ENSO teleconnections in eddy-rich climate models

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Supplementary Material

Institution	Model name (LR, HR)	Atmosphere Resolution (km)	Ocean Resolution (km)	Number of members	
				highresSST-present	hist-1950
CMCC	CMCC-CM2-HR4	100	25	1	1
	CMCC-CM2-VHR4	25	25	1	1
CERFACS	CNRM-CM6.1	250	100	1	1
	CNRM-CM6.1-HR	100	25	1	1
EC-EARTH Cons.	EC-EARTH-3P	100	100	3	3
	EC-EARTH-3P-HR	50	25	3	3
ECMWF	ECMWF-IFS-LR	50	100	8	8
	ECMWF-IFS-HR	25	25	6	6
MOHC	HadGEM3-GC3.1-MM	100	25	3	3
	HadGEM3-GC3.1-HM	50	25	3	2
MPI-M	MPI-ESM-1-2-HR	100	50	1	1
	MPI-ESM1-2-XR	50	50	1	1

Table S1: List of HighResMIP simulations used in this study.
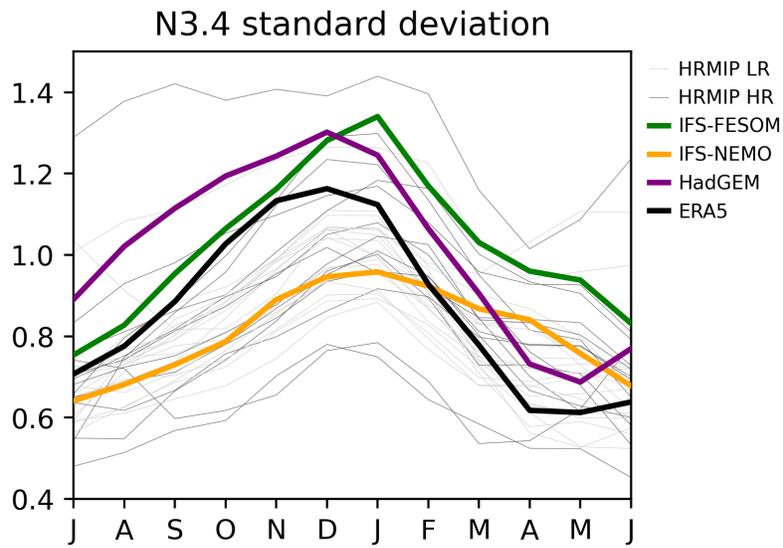
N3.4 standard deviation

Figure S1: Standard deviation of SST monthly anomalies in the Niño3.4 region in the EERIE coupled models (colored lines) and in the HighResMIP coupled models (grey lines), compared to ERA5 (black line). Period: 1950-2014.
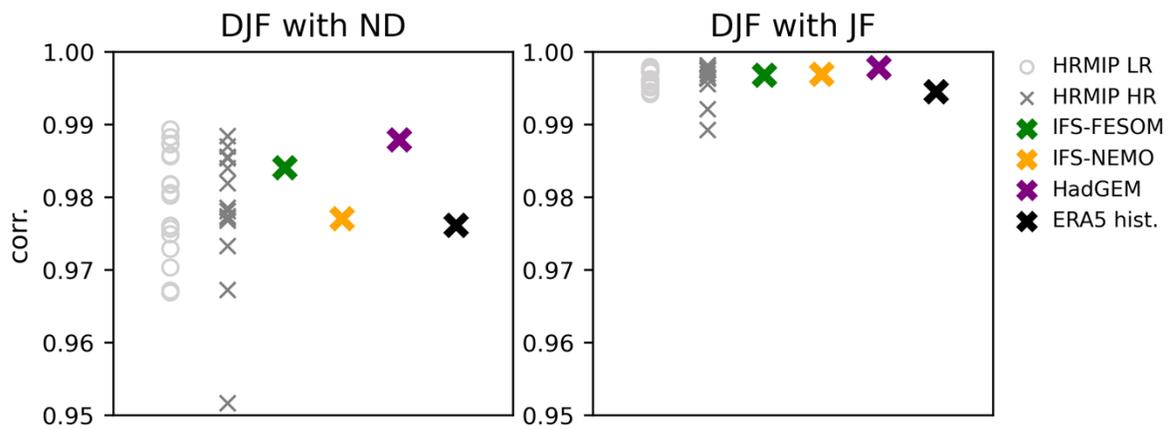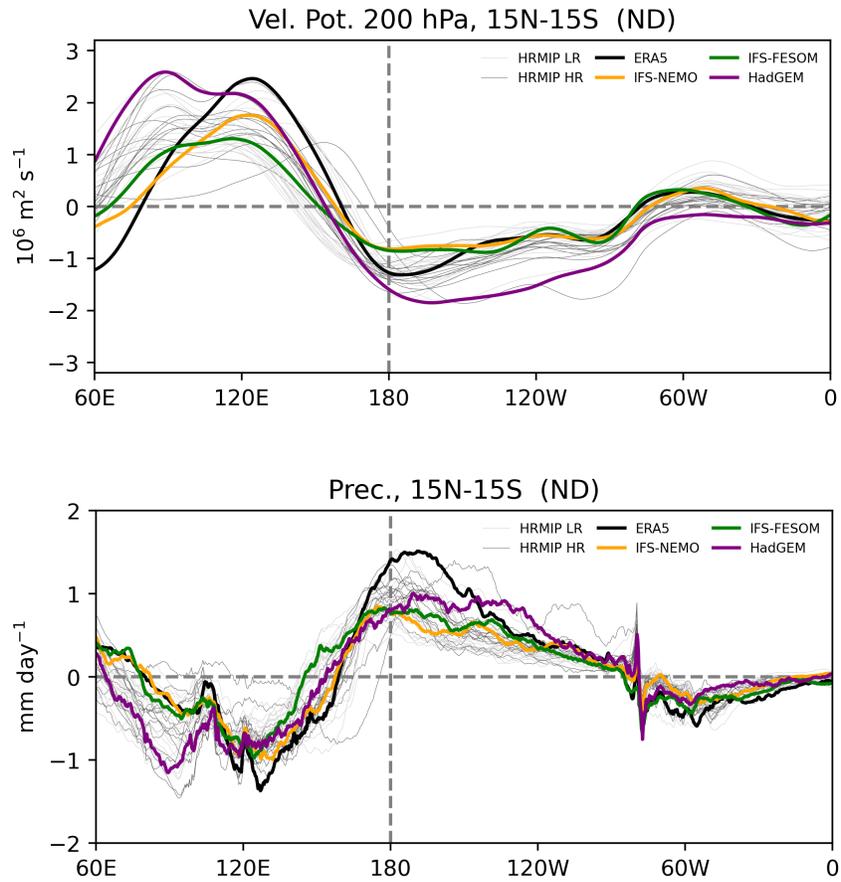

Figure S2: Correlation between the N3.4 index in DJF and the same index computed in ND and in JF, in ERA5-hist and in the coupled models.

Figure S3: Top: 200-hPa velocity potential anomalies averaged between 15°N and 15°S and regressed on the N3.4 index in the EERIE coupled models (colored lines) and in the HighResMIP coupled models (grey lines), compared to ERA5 (black line). Nov-Dec. Bottom: same, but for the maximum precipitation.
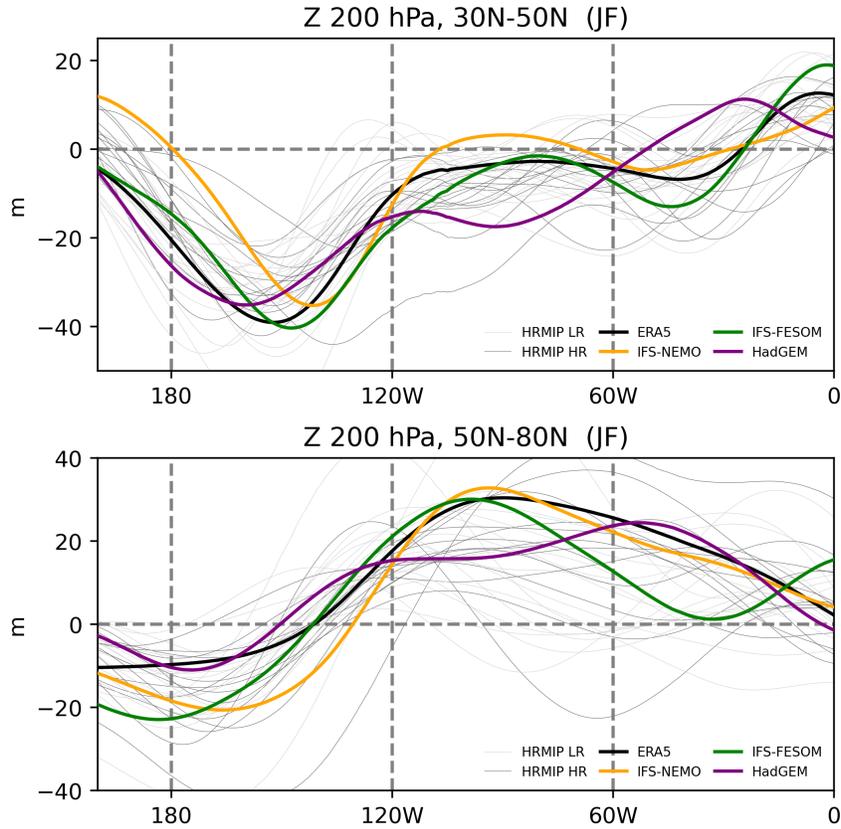
Figure S4: Top: 200-hPa geopotential height anomalies averaged between 30°-50°N and regressed on the N3.4 index in the EERIE coupled models (colored lines) and in the HighResMIP coupled models (grey lines), compared to ERA5 (black line). Jan-Feb. Bottom: same, but for the band 5°0-80°N.
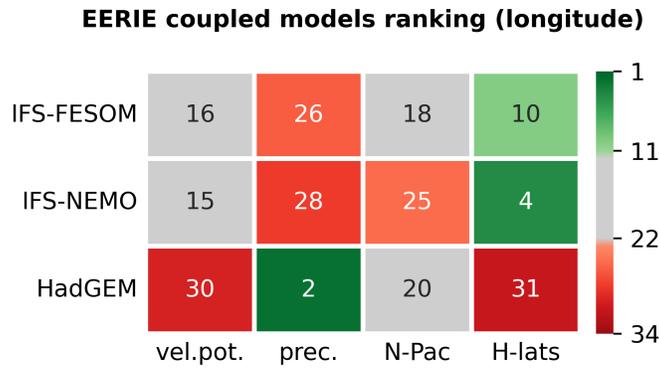

Figure S5: Summary of the ranking for the EERIE models based on the longitude, for each metric. Columns 1-2: tropical response in the velocity potential and precipitation, see Sect. 3.1. Columns 3-4: extra-tropical 200-hPa geopotential height, see Sect. 3.3. Red indicates that the EERIE models are worse than most HighResMIP members (lower tercile), green that they are better (upper tercile), grey that they are average.
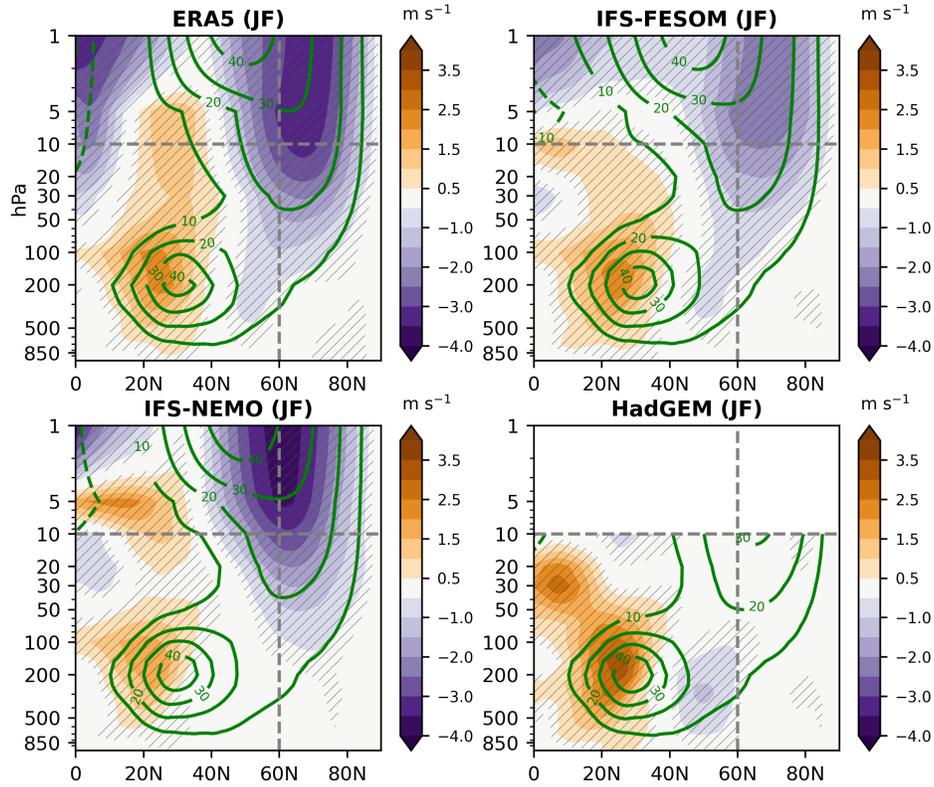
Figure S6: Linear regression on the N3.4 index of zonal-mean zonal wind anomalies in Jan-Feb, for ERA5 and the EERIE coupled models. Hatches indicate statistical significance at the 95% level. The green contours indicate the zonal-mean zonal wind climatology.
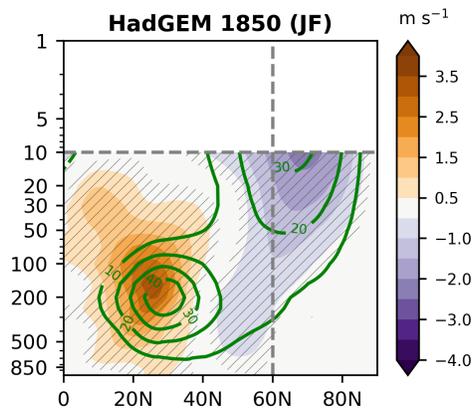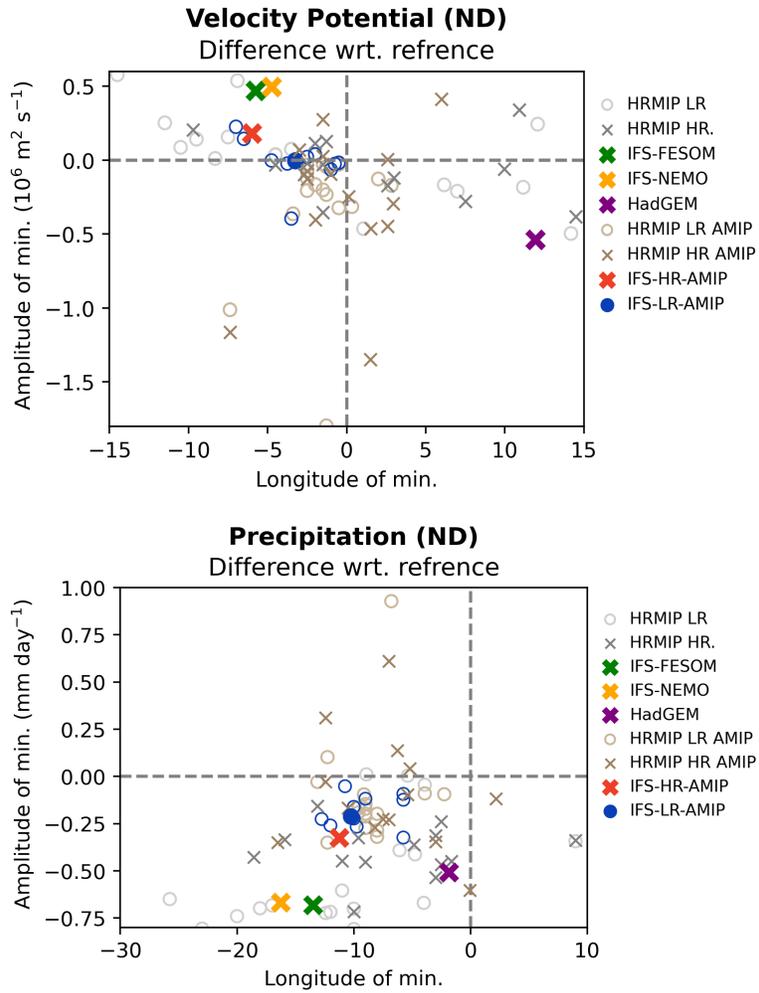

Figure S7: Linear regression on the N3.4 index of zonal-mean zonal wind anomalies in Jan-Feb in HadGEM, using the extended period 1850-2014. Hatches indicate statistical significance at the 95% level. The green contours indicate the zonal-mean zonal wind climatology.
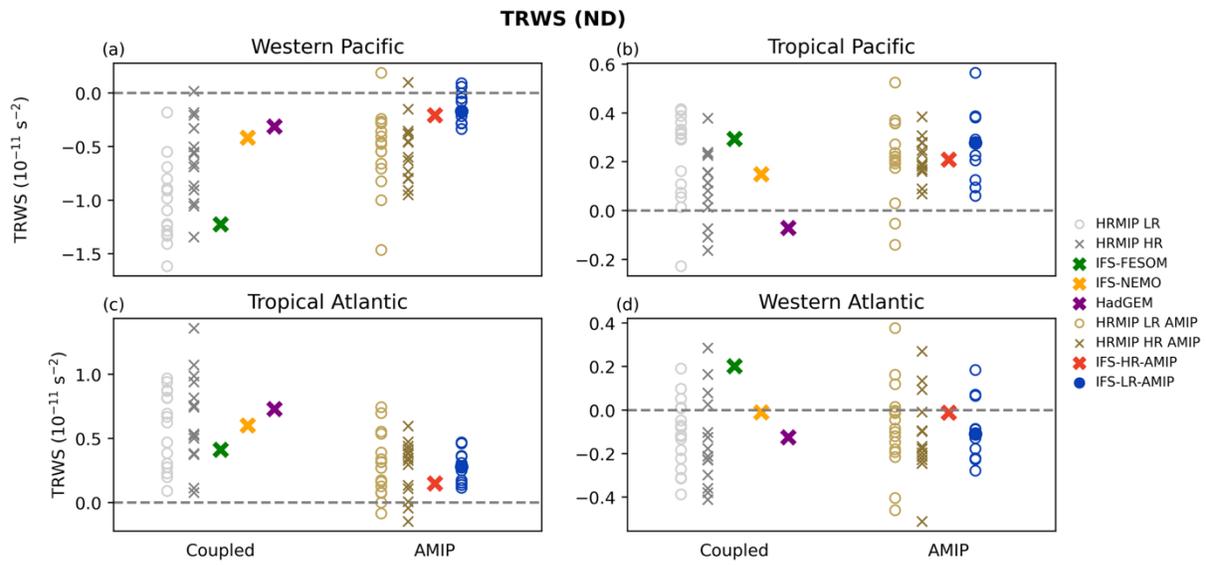
Figure S8: As Fig. 2 but showing the difference with respect to ERA5 instead of the absolute values. Note that the difference is computed with respect to ERA5 over different periods: ERA5-hist (1950-2014) is used as reference for HighResMIP and the EERIE coupled models, while ERA5-rec (1980-2023) is used for the EERIE AMIP simulations.
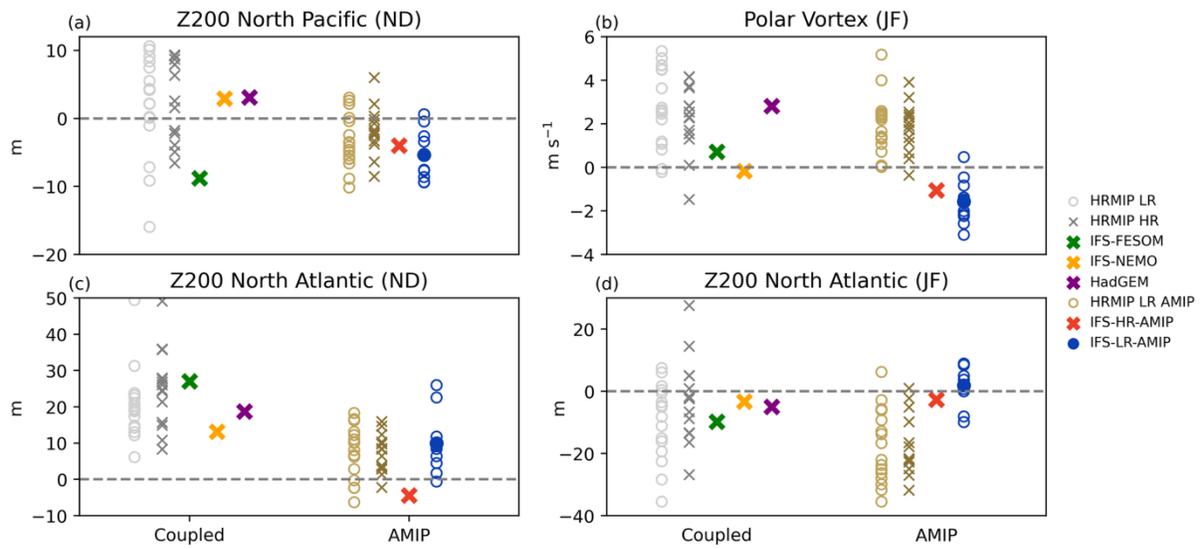
Figure S9. As Fig. 6 but showing the difference with respect to ERA5 instead of the absolute values. Note that the difference is computed with respect to ERA5 over different periods: ERA5-hist (1950-2014) is used as reference for HighResMIP and the EERIE coupled models, while ERA5-rec (1980-2023) is used for the EERIE AMIP simulations.
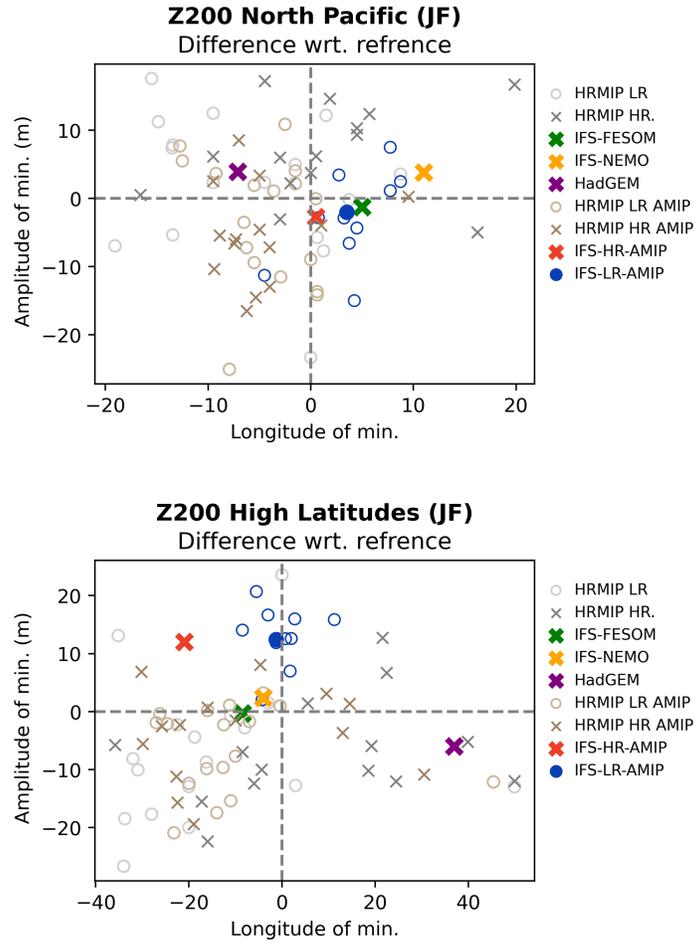
Figure S10: As Fig. 7 but showing the difference with respect to ERA5 instead of the absolute values. Note that the difference is computed with respect to ERA5 over different periods: ERA5-hist (1950-2014) is used as reference for HighResMIP and the EERIE coupled models, while ERA5-rec (1980-2023) is used for the EERIE AMIP simulations. while ERA5-rec (1980-2023) is used for the EERIE AMIP simulations.

Figure S11: As Fig. 4 but showing the difference with respect to ERA5 instead of the absolute values. Note that the difference is computed with respect to ERA5 over different periods: ERA5-hist (1950-2014) is used as reference for HighResMIP and the EERIE coupled models, while ERA5-rec (1980-2023) is used for the EERIE AMIP simulations.
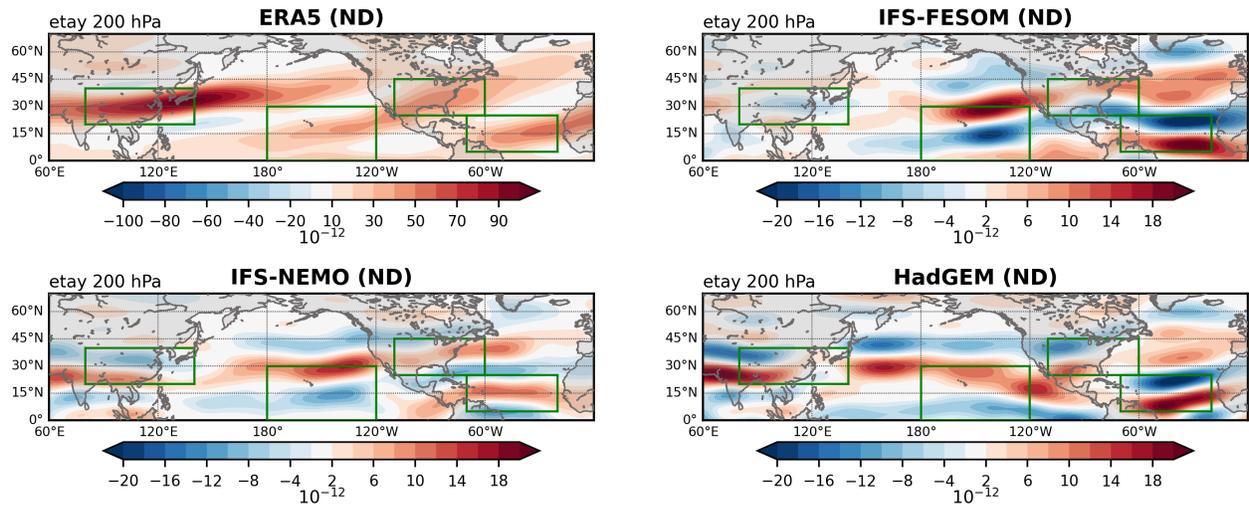
Figure S12: (a) Climatology of the meridional gradient of the 200-hPa absolute vorticity in ERA5, in Nov-Dec (b-d) Bias in the EERIE coupled models.