

Weak but positive multi-decadal trend in the wintertime NAM during the late 20th century in both models and reanalyses

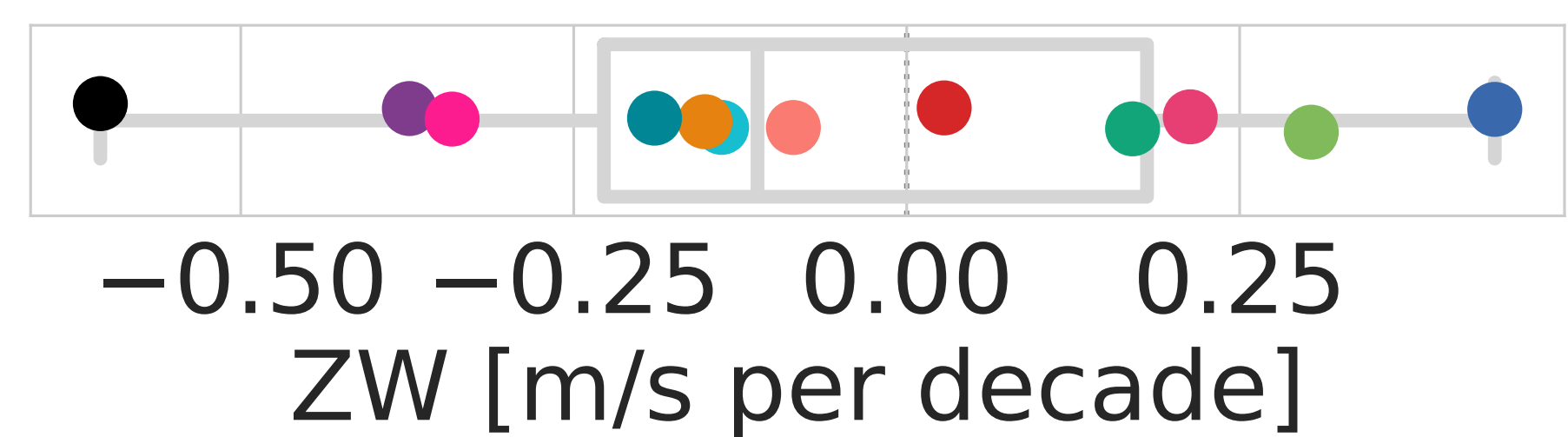
Single-forcing experiments explain this positive trend as a combination of multiple forcing agents

Northern Hemisphere stratospheric polar vortex change: insights from LESFMIP and role of individual forcings

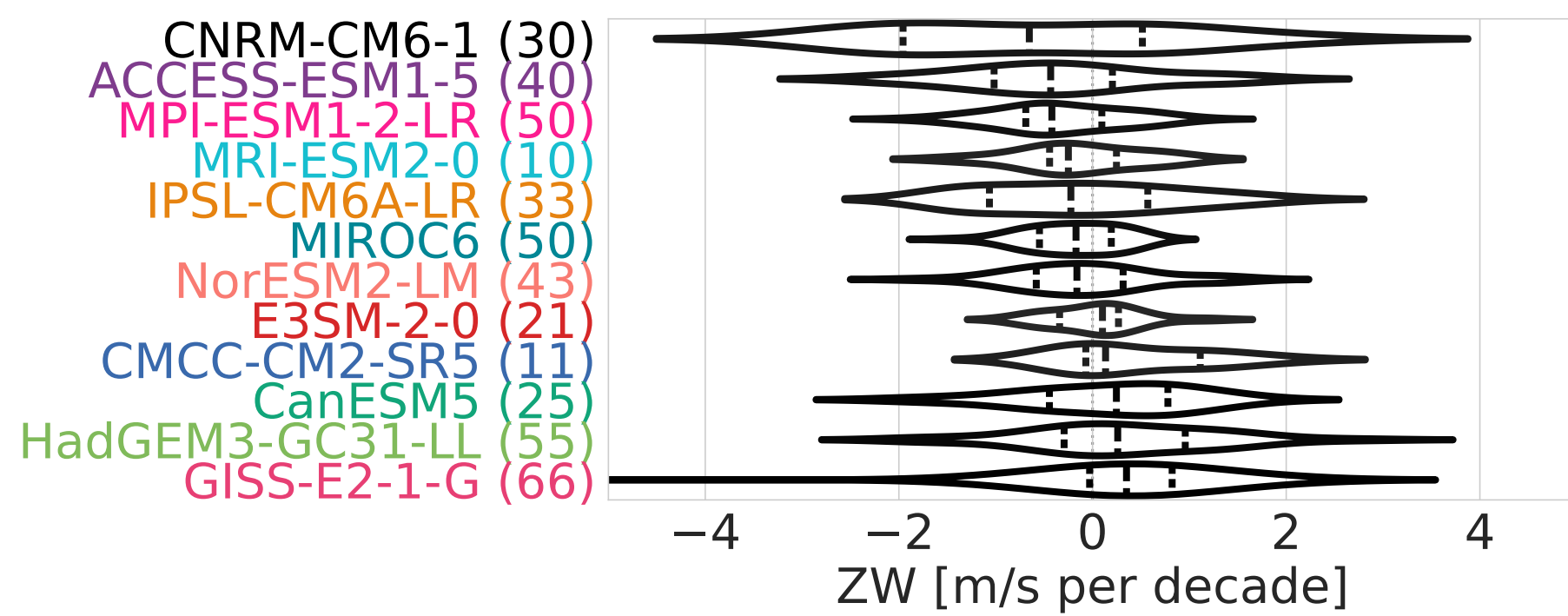
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Introduction

Large uncertainty in the projected winter Arctic stratospheric polar vortex response (at 10 hPa, 60°N):



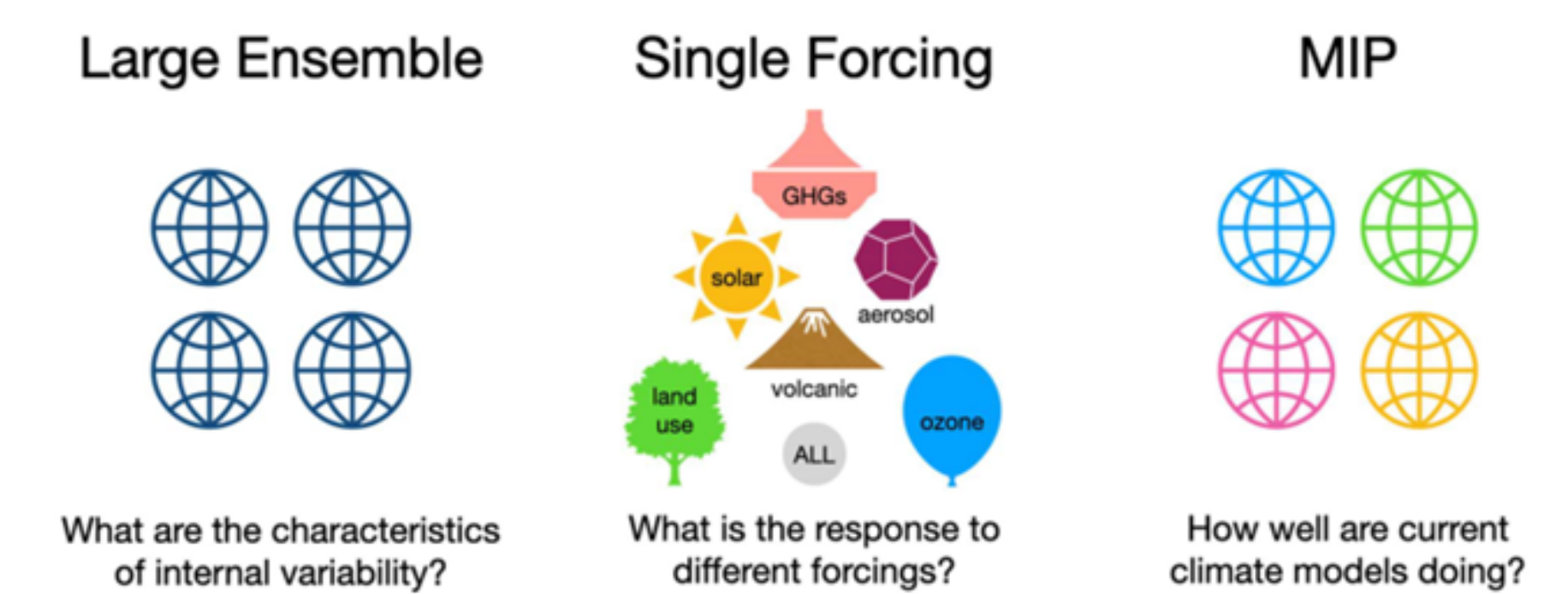
Individual models not confident either:



Little evidence of an emergent constraint in the polar vortex neck region (Karpechko et al 2024)

Dataset description

Large Ensemble Single Forcing MIP (LESFMIP)

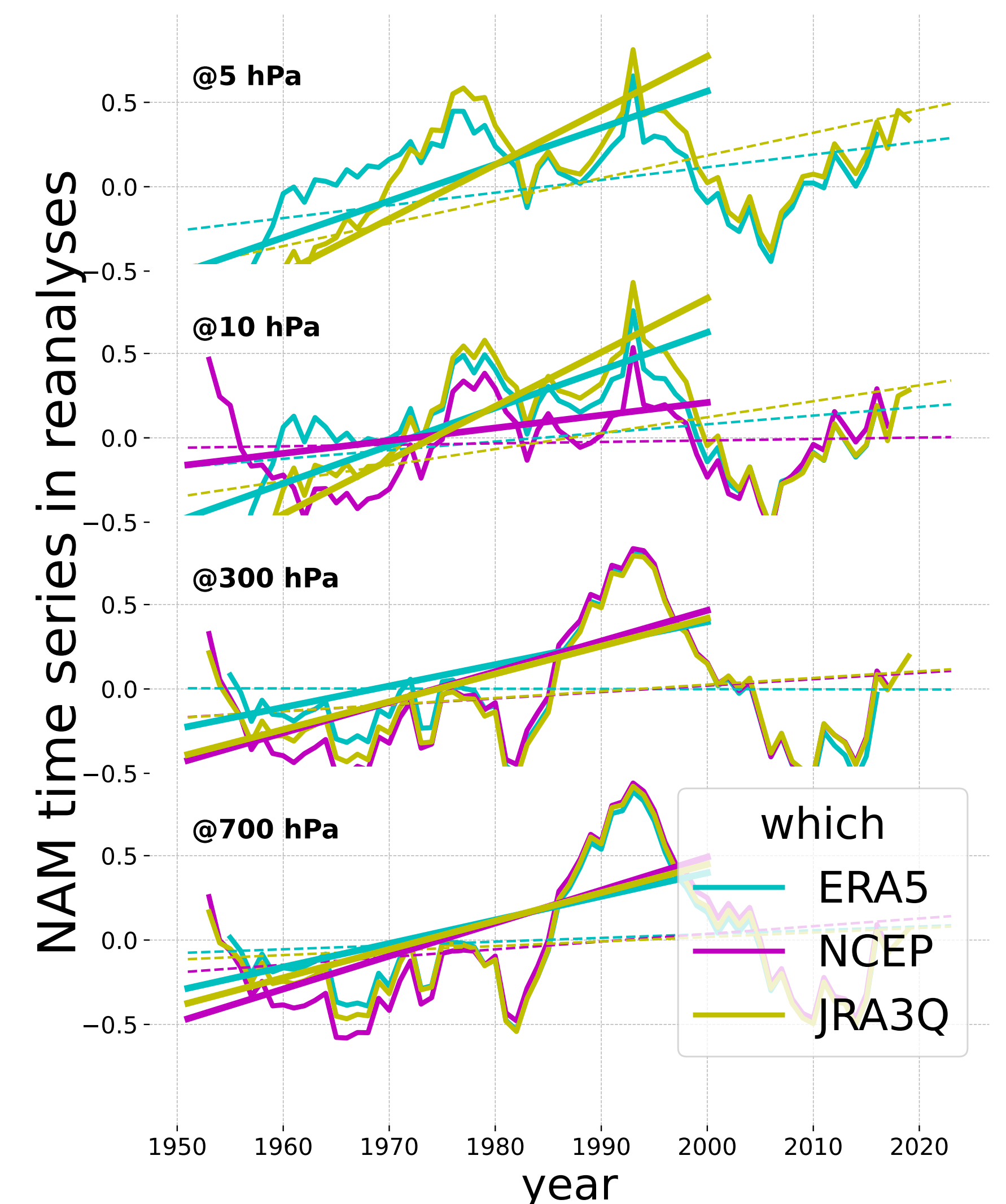


- Mainly DAMIP simulations, with ≥ 10 ensemble members per model for 1850–2020 (Smith et al, 2022)
- Additional runs to assess nonlinearity and sensitivity to the background state
- ~ 13 modeling centers. Data stored and processed on **JASMIN**. Four of the models (CNRM-CM6-1, HadGEM3-GC31-LL, IPSL-CM6A-LR, MIROC6) spontaneously simulate a QBO (Garfinkel et al, 2025)

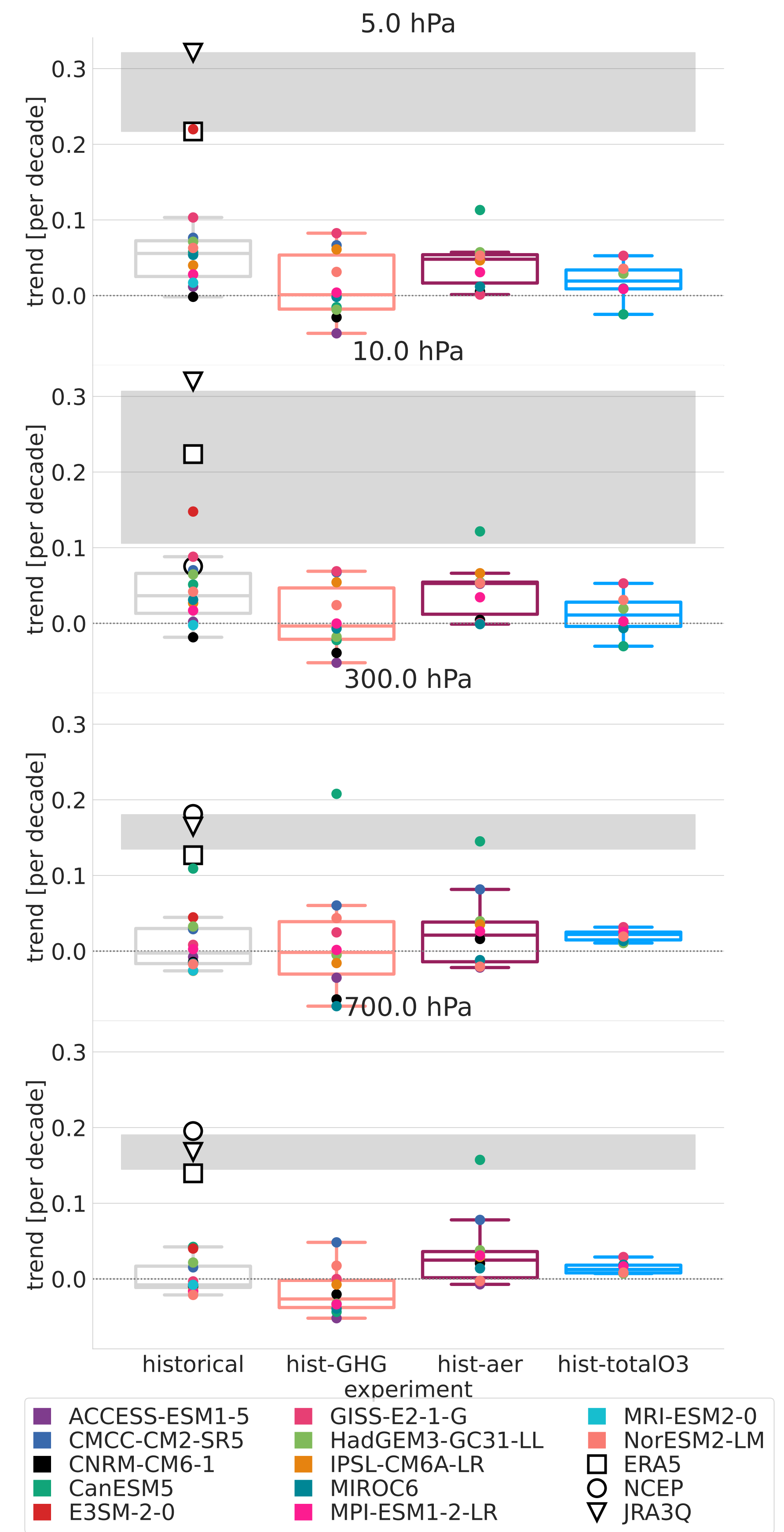
Experiment	Description
historical	all forcings
hist-GHG	Well-mixed greenhouse-gas-only historical simulations
hist-aer	Anthropogenic-aerosol-only historical simulations
hist-totalO3	Ozone-only historical simulations (strat. and trop. ozone)

Northern Annular Mode (NAM)

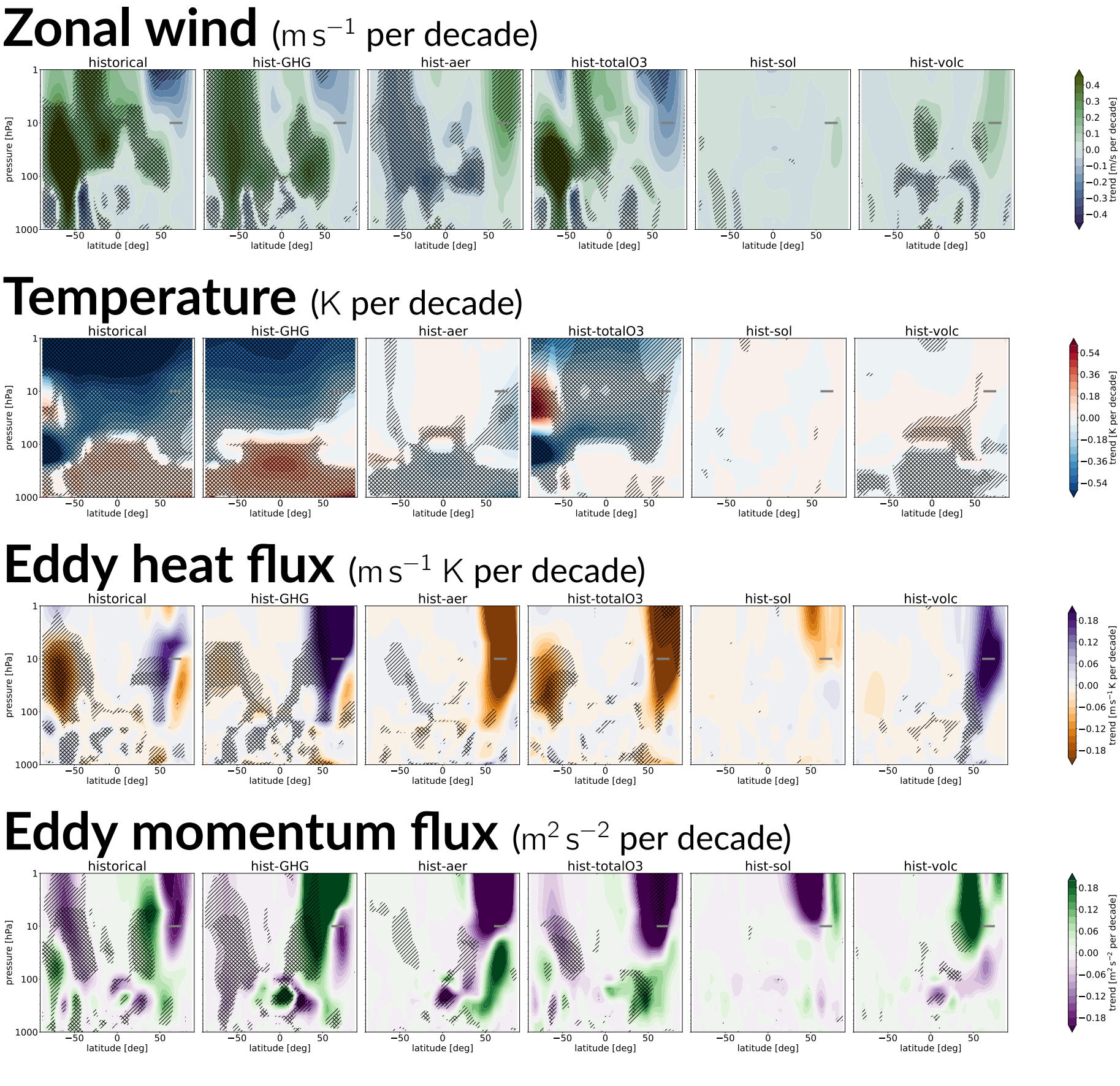
NAM time-series in ERA5, NCEP and JRA3Q



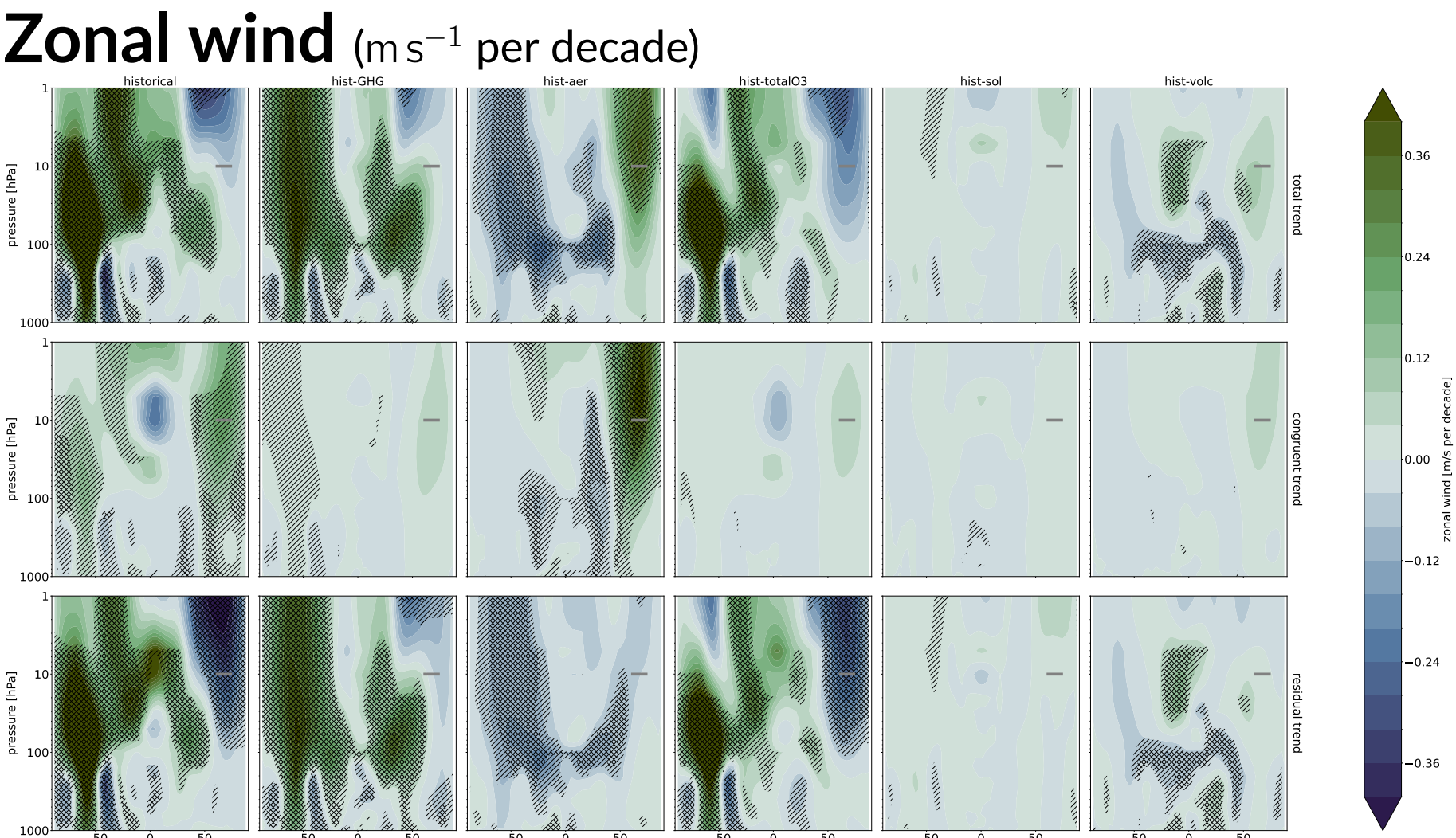
NAM trend (DJF) for 1951–2000 in LESFMIP



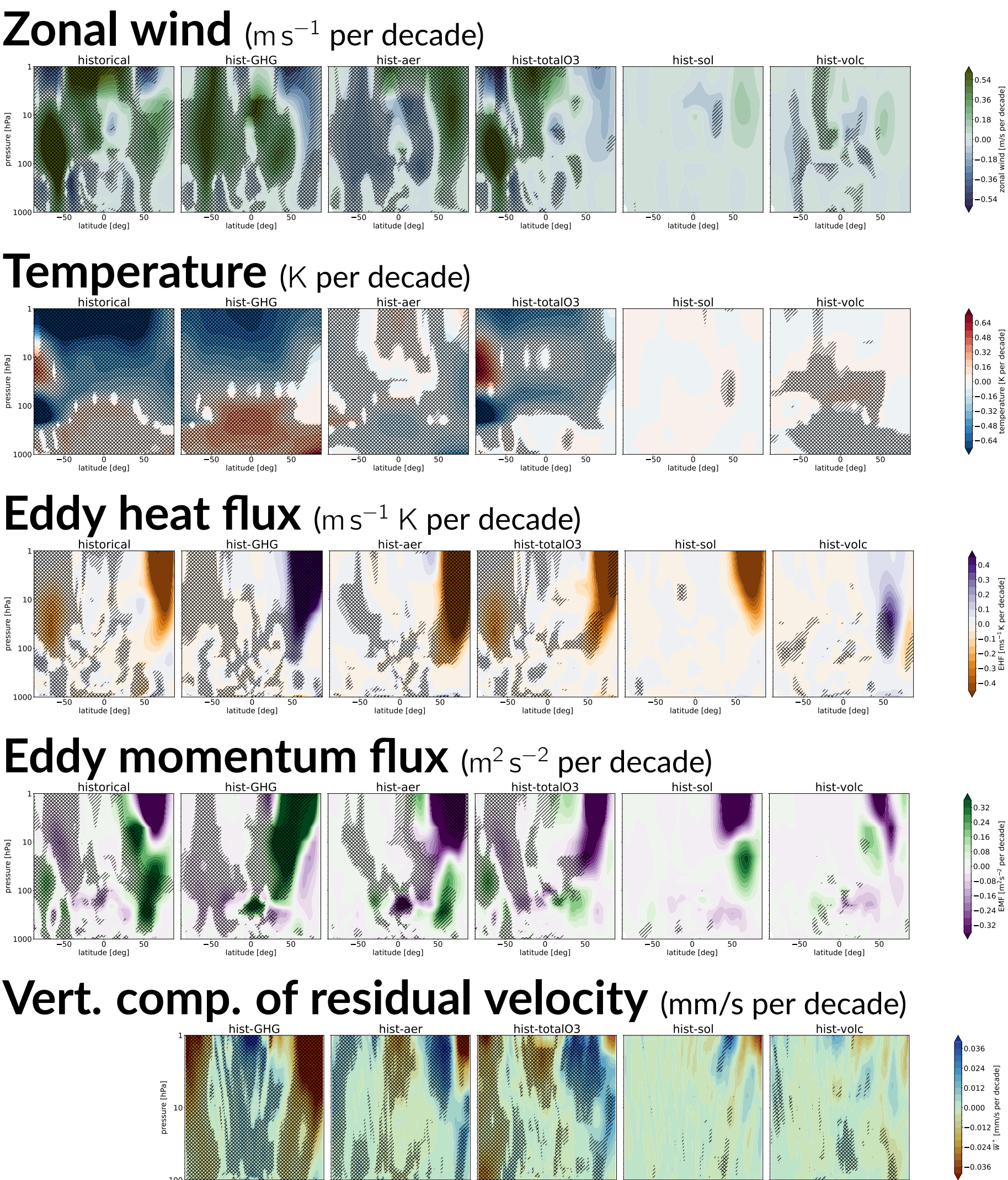
Trends (DJF) for 1951–2000 in LESFMIP



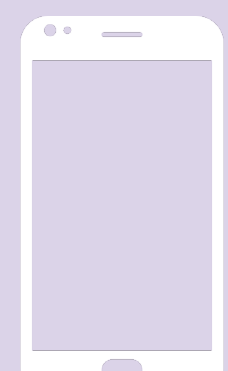
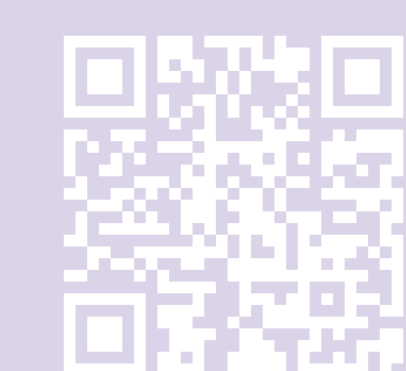
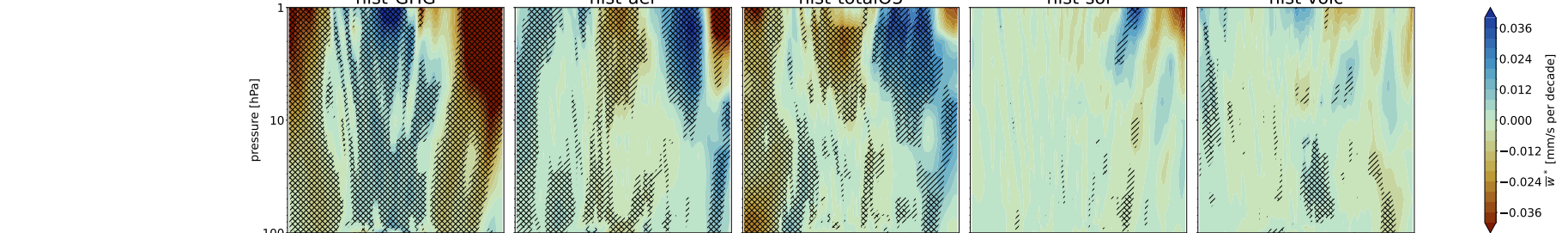
Congruence of trends with NAM@10 hPa (DJF) for 1951–2000



Trends (DJF) for 1951–2000 in HadGEM3-GC31-LL



Vert. comp. of residual velocity (mm/s per decade)



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