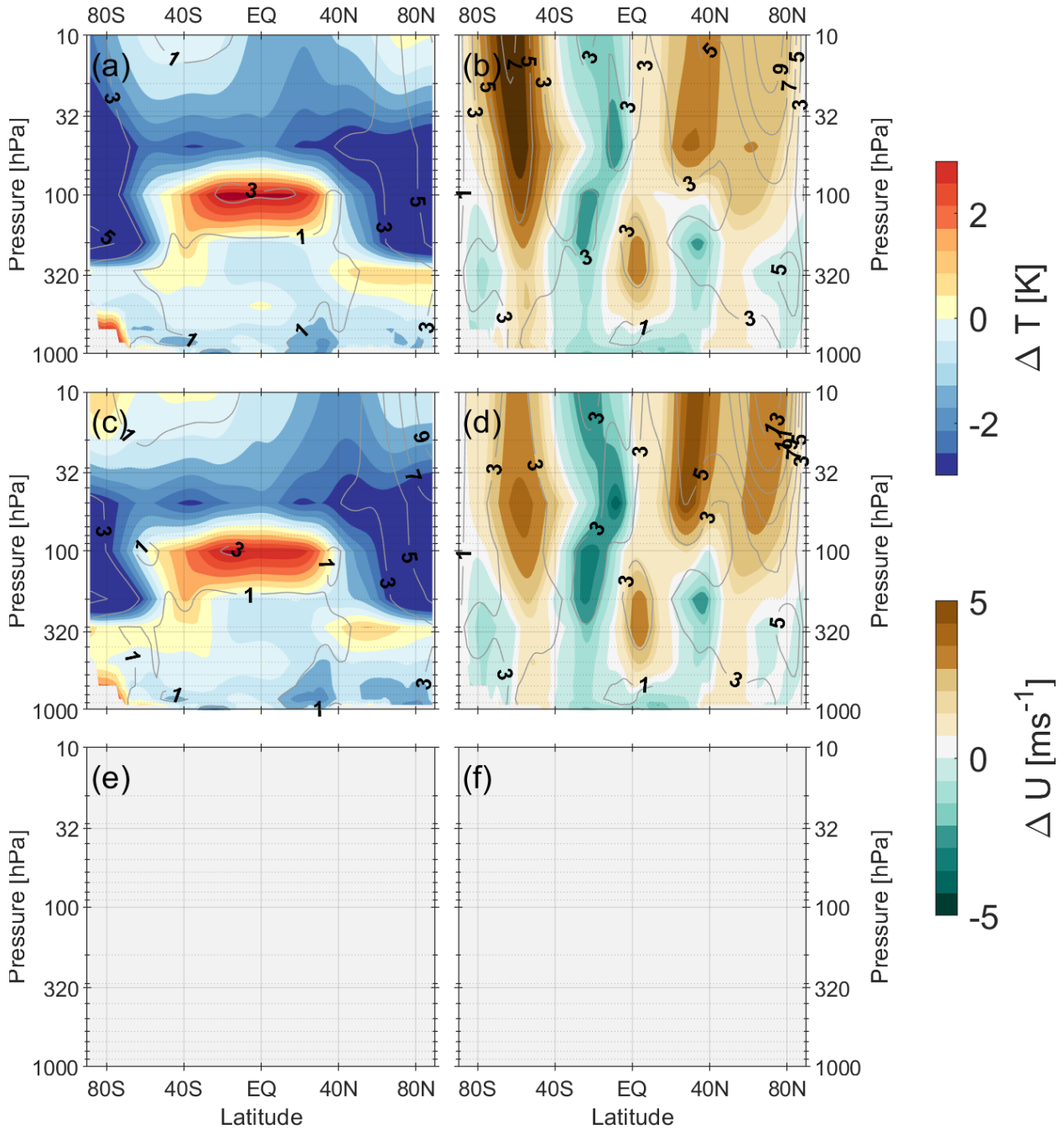


Figure S3. As in Figure S1, but for the CESM2-WACCM system. The bottom row is left blank since the CESM2-WACCM system only ran hindcasts from September to March. The “annual-mean” composite in the top row is then based only on 7 months (excluding April-August).

CMA-S2Sv1*

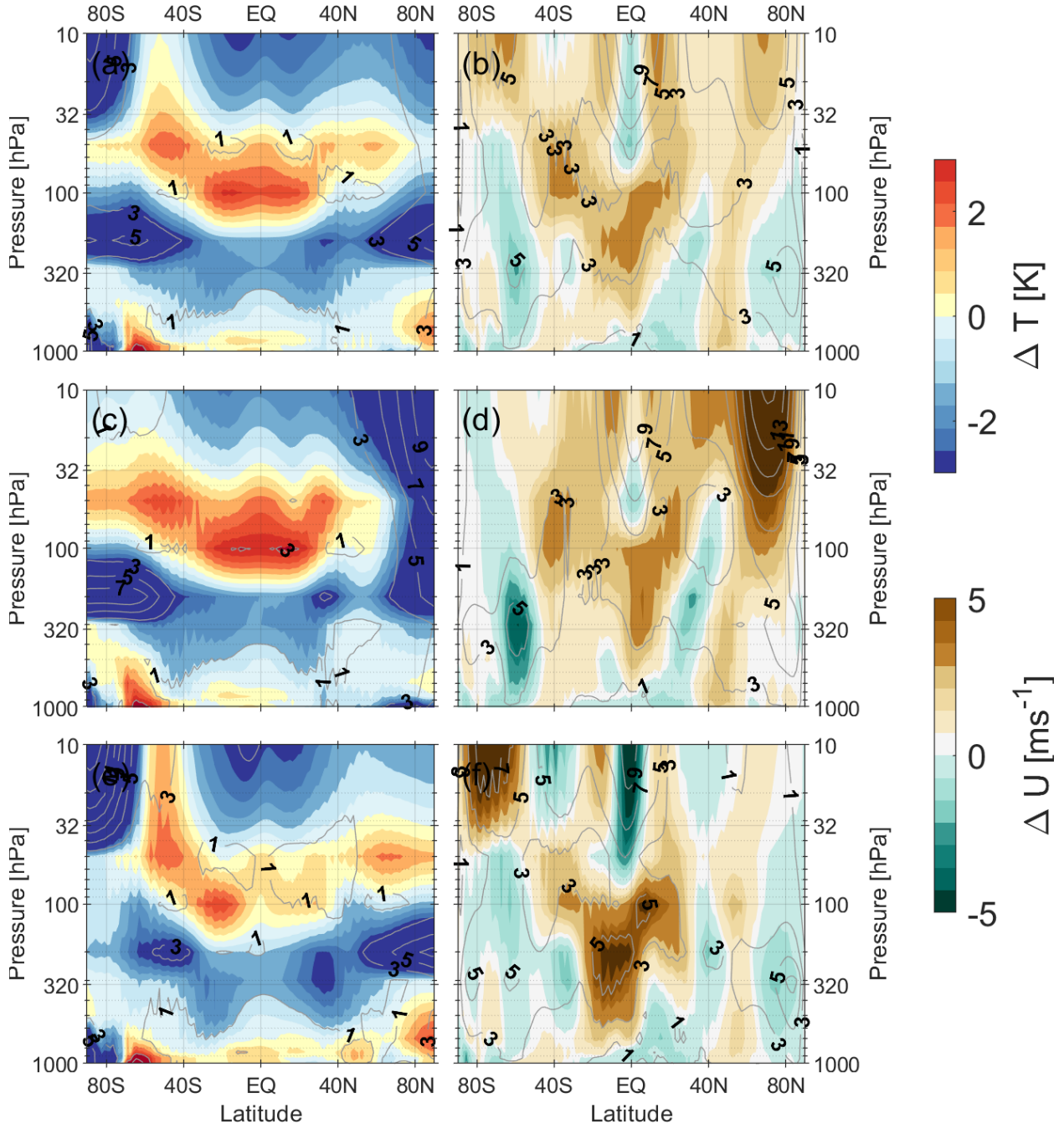


Figure S4. As in Figure S1, but for the CMA system.

CNR-ISAC*

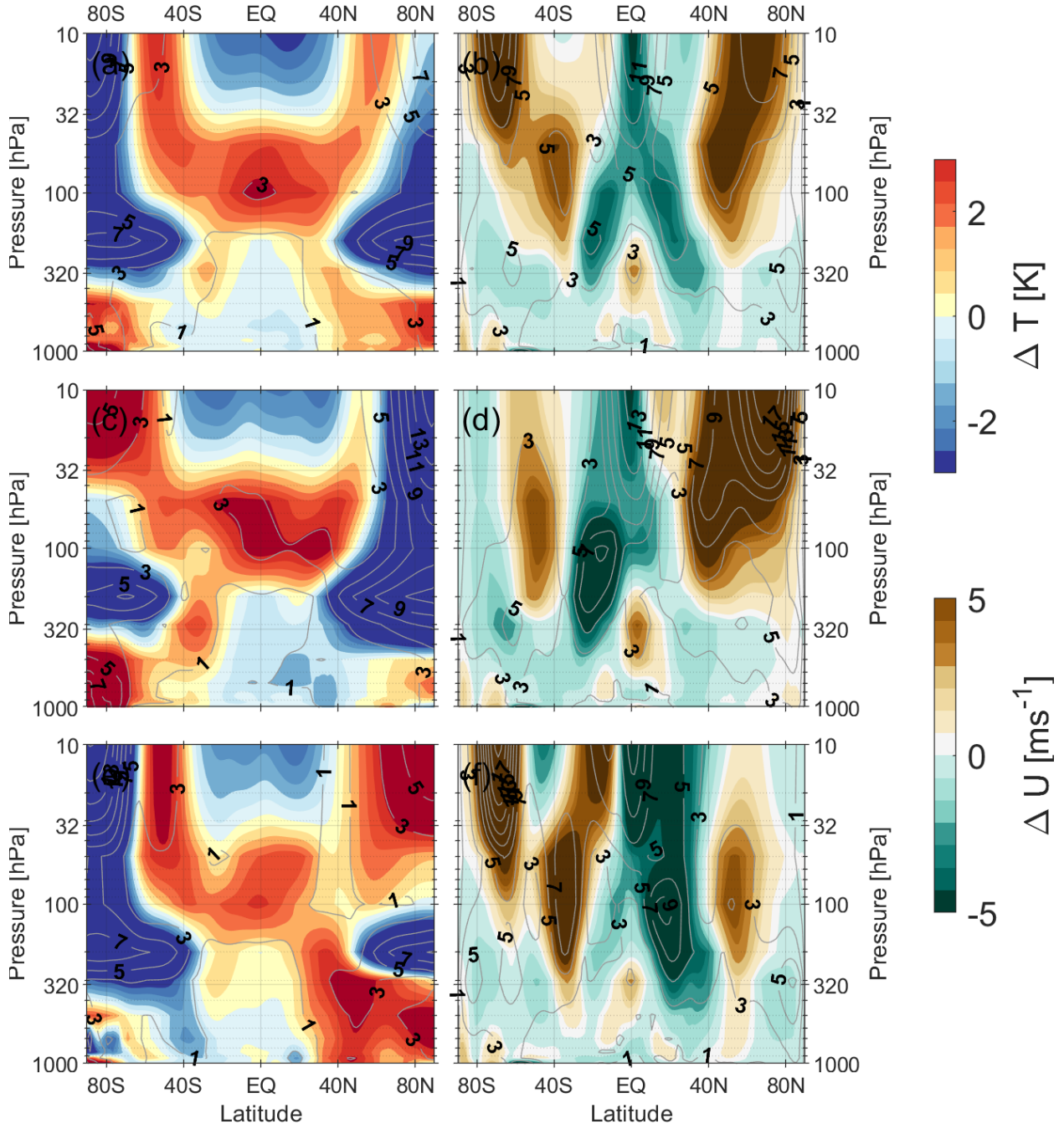


Figure S5. As in Figure S1, but for the CNR-ISAC system.

CNRM

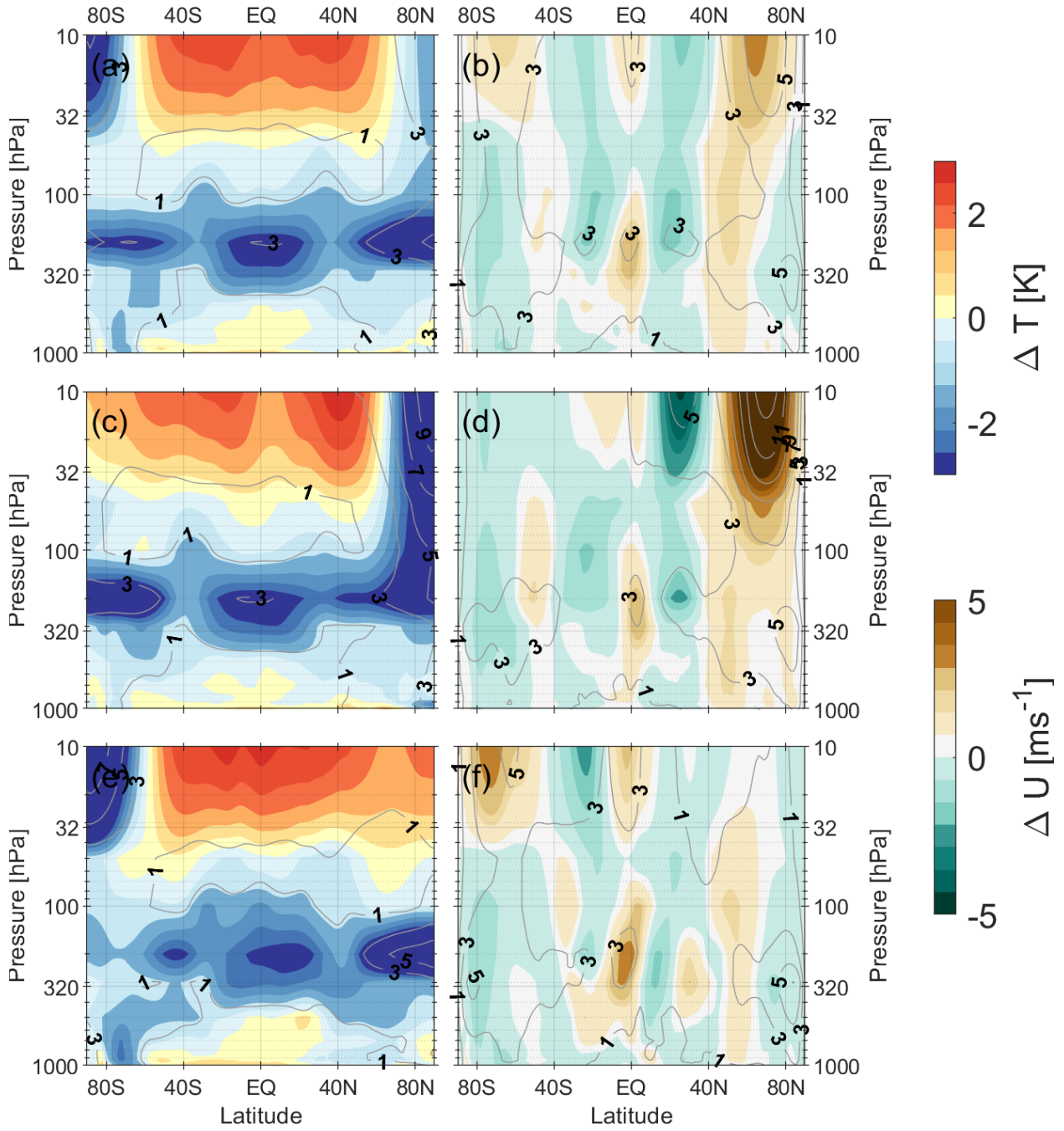


Figure S6. As in Figure S1, but for the CNRM system.

ECCC-GEPS19

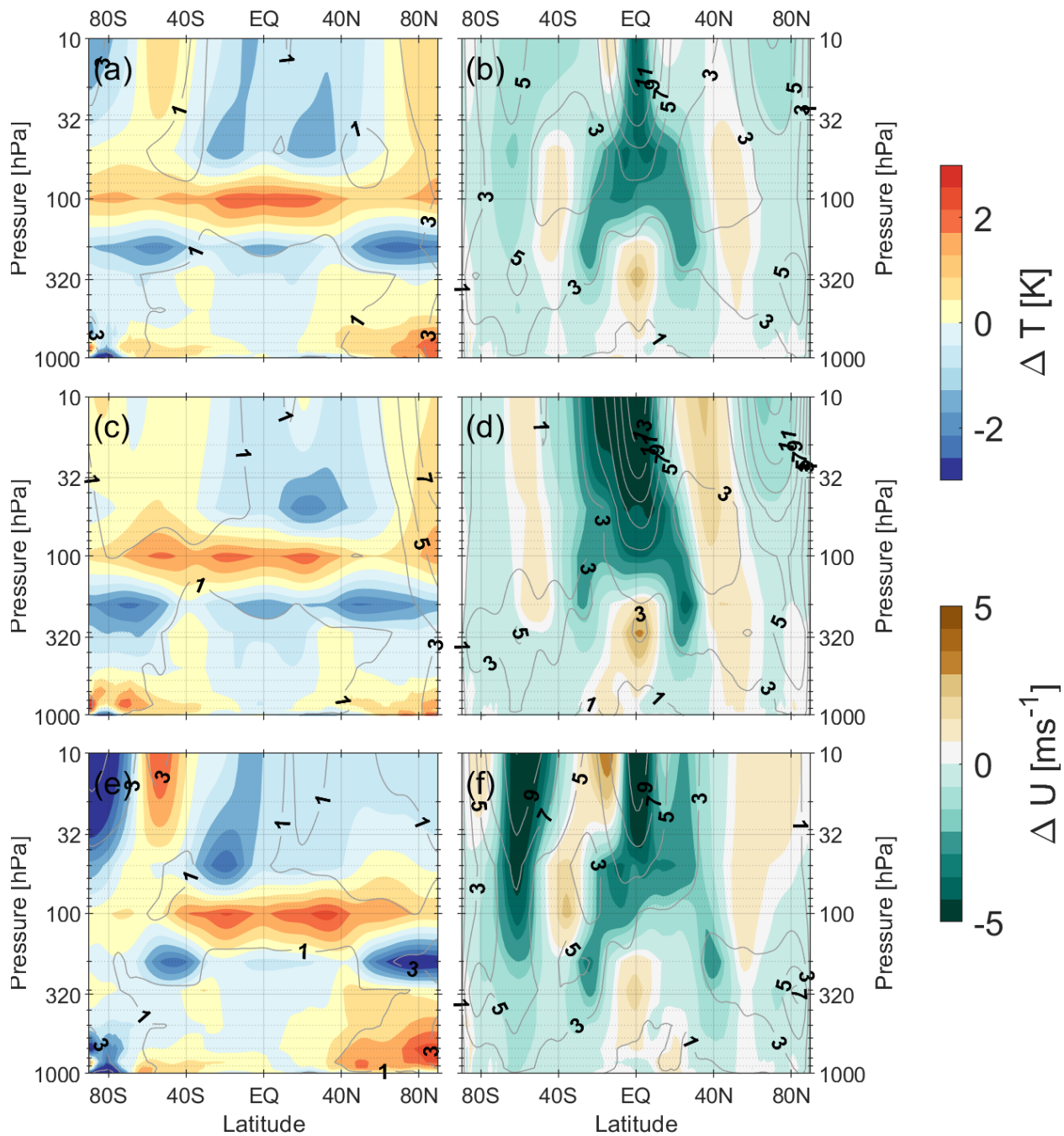


Figure S7. As in Figure S1, but for the high-top ECCC system (GEPS19).

ECMWF

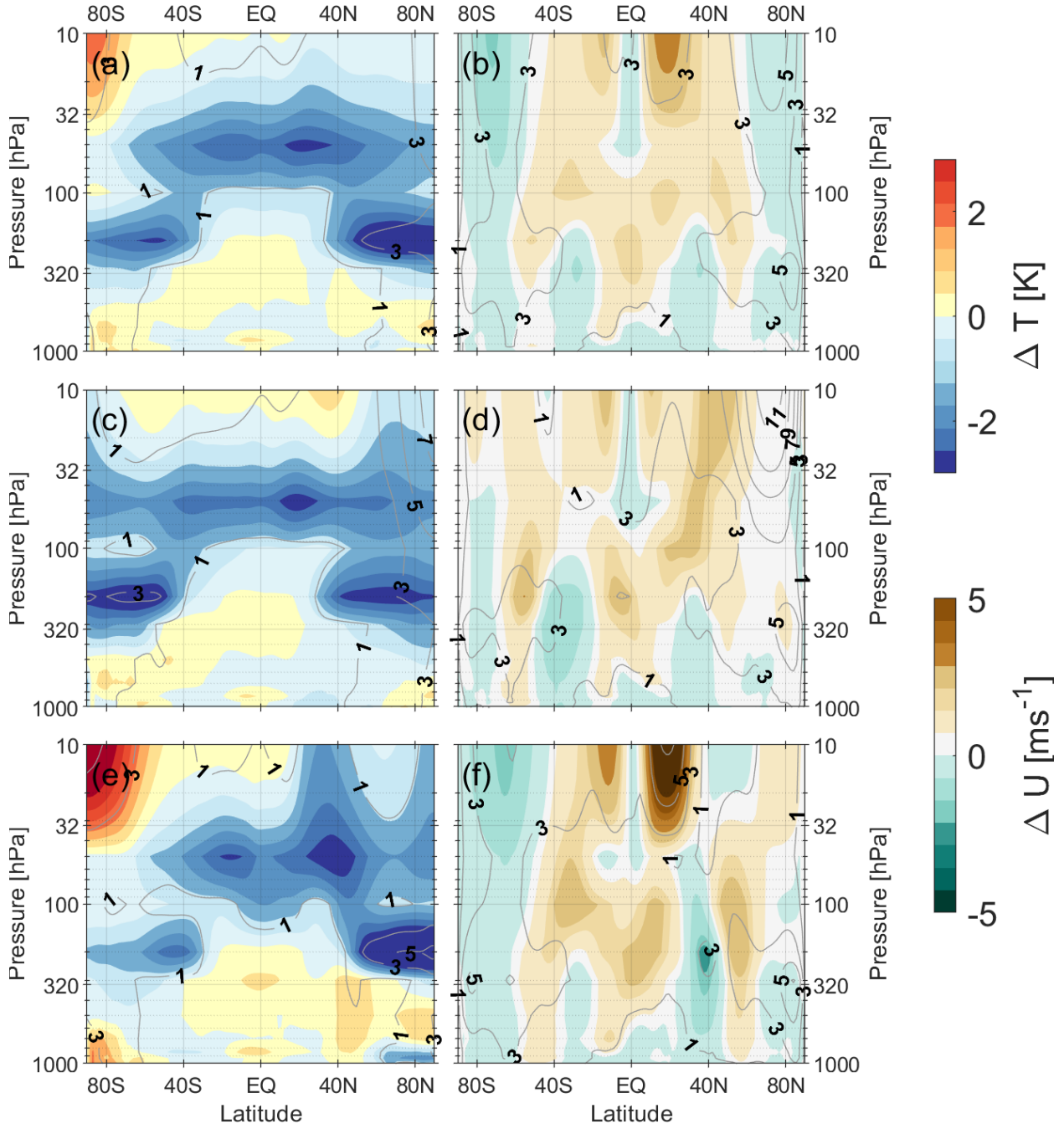


Figure S8. As in Figure S1, but for the ECMWF system.

GEFSV12

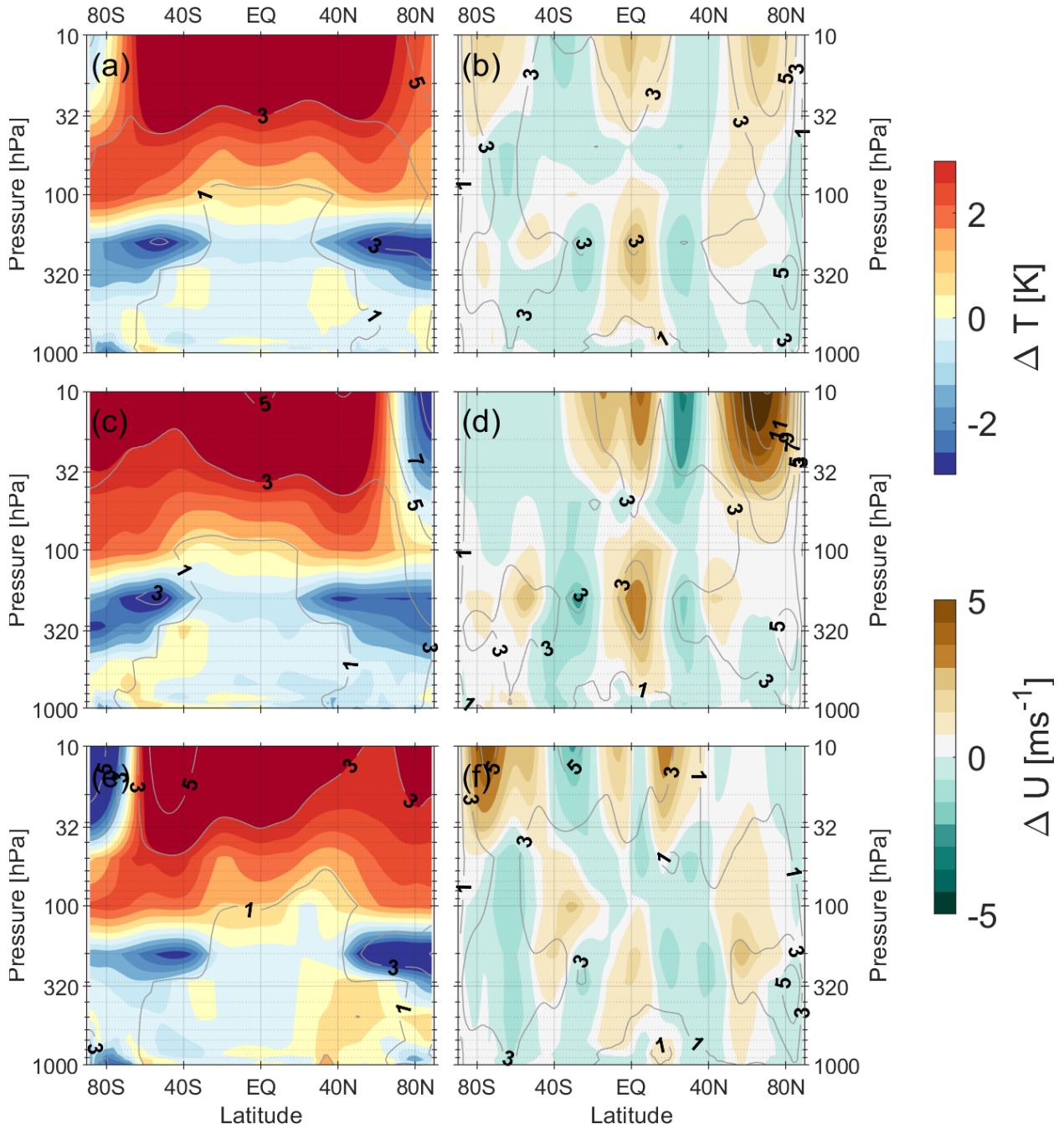


Figure S9. As in Figure S1, but for the GEFSv12 system.

GFDL-SPEAR*

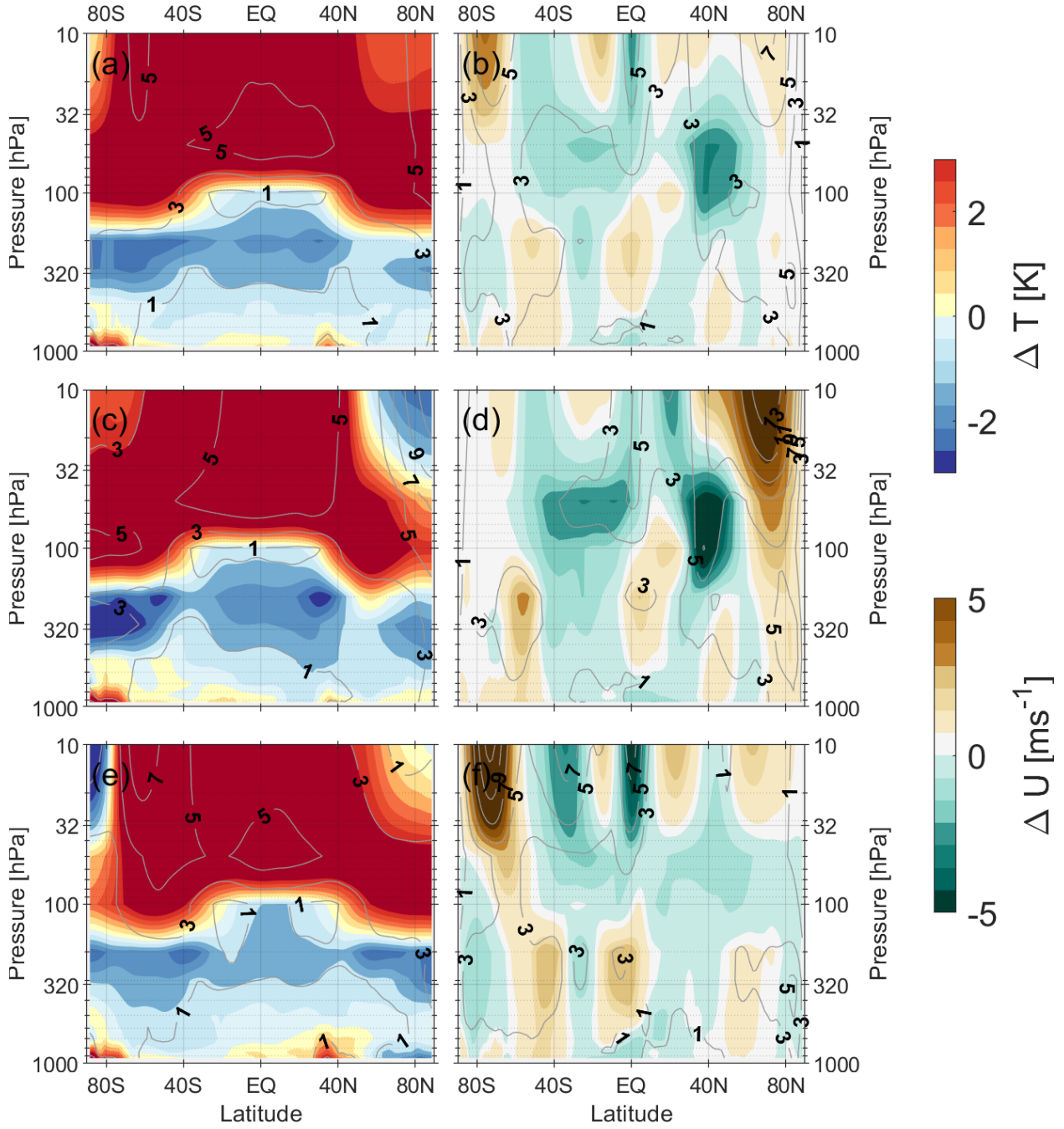


Figure S10. As in Figure S1, but for the GFDL-SPEAR system.

JMA

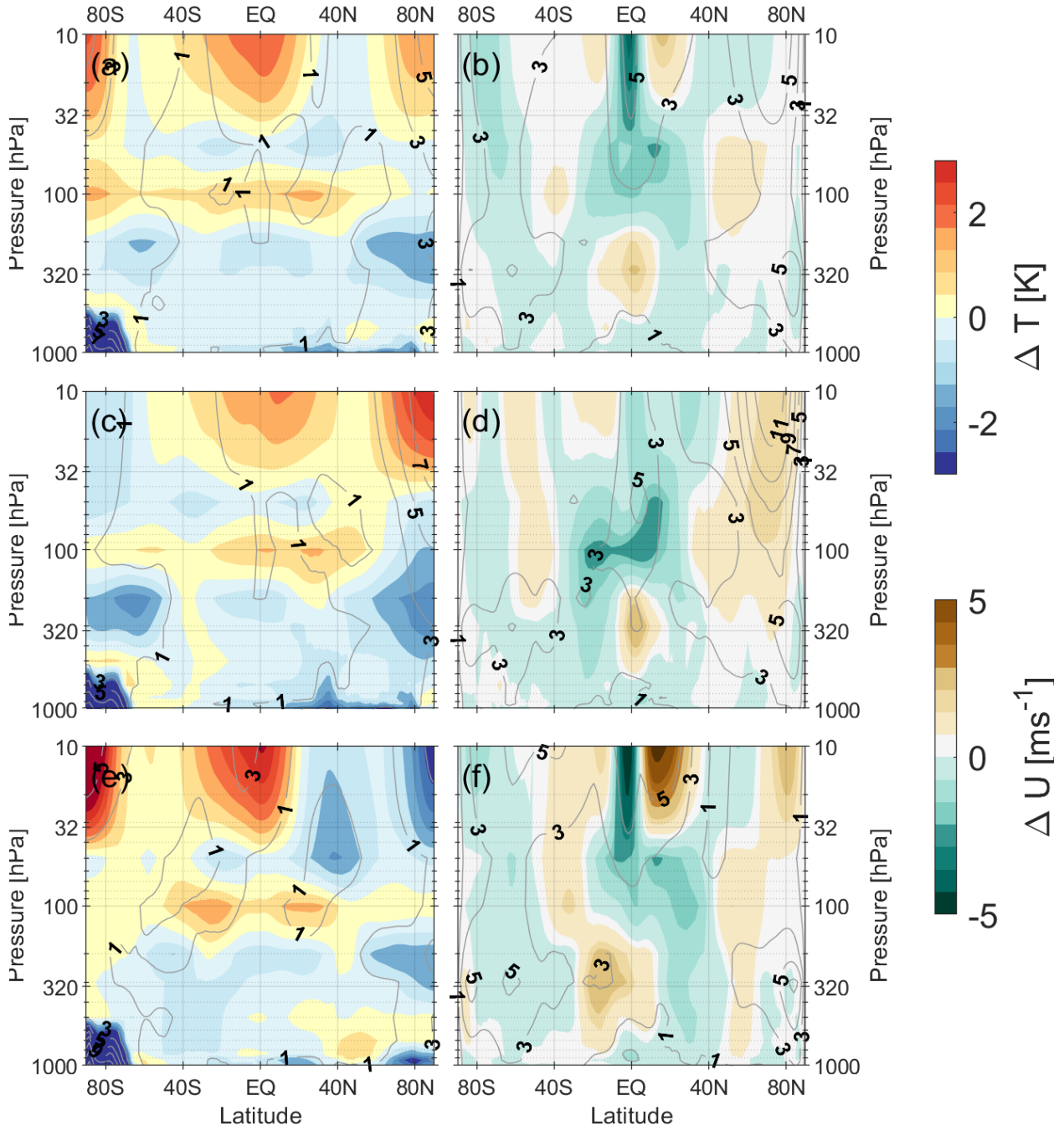


Figure S11. As in Figure S1, but for the JMA system.

KMA

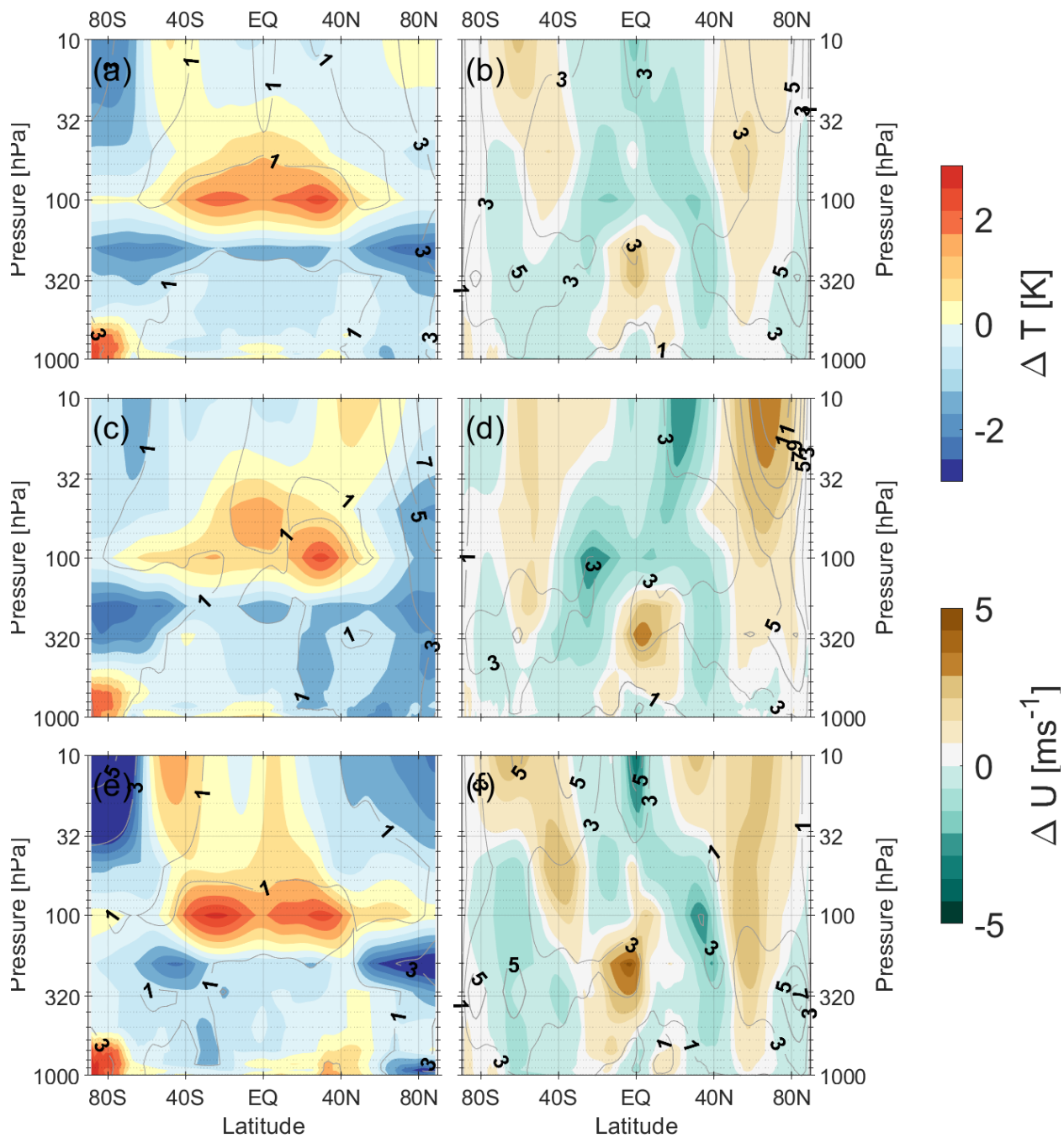


Figure S12. As in Figure S1, but for the KMA system.

NCEP

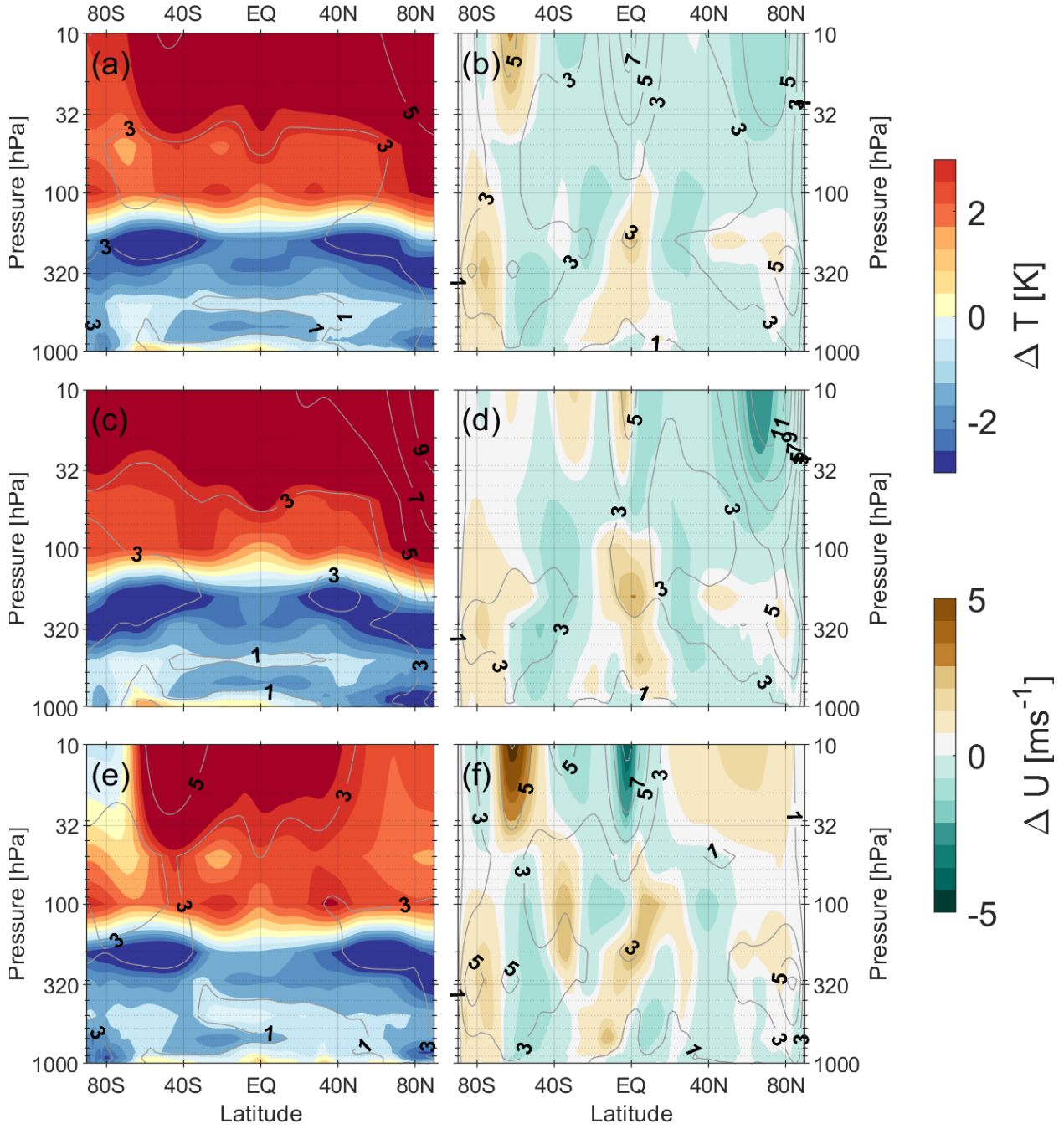


Figure S13. As in Figure S1, but for the NCEP system.

UKMO

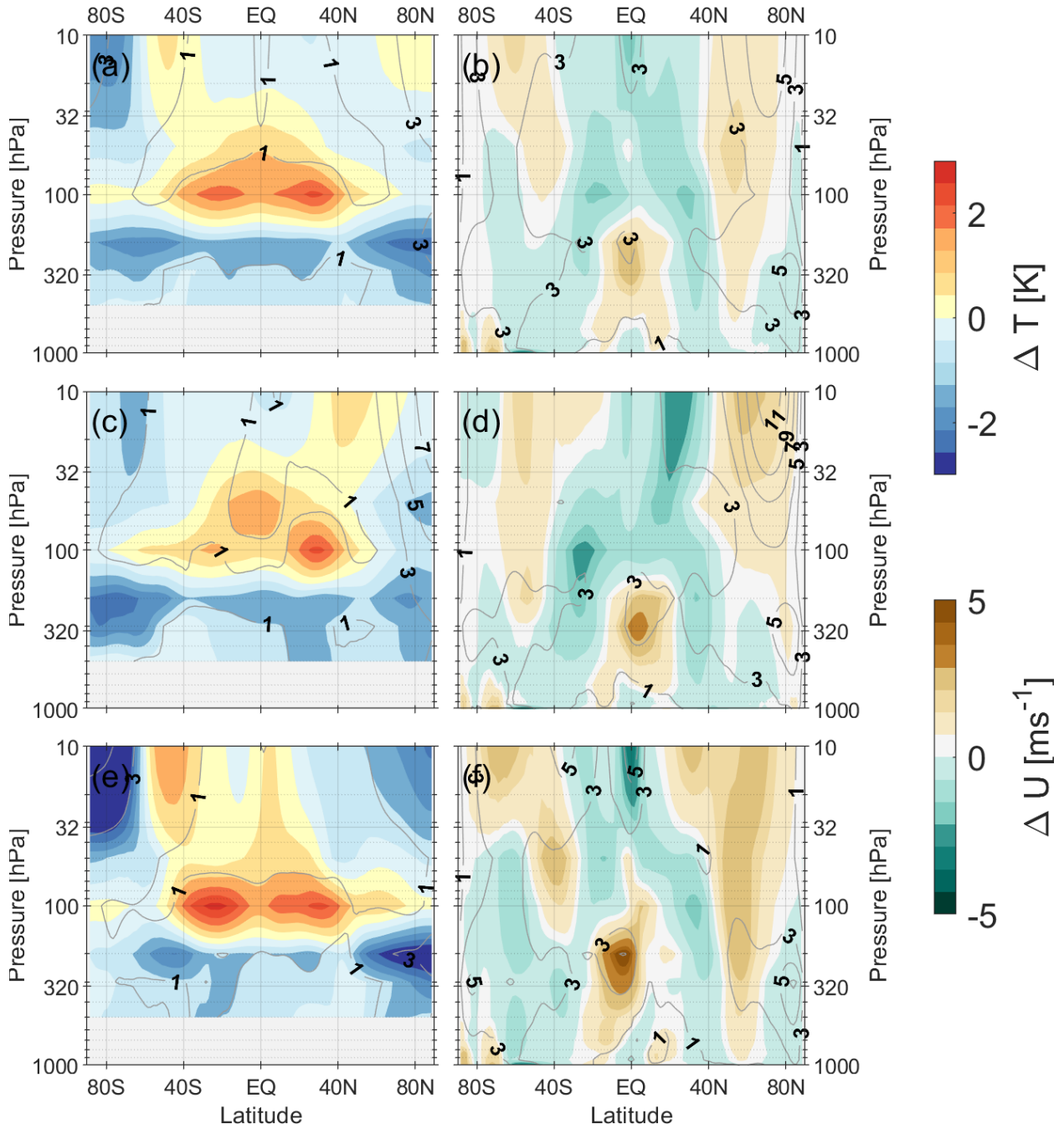


Figure S14. As in Figure S1, but for the UKMO system.

High Top - Low Top

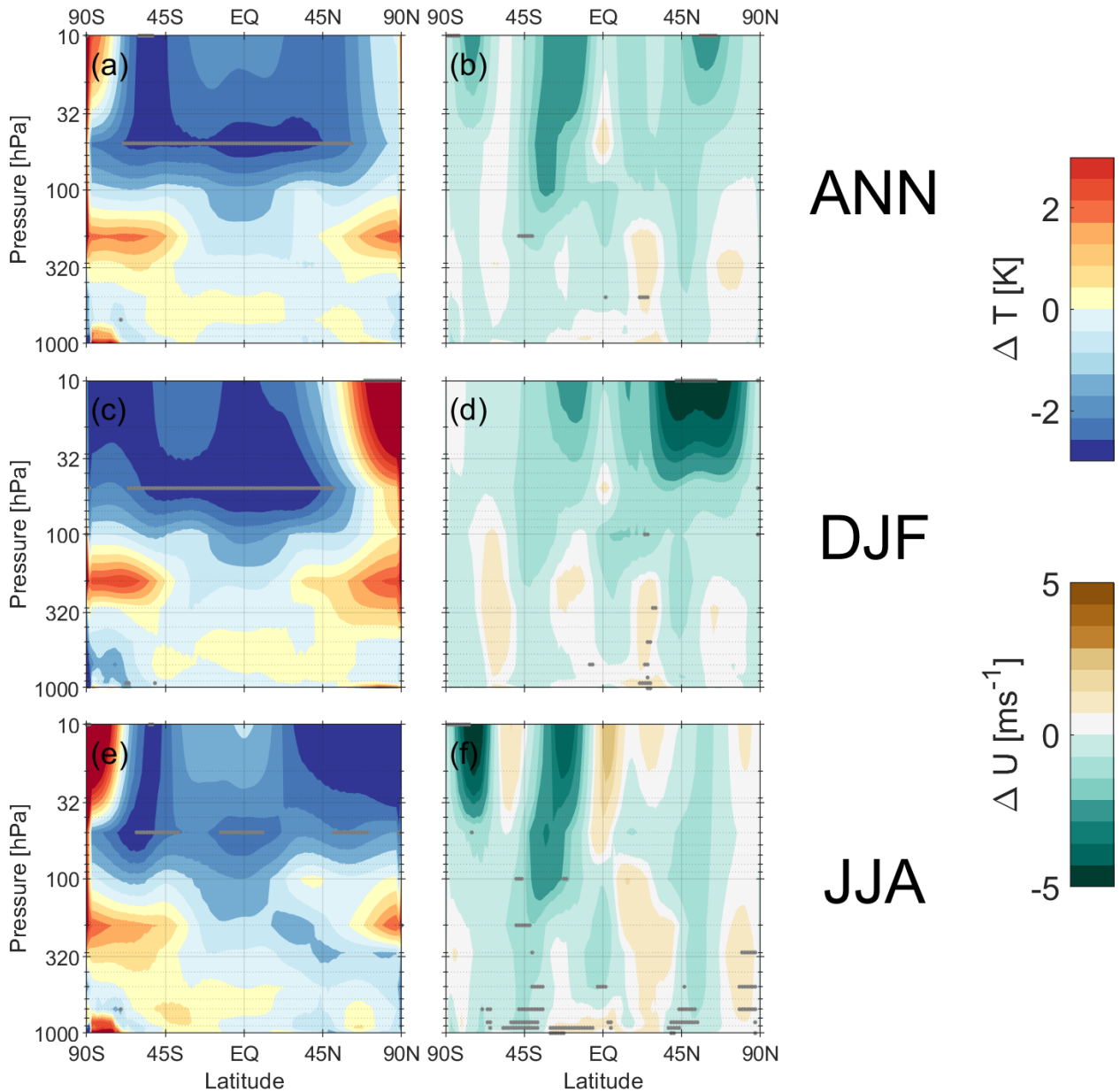


Figure S15. Differences between the high- and low-top zonal mean bias composites for (left column) zonal mean temperature and (right column) zonal mean zonal winds. Stippling is shown where the differences are significant at the 95% level from a two-sided Student's t-test.

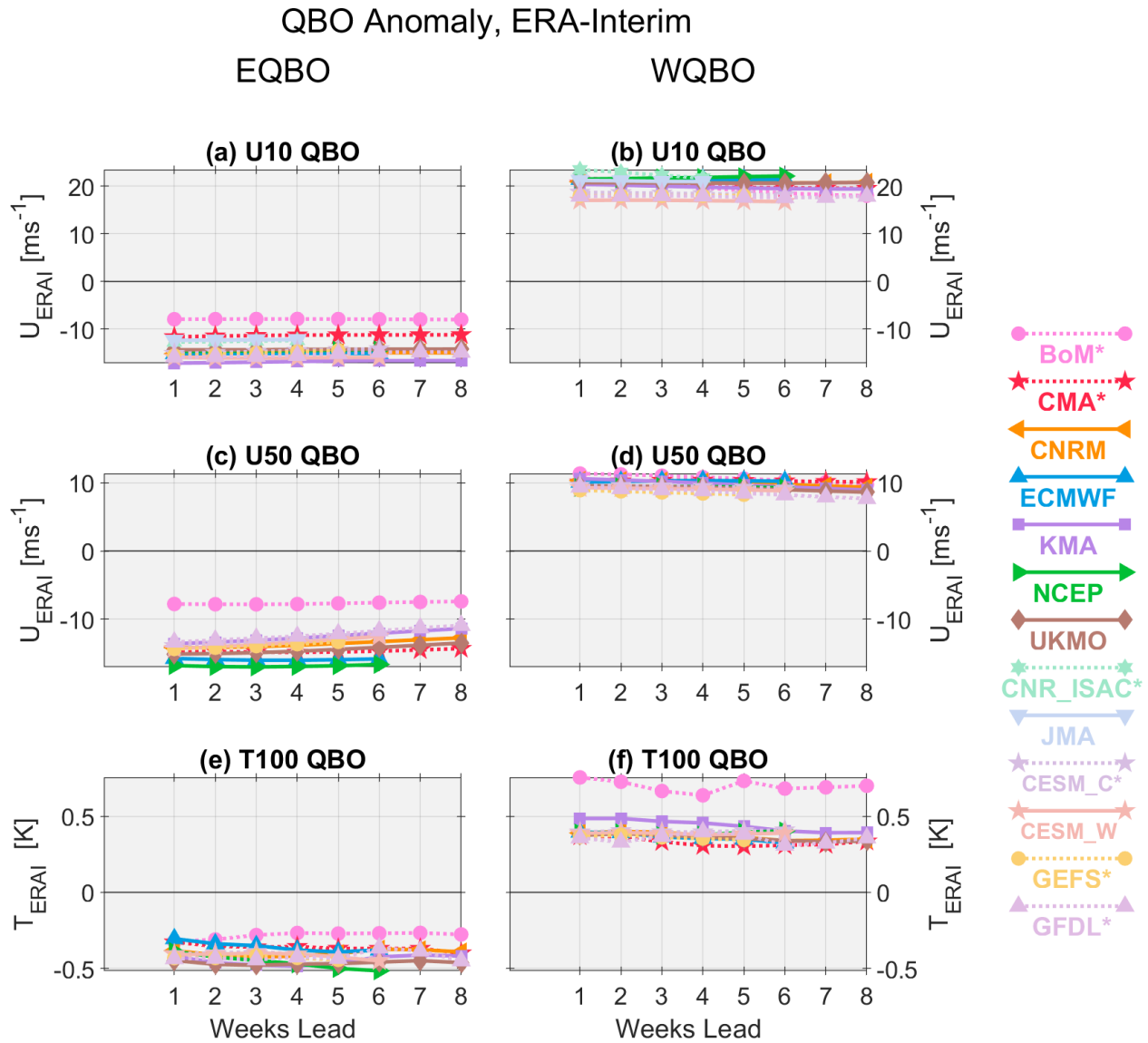


Figure S16. Tropical (5S-5N) stratospheric anomalies associated with the QBO in ERA-Interim reanalysis data for (top row) 10 hPa tropical zonal winds with QBO phases defined using S2S hindcast 10 hPa winds; (middle row) 50 hPa tropical zonal winds with QBO phases defined using S2S hindcast 50 hPa winds; and (bottom row) 100 hPa tropical temperatures with QBO phases defined using S2S hindcast 50 hPa winds. This figure is associated with Figure 3 in the main paper; the reanalysis data shown in each panel is sampled to match the initializations and verification times for each prediction system.

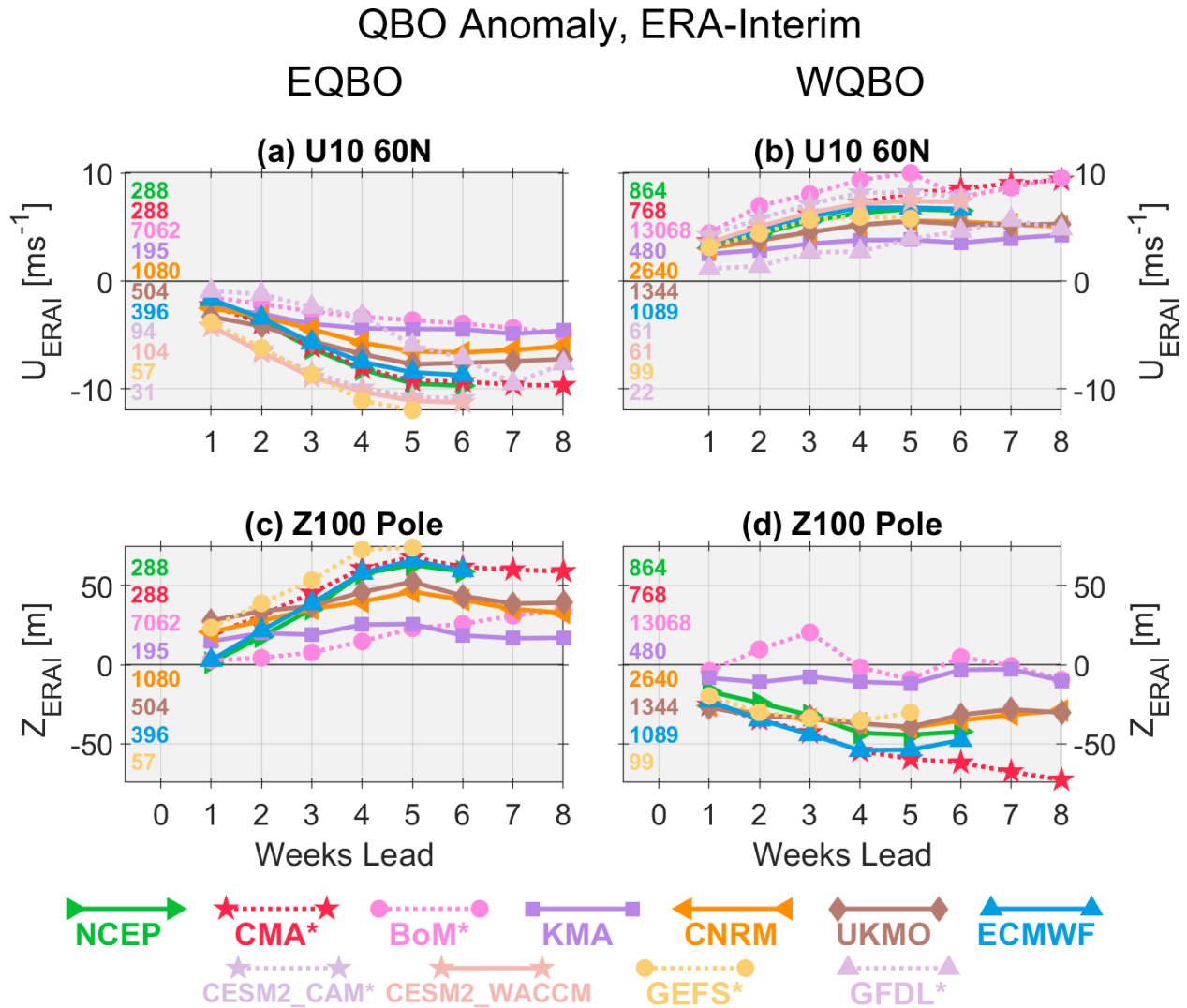


Figure S17. Extratropical stratospheric anomalies associated with the QBO in ERA-Interim reanalysis data for (top row) 10 hPa 60N zonal mean zonal winds, and (bottom row) 100 hPa polar cap geopotential heights. In both cases, the QBO phases are defined using S2S hindcast 50 hPa zonal winds. This figure is associated with Figure 4 in the main paper; the reanalysis data shown in each panel is sampled to match the initializations and verification times for each prediction system.