Trends in the atmospheric jet streams are emerging in observations and could be linked to tropical warming: Supplementary Information

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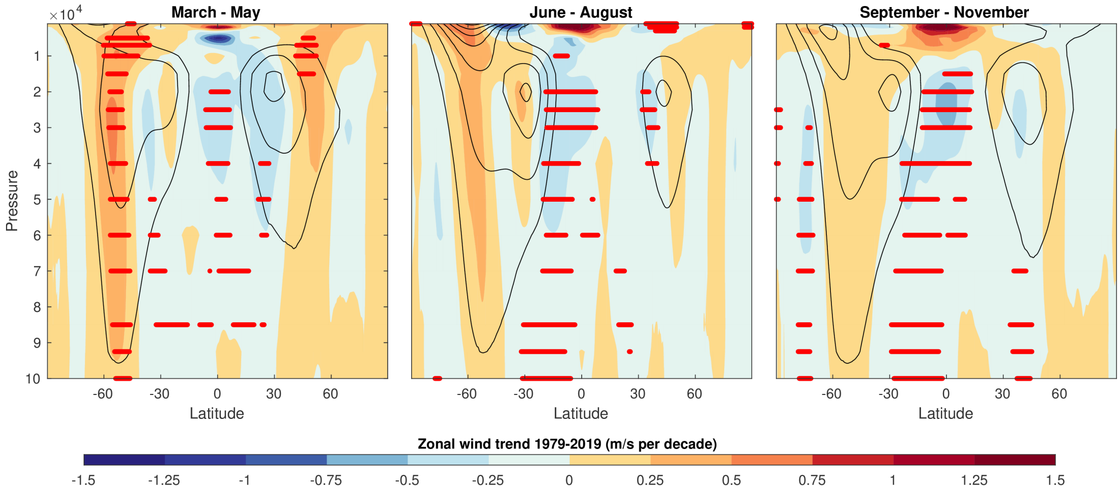
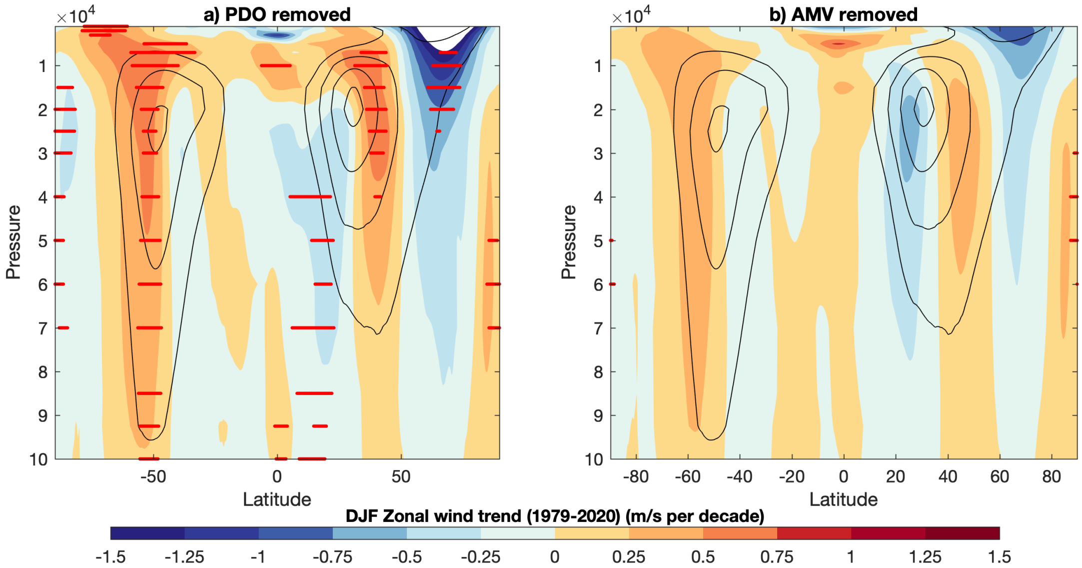
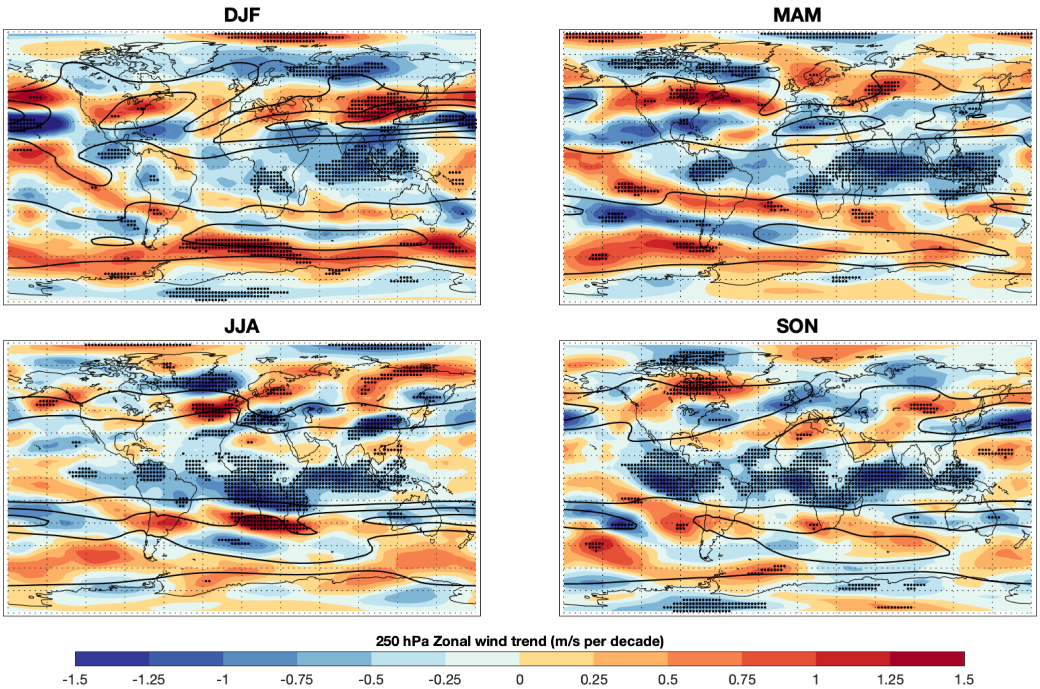


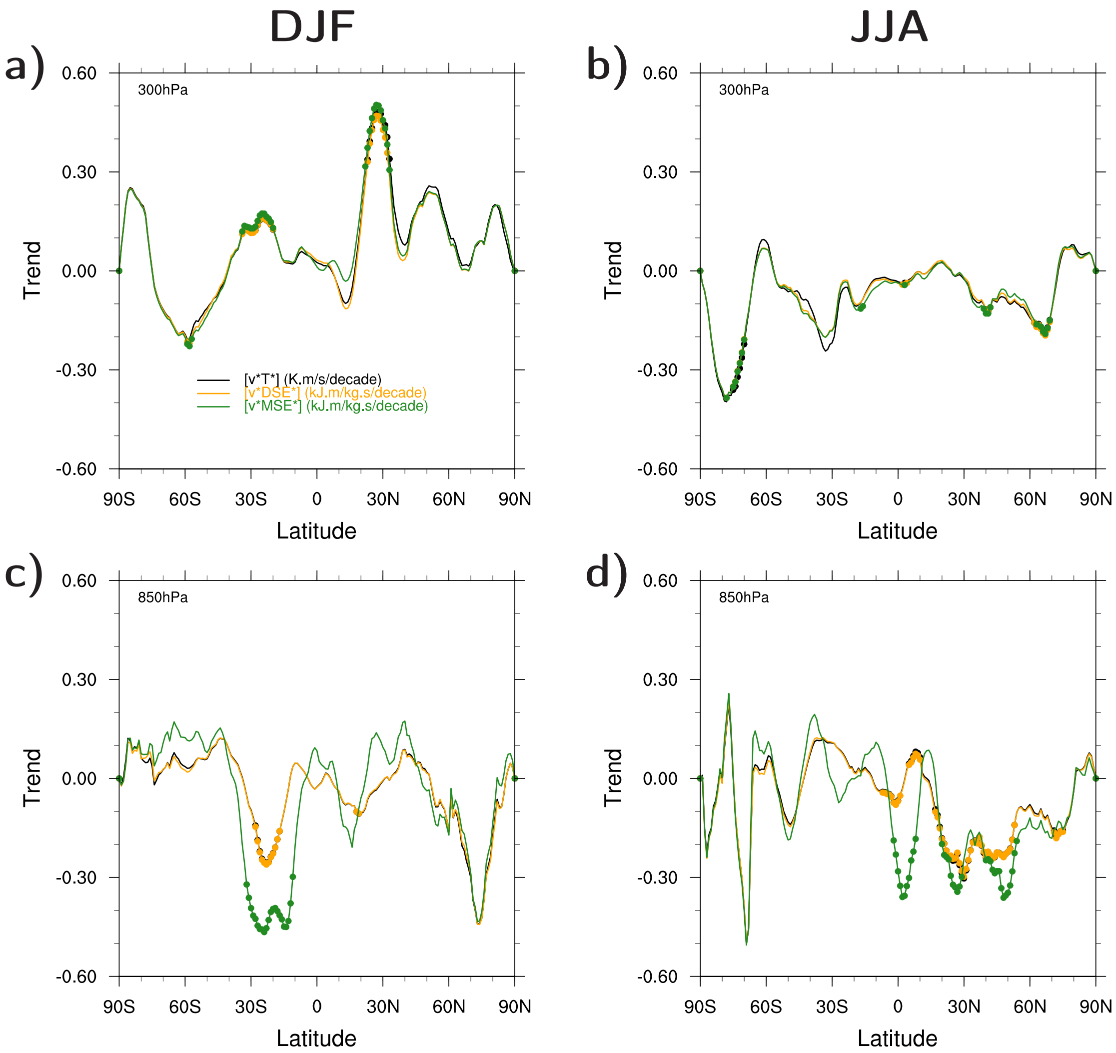
Supplementary Figure 1: Zonal wind trends from ERA5 in the other three seasons. Red dots mark trends which are significant at the 5% level, based on a T-test.



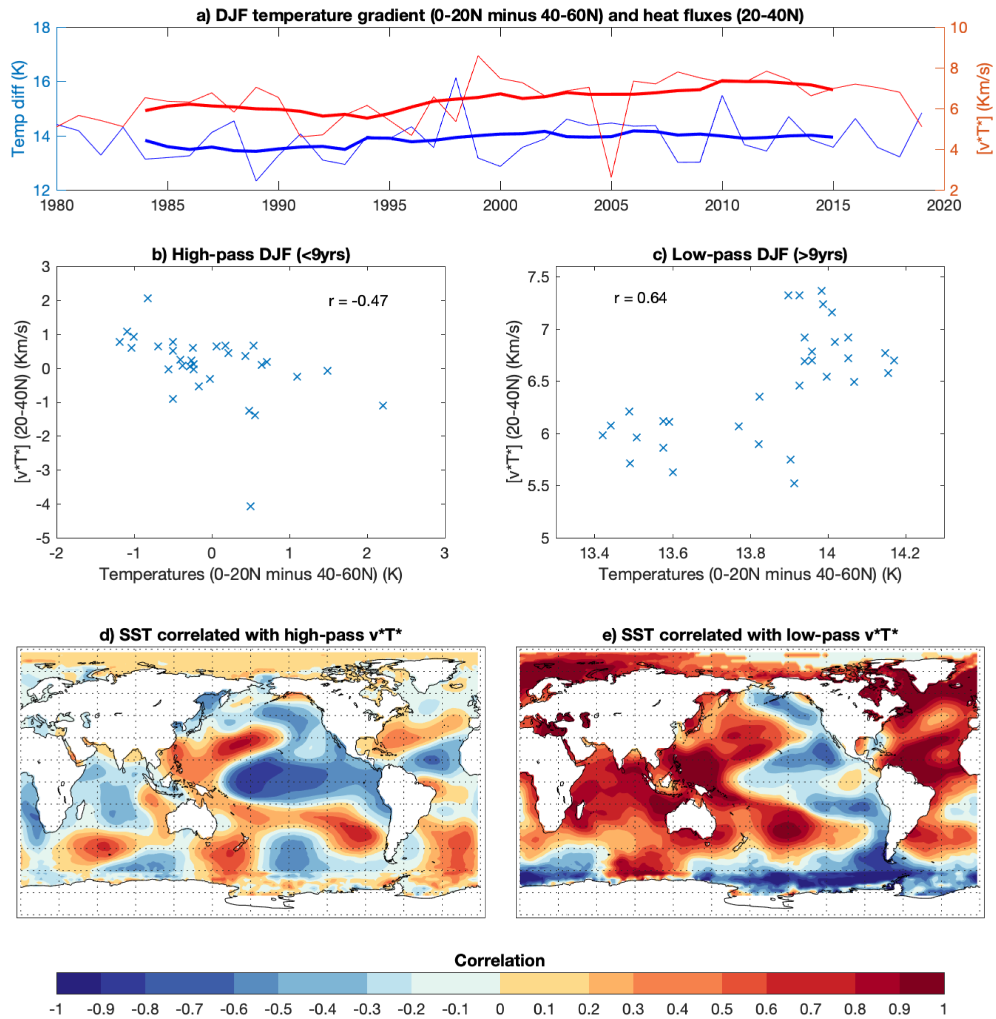
Supplementary Figure 2: Linear trends from ERA5 with the signals associated with PDO and AMV removed using linear regression from the DJF mean zonal wind before trend analysis. The ERSST PDO time series was obtained from https://www.ncdc.noaa.gov/teleconnections/pdo/ and AMV from https://www.psl.noaa.gov/data/correlation/amon.us.data. Neither were detrended prior to the analysis. Red dots mark trends which are significant at the 5% level, based on a T-test.



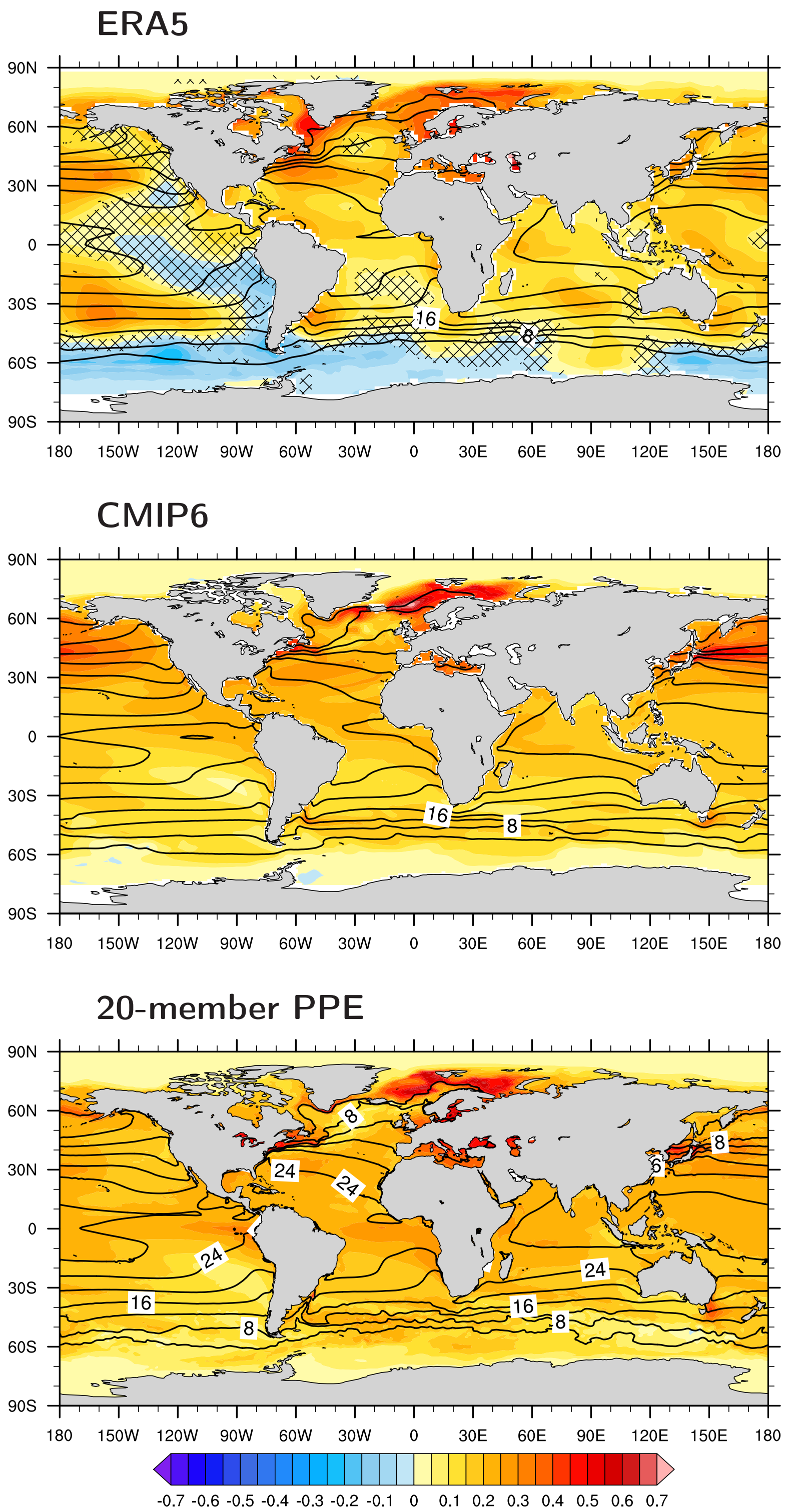
Supplementary Figure 3: Linear trends of 250hPa zonal wind from ERA5. Black contours show the climatology every 15m/s. Dots mark significance at the 5% level using a T-test.



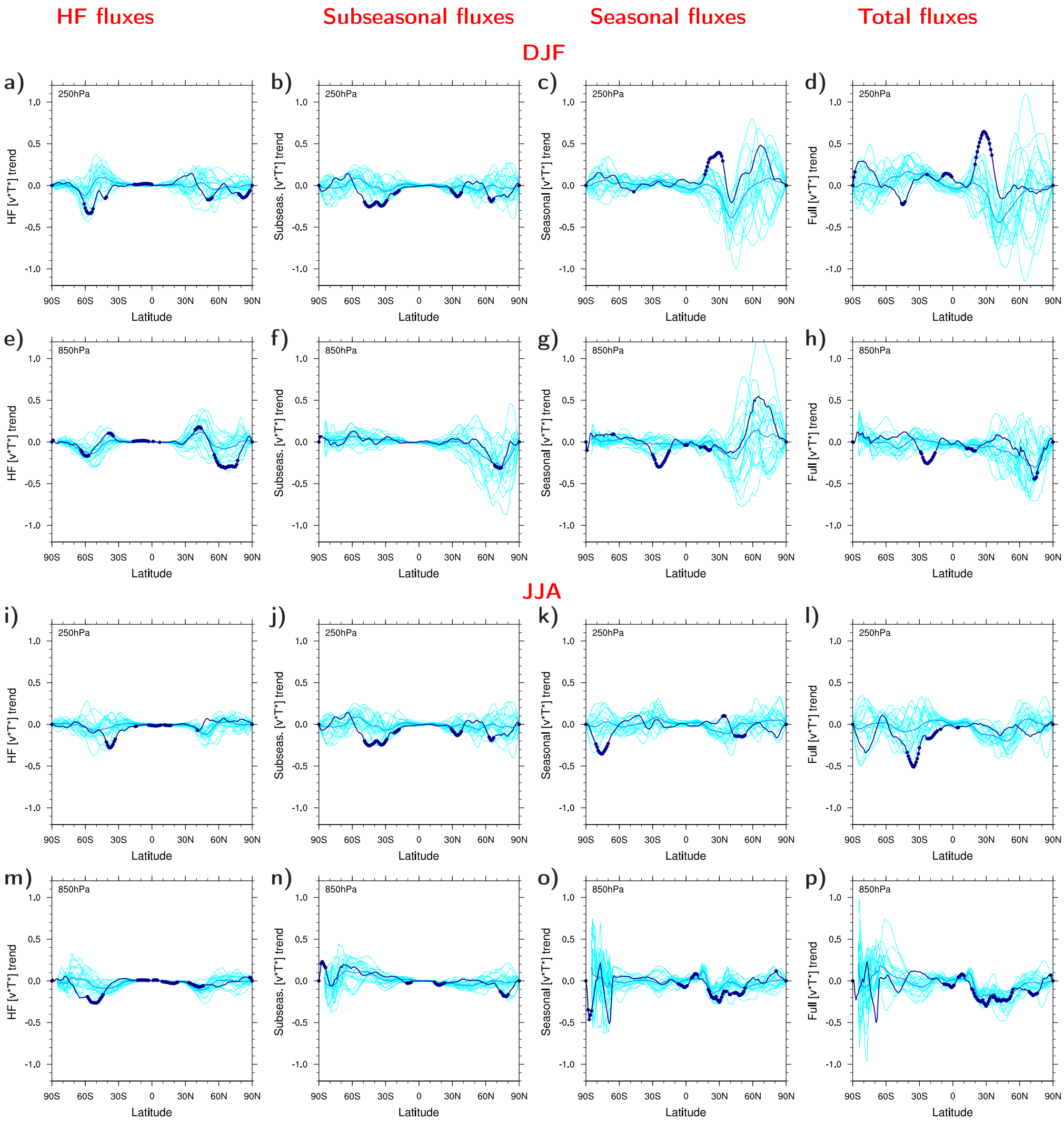
Supplementary Figure 4: Linear trends of eddy fluxes of heat and both dry and moist static energy fluxes at 300hPa (a, b) and 850 hPa (c, d) from ERA5. Dots mark significance at the 5% level using a T-test.



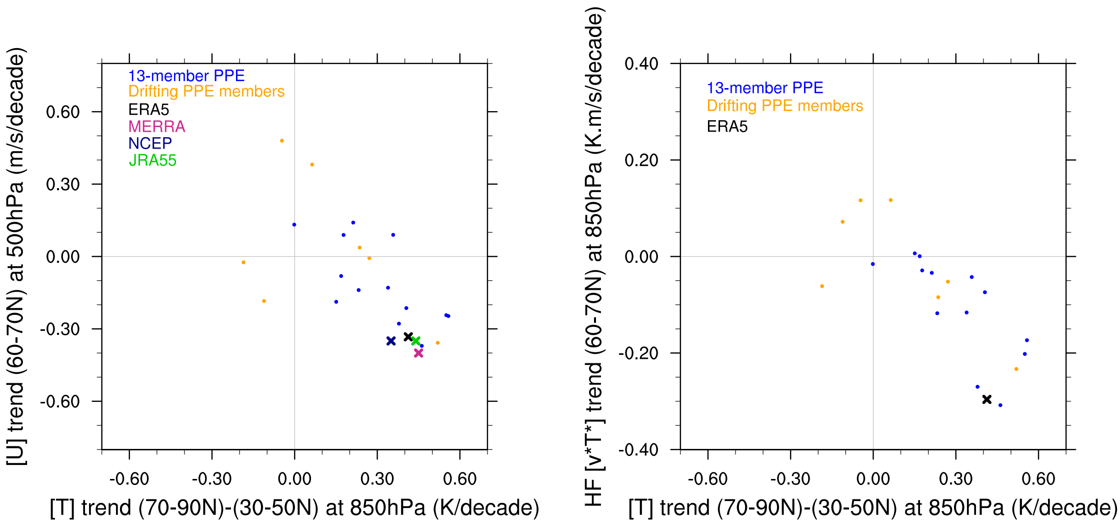
Supplementary Figure 5: For northern hemisphere winter in ERA5, a) shows the evolution of the 250hPa meridional temperature gradient and eddy heat fluxes. These quantities are negatively correlated on interannual timescales (b) but positively correlated in terms of trend (c). (d,e) show correlation maps of the Sea Surface Temperature (SST) with the high- and low-pass heat flux series. The low-pass corresponds to a 9-year running mean and the high-pass is the given by the full series minus the low-pass.



Supplementary Figure 6: Linear trends in annual mean SSTs (degrees per decade) from ERA5, CMIP6 multi-model mean and the ensemble mean of UKCP-PPE20. The trends and climatologies are computed over the period 1979-2019 for ERA5 and UKCP-PPE20 and 1979-2014 for CMIP6. The climatologies are shown in black contours and crossed areas are not significant at the 5% level using a T-test.



Supplementary Figure 7: Linear trends in meridional eddy heat flux $[v^*T^*]$ in $\mathrm{Kms^{-1}}$ per decade. ERA5 trends are shown in dark blue, with dots indicating significance at the 5% level. Light blue lines show the individual members of the UKCP-PPE20 ensemble, along with the ensemble mean. The data have been filtered into different timescales as described in the Methods section.



Supplementary Figure 8: Relation between Arctic amplification and high latitude zonal wind / heat fluxes in DJF. Reanalysis trends are marked with crosses, while UKCP-PPE20 members are marked with dots. Yellow dots indicate UKCP-PPE20 members which exhibit a weakening of their Atlantic Meridional Overturning Circulation or a drift in temperatures, as described in the Methods section.