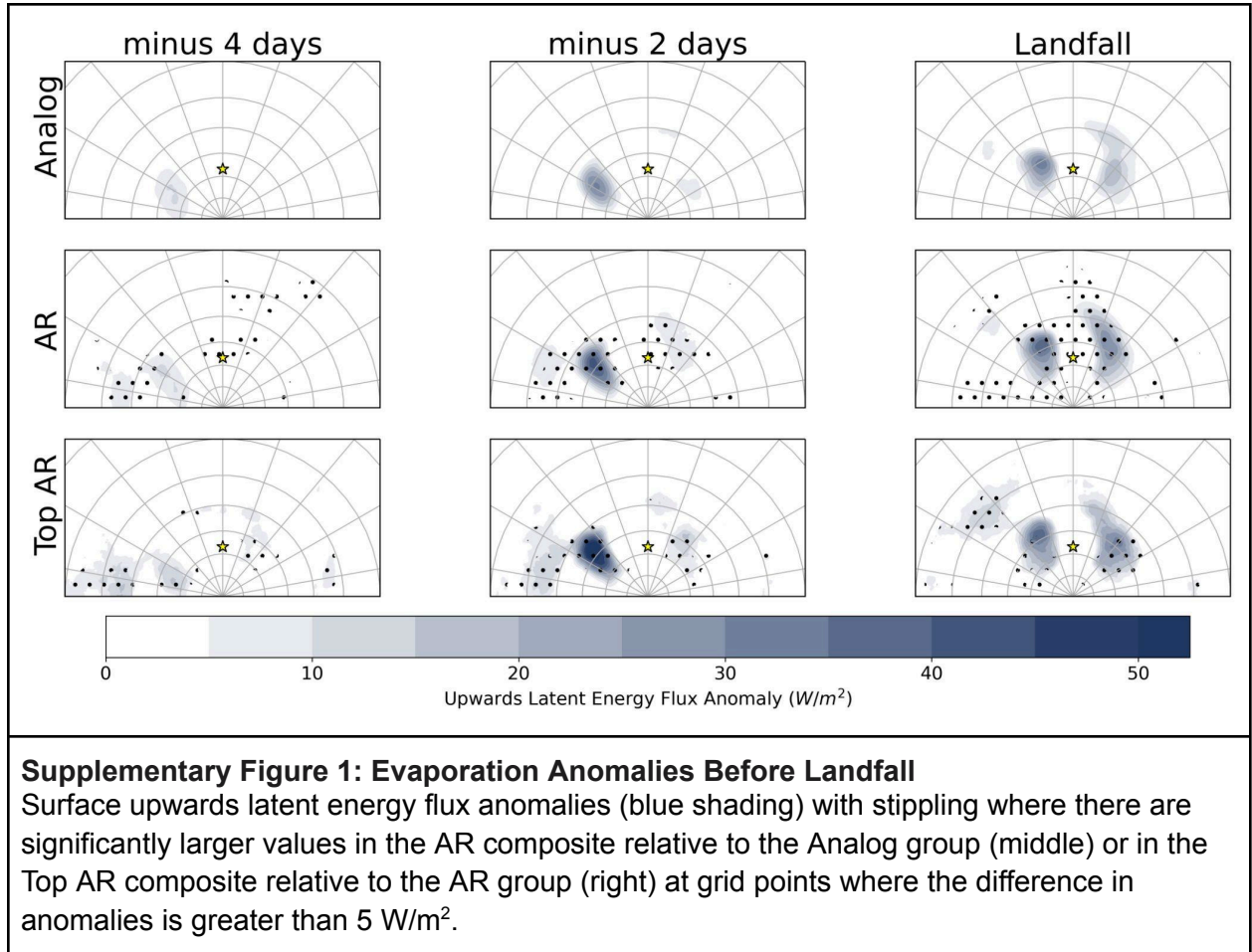
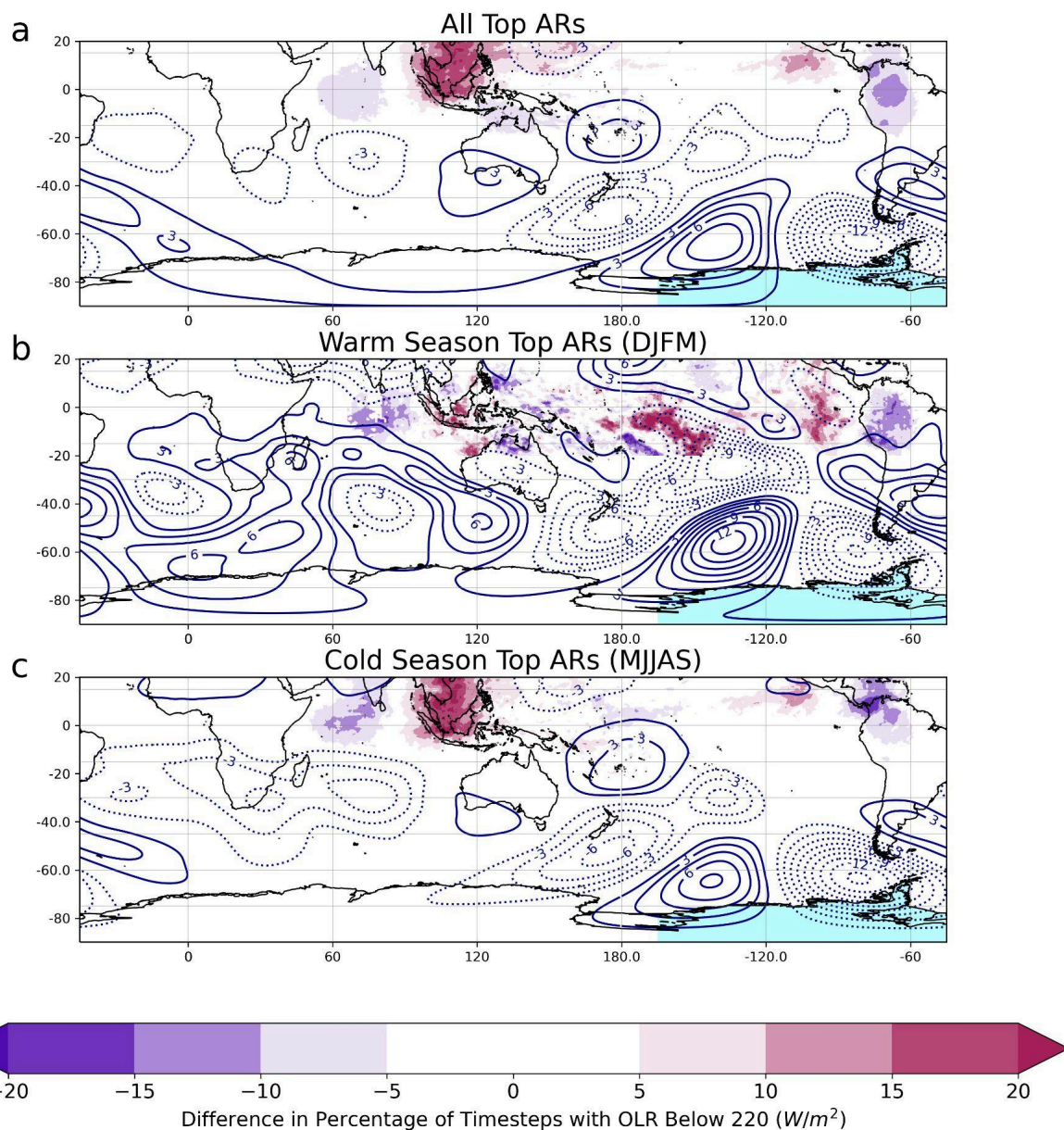


Supplementary Figures

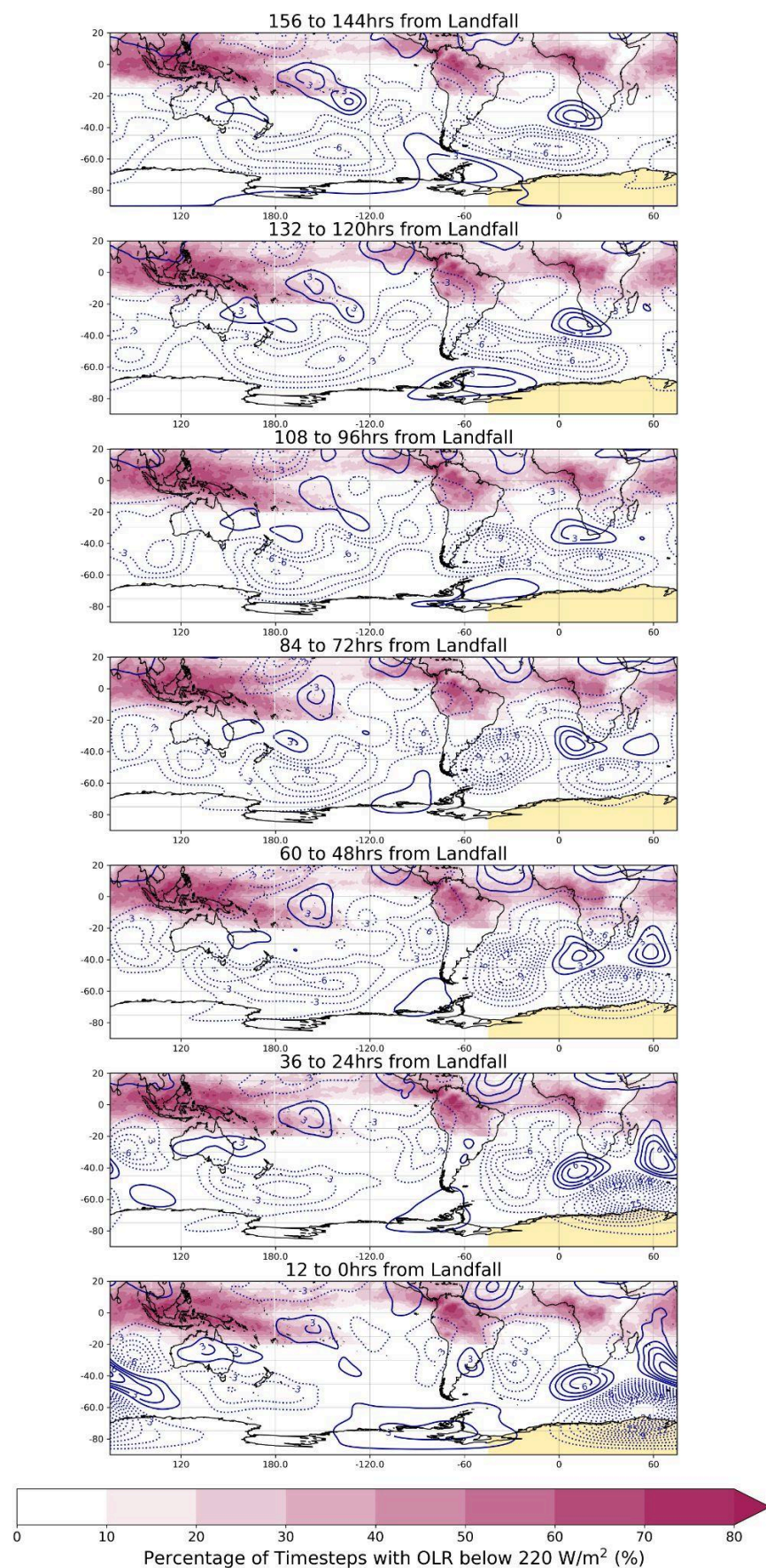


Top ARs in West Region



Supplementary Figure 2: West Sector Planetary-Scale Dynamics - Seasonal

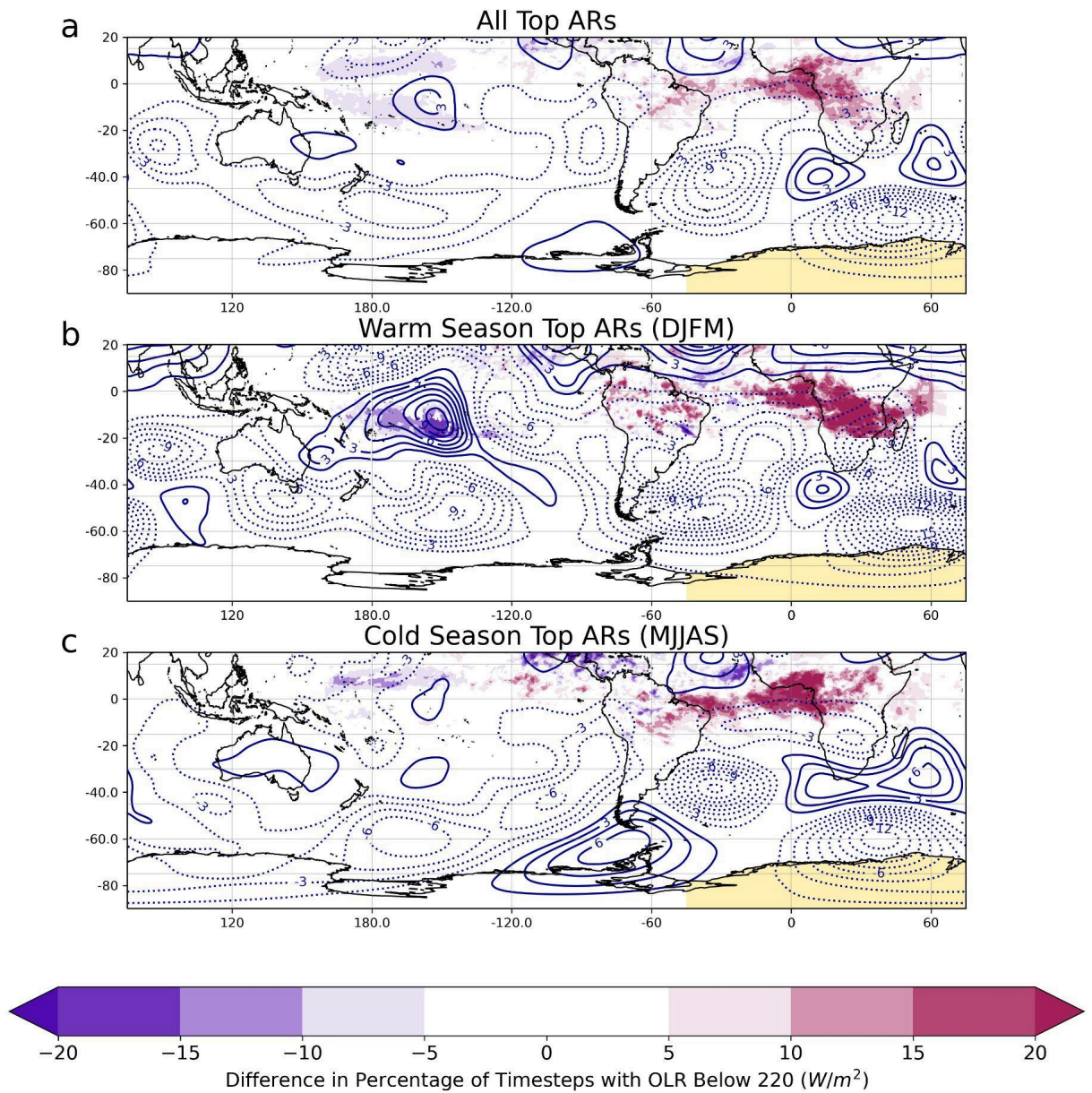
a West sector longitudes (light blue shading). 200-hPa streamfunction anomaly composites in $10^6 m^2/s$ for all Top AR timesteps averaged over the four-day period prior to AR landfall (dark blue contours). Statistically significant differences in the percentage of timesteps with OLR below 220 W/m^2 from 20°N to 20°S between Top AR and AR timesteps (purple and pink shading) four days prior to AR landfall. **b** Same as **a** but only including West sector Top AR timesteps that occur in December, January, February, March. **c** Same as **a** but only including West sector Top AR timesteps that occur in May, June, July, August, and September.



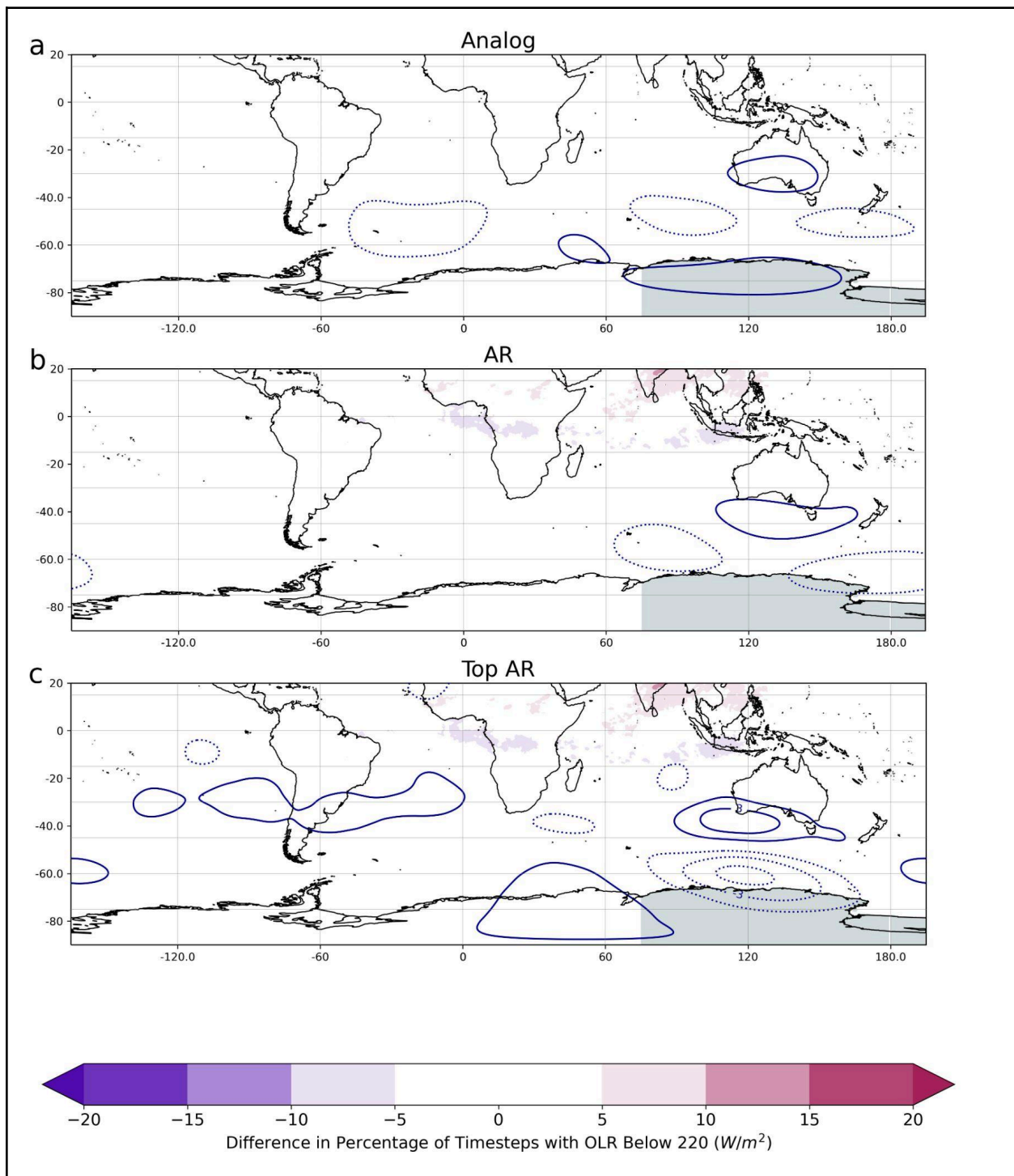
Supplementary Figure 3: East 1 Top AR Planetary-Scale Evolution

East 1 sector longitudes (yellow shading). 200-hPa streamfunction anomaly composites in 10^6 m²/s for all Top AR timesteps averaged over 12-hour periods starting with 156 hours prior to AR landfall (dark blue contours). Mean percentage of East 1 Top AR timesteps with OLR below 220 W/m² from 0° to 30°S (pink shading) during each 12-hour period.

Top ARs in East 1 Region



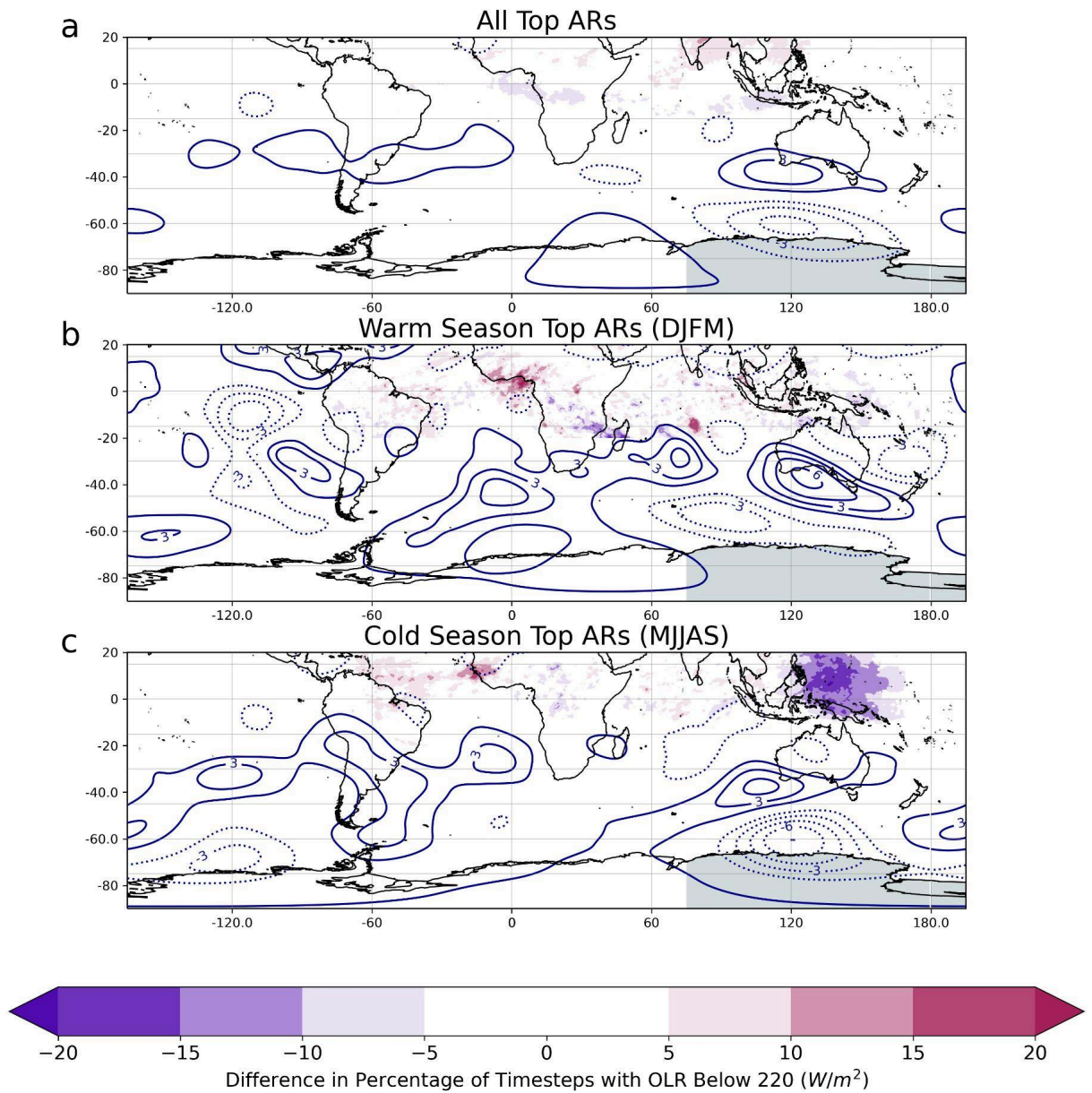
Supplementary Figure 4: East 1 Sector Planetary-Scale Dynamics - Seasonal
Same conventions as in Supplementary Figure 1, except for East 1 (yellow shading) sector Top ARs.



Supplementary Figure 5: East 2 Sector Planetary-Scale Dynamics

East 2 sector longitudes (gray shading). 200-hPa streamfunction anomaly composites in $10^6 \text{ m}^2/\text{s}$ for Analog, AR, and Top AR timesteps averaged over the four-day period prior to AR landfall (dark blue contours). Statistically significant differences in the percentage of timesteps with OLR below $220 \text{ W}/\text{m}^2$ from 20°N to 20°S between **b** AR and Analog timesteps, **c** Top AR and AR timesteps (purple and pink shading) four days prior to AR landfall.

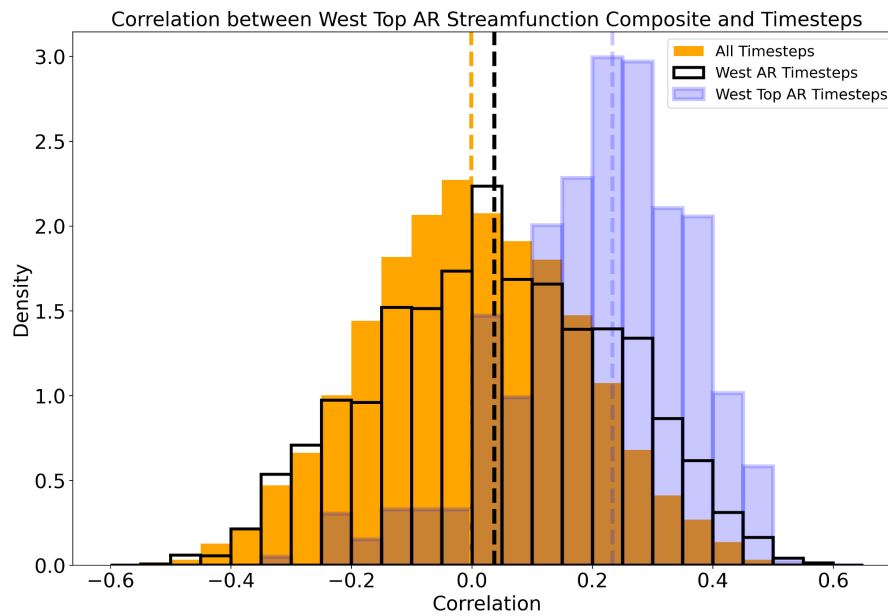
Top ARs in East 2 Region



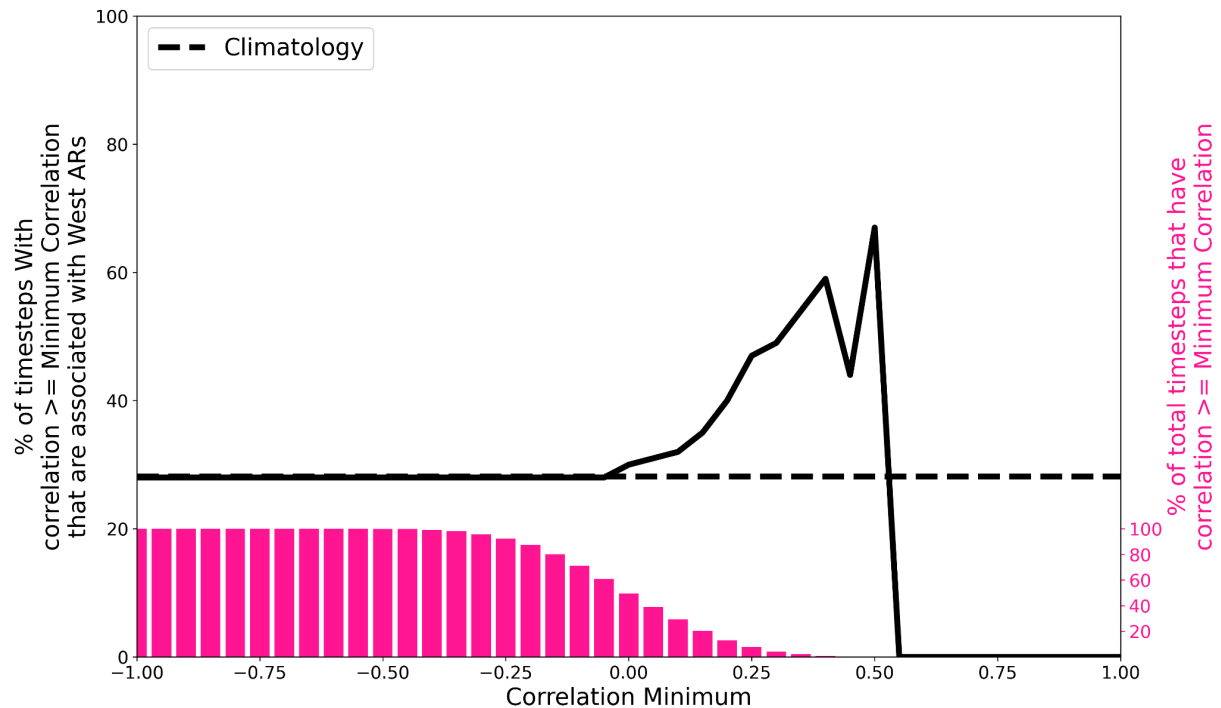
Supplementary Figure 6: East 2 Sector Planetary-Scale Dynamics - Seasonal
Same conventions as in Supplementary Figure 1, except for East 2 (gray shading) sector Top ARs.

WEST

a.



b.

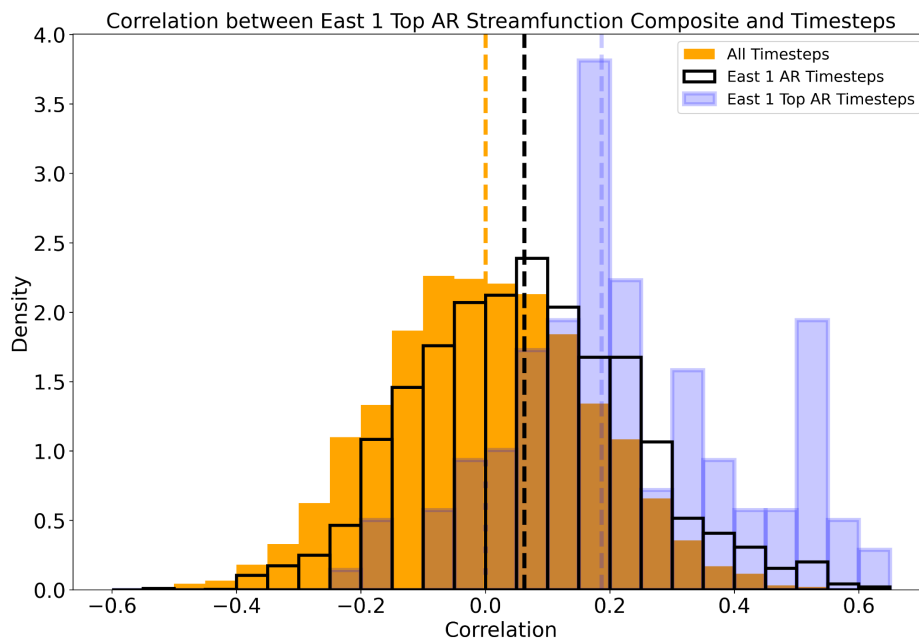


Supplementary Figure 7: West Hemisphere Patterns v. Frequency of West Antarctic ARs

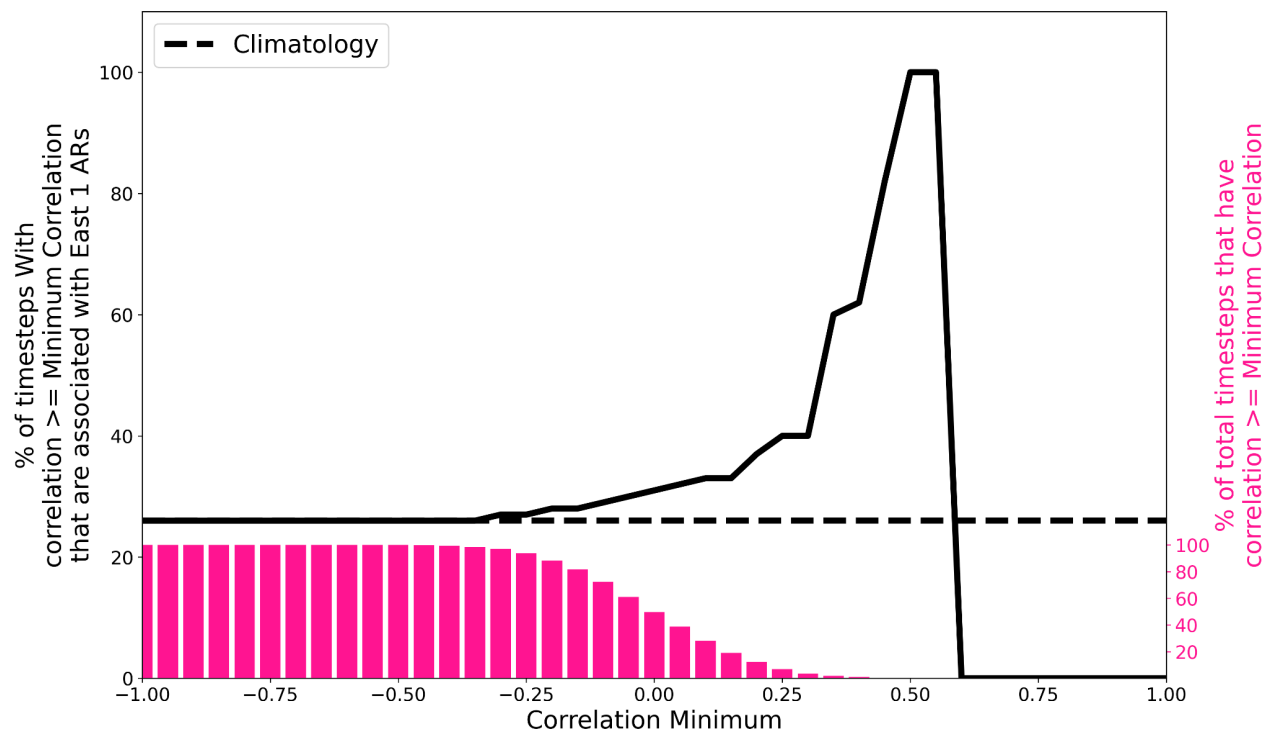
(a) Correlations between 4-day streamfunction anomalies for all timesteps (orange), West AR timesteps (black outline), and West Top AR timesteps (purple) with the West Top AR streamfunction anomaly composite. The median values for each distribution are shown in dashed lines. (b) At each Correlation Minimum (x-axis), we consider all 4 day timesteps (1980-2019) that have a correlation with the West Top AR streamfunction composite at or above that value. We plot the percentage of these timesteps that feature a West AR (solid black line) as a function of the Correlation Minimum. The dashed black line shows the climatological frequency of West ARs: the percentage of all 4 day timesteps associated with West ARs. Pink bars show the percentage of 4 day timesteps with a correlation at or above each Correlation Minimum.

EAST 1

a.



b.



Supplementary Figure 8: East 1 Hemisphere Patterns v. Frequency of East 1 Antarctic ARs
Same as Supplementary Figure 7, except for the East 1 region

