

Supplementary Material:  
Climate emulation framework METEORv1.6:  
Monthly climate variability and integrated  
impact assessment extensions

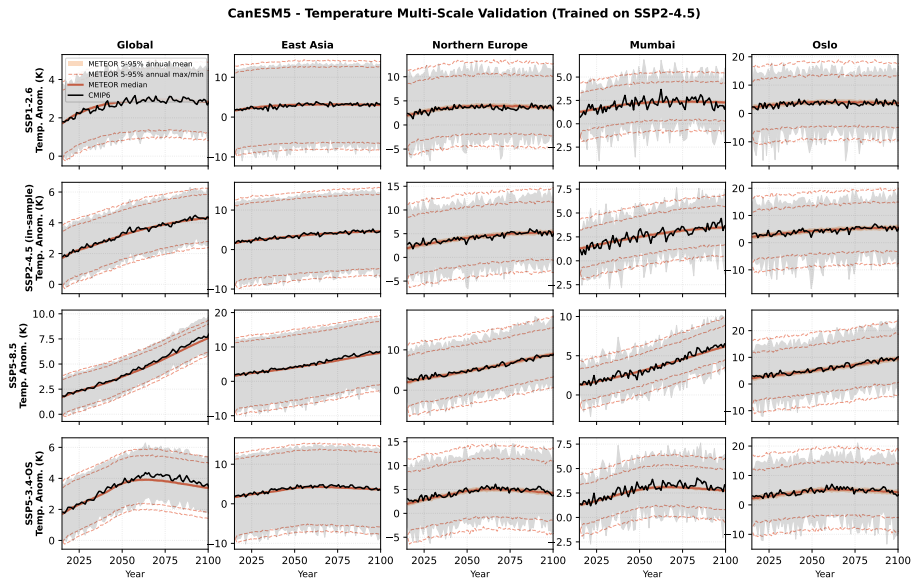
B. M. Sanderson et al.

April 9, 2026

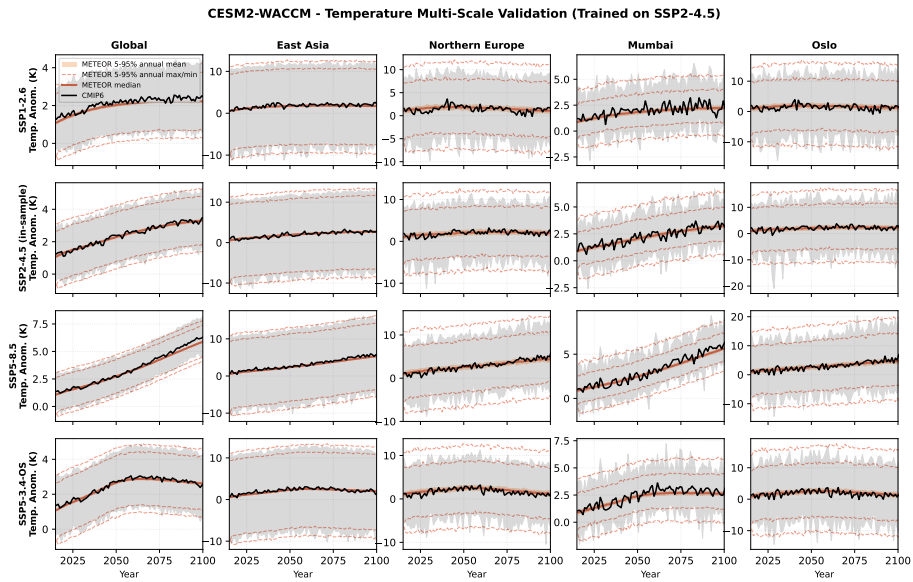
## Supplemental Material

Table 1: Variance decomposition for the METEOR noise model across five CMIP6 models. Seasonal  $R^2$  shows variance explained by the temperature-dependent harmonic model; Anomaly  $R^2$  (PCA) shows variance of residuals explained by 40 principal components; Total  $R^2$  combines both components.

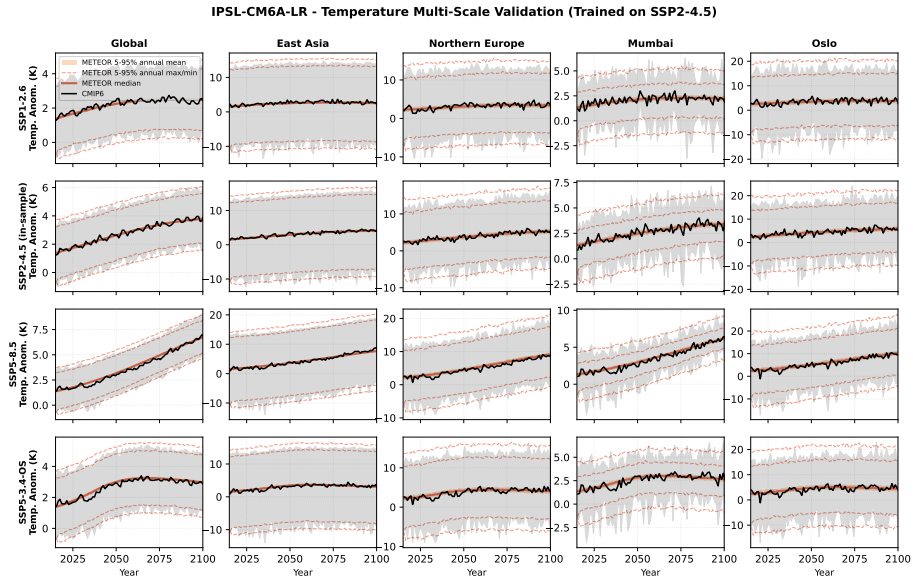
Model	Temperature			Precipitation		
	Seasonal	PCA	Total	Seasonal	PCA	Total
CanESM5	91.6%	76.8%	98.1%	34.4%	33.1%	56.1%
CESM2-WACCM	90.7%	80.3%	98.2%	33.5%	45.4%	63.7%
CNRM-ESM2-1	91.0%	75.3%	97.8%	30.9%	37.5%	56.8%
IPSL-CM6A-LR	91.3%	76.0%	97.9%	31.3%	28.5%	50.9%
UKESM1-0-LL	90.6%	75.7%	97.7%	31.7%	34.9%	55.5%



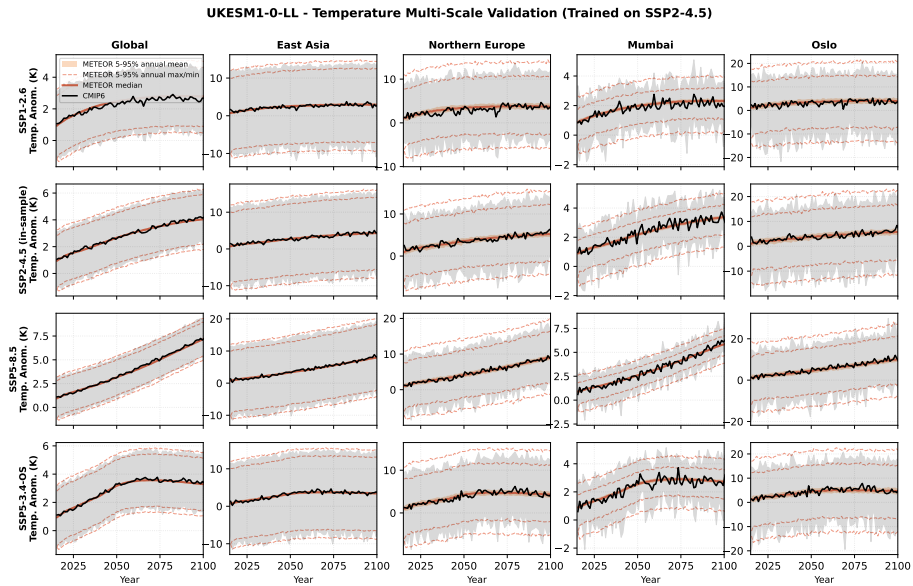
Supplemental Figure 1: Out-of-sample temperature validation for CanESM5 trained on SSP2-4.5. Layout as in Figure 7.



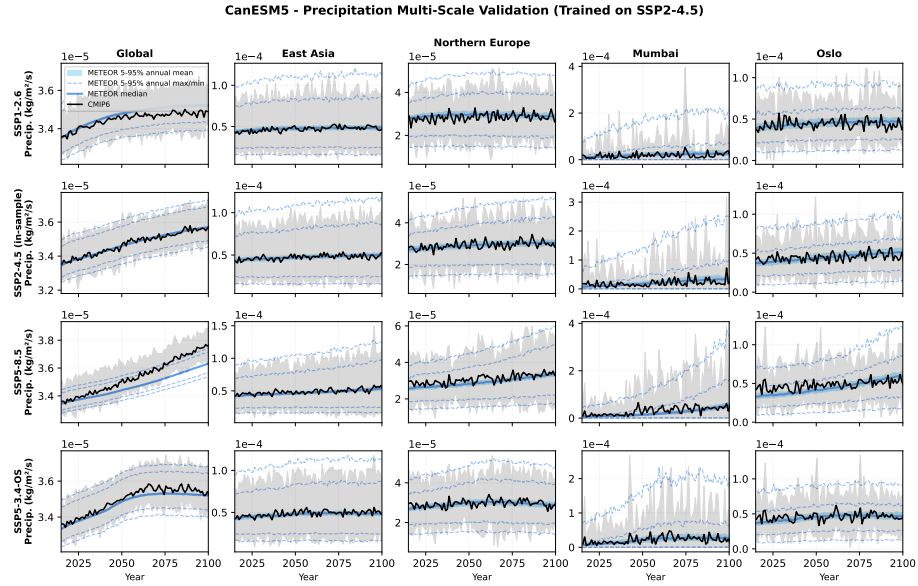
Supplemental Figure 2: Out-of-sample temperature validation for CESM2-WACCM trained on SSP2-4.5. Layout as in Figure 7.



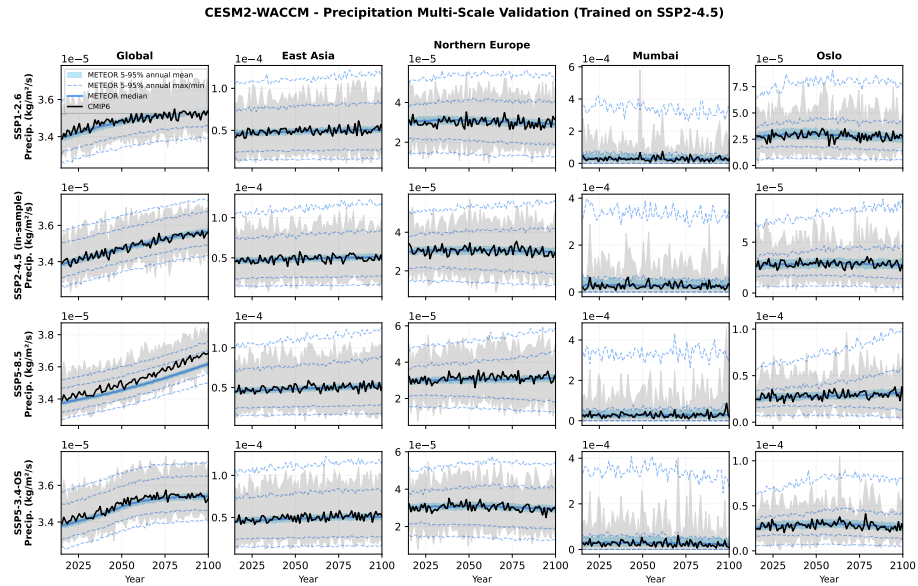
Supplemental Figure 3: Out-of-sample temperature validation for IPSL-CM6A-LR trained on SSP2-4.5. Layout as in Figure 7.



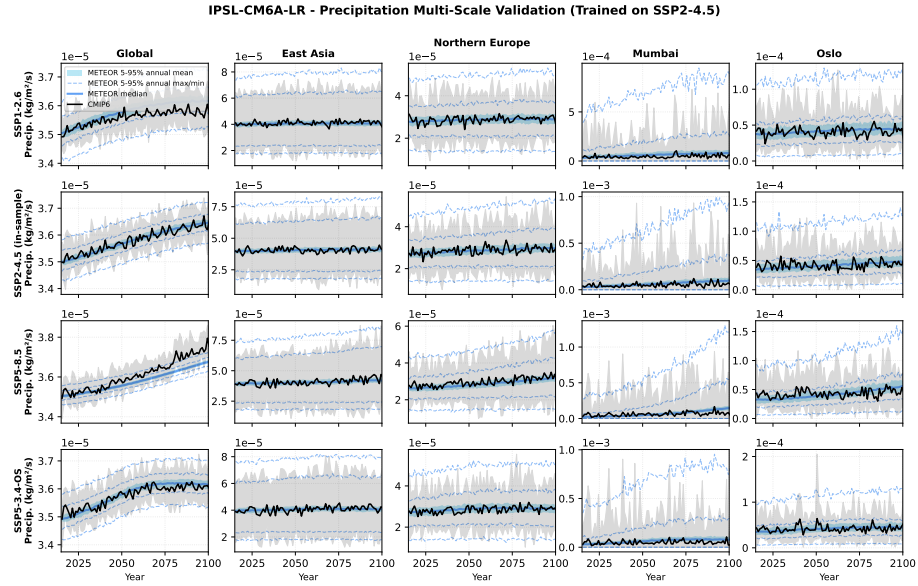
Supplemental Figure 4: Out-of-sample temperature validation for UKESM1-0-LL trained on SSP2-4.5. Layout as in Figure 7.



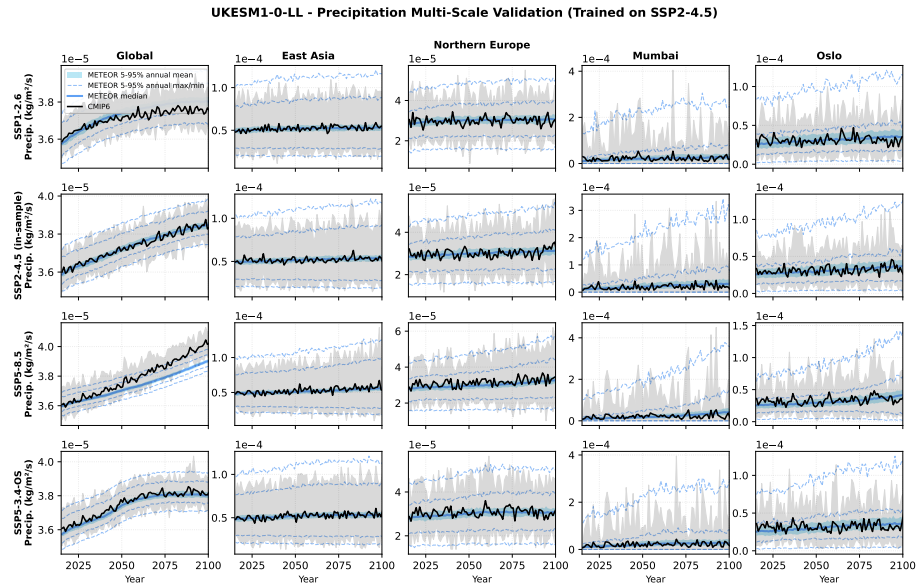
Supplemental Figure 5: Out-of-sample precipitation validation for CanESM5 trained on SSP2-4.5. Layout as in Figure 8.



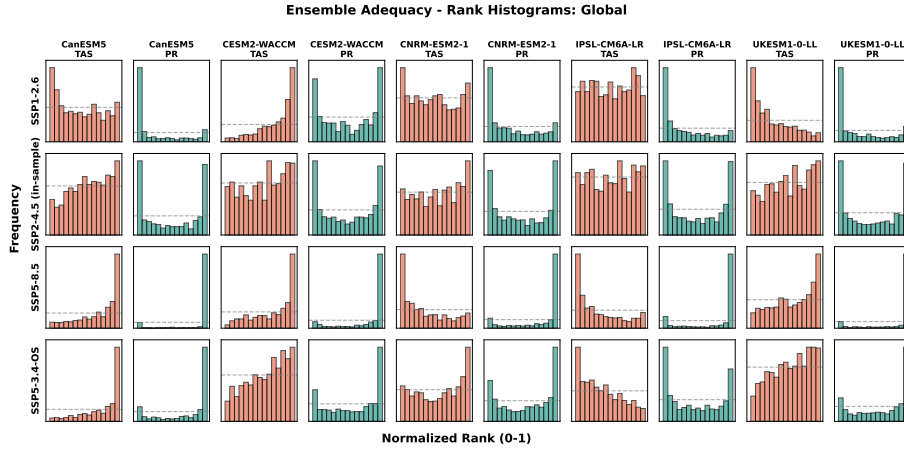
Supplemental Figure 6: Out-of-sample precipitation validation for CESM2-WACCM trained on SSP2-4.5. Layout as in Figure 8.



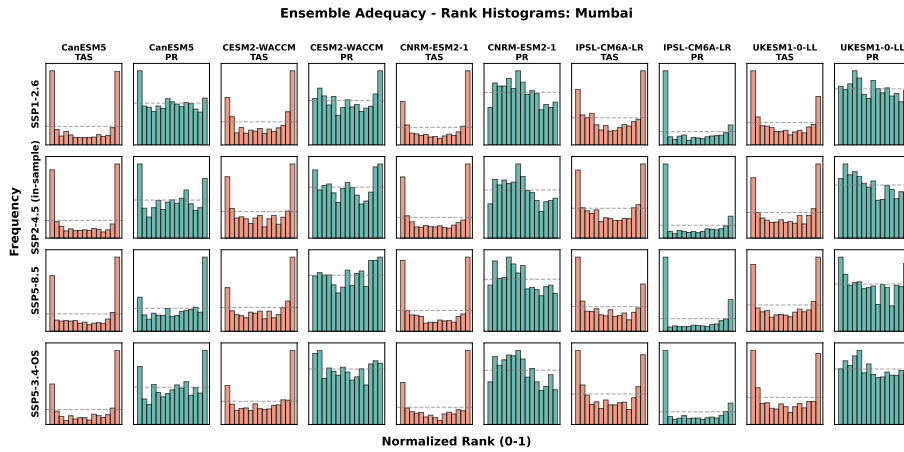
Supplemental Figure 7: Out-of-sample precipitation validation for IPSL-CM6A-LR trained on SSP2-4.5. Layout as in Figure 8.



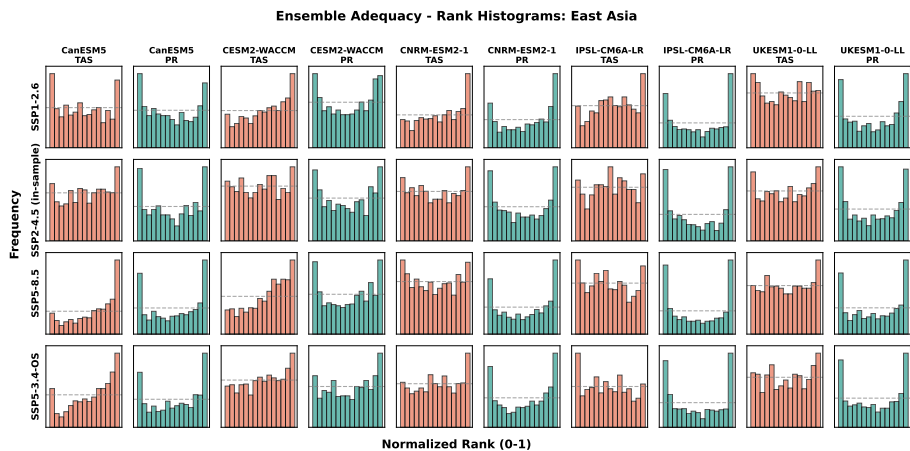
Supplemental Figure 8: Out-of-sample precipitation validation for UKESM1-0-LL trained on SSP2-4.5. Layout as in Figure 8.



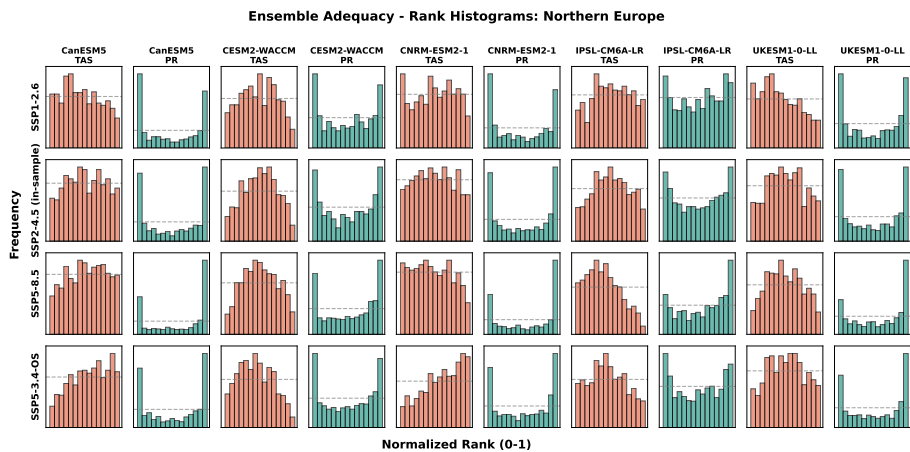
Supplemental Figure 9: Out-of-sample rank histograms for global mean. Layout as in Figure 9. Note the more pronounced underdispersion in precipitation compared to point-scale results, suggesting the precipitation distributional transform may be less appropriate for large-scale spatial aggregations.



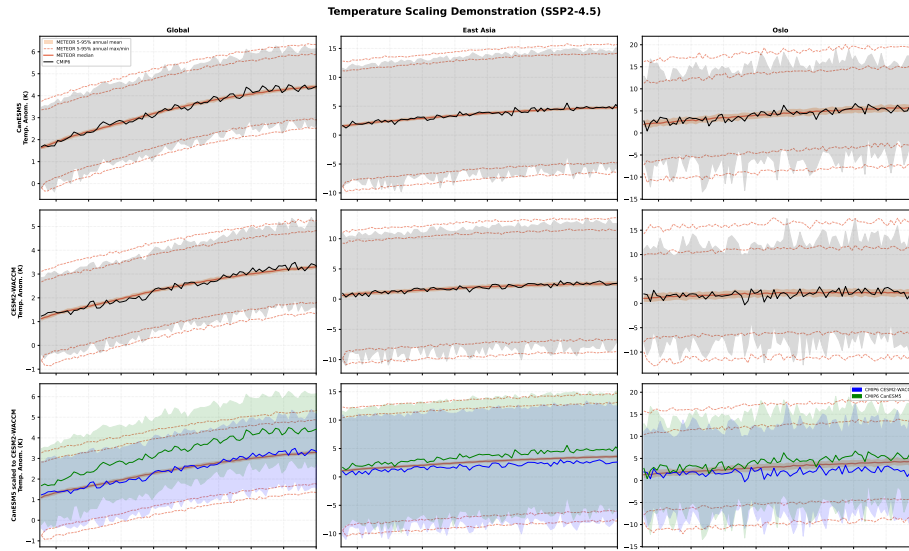
Supplemental Figure 10: Out-of-sample rank histograms for Mumbai, India. Layout as in Figure 9.



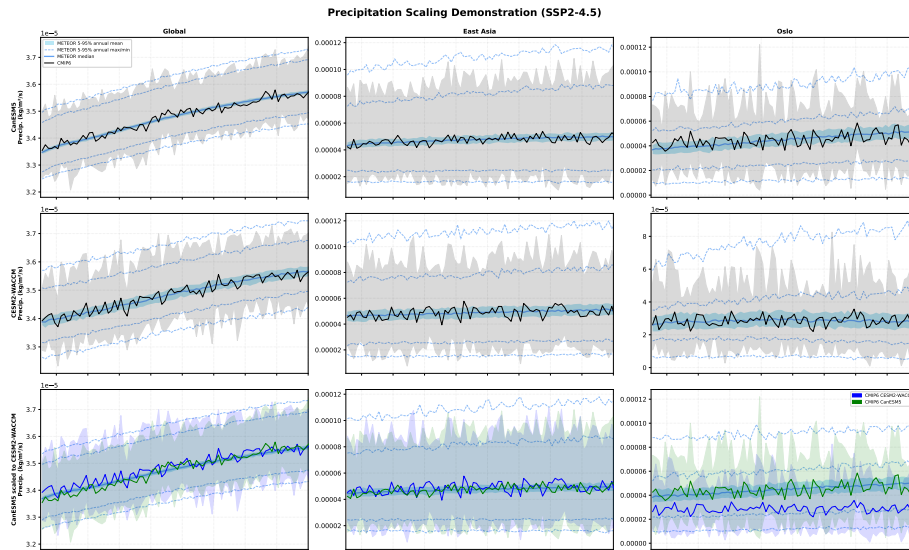
Supplemental Figure 11: Out-of-sample rank histograms for East Asia (AR6 region). Layout as in Figure 9.



Supplemental Figure 12: Out-of-sample rank histograms for Northern Europe (AR6 region). Layout as in Figure 9.



Supplemental Figure 13: Temperature anomaly results for ssp245 with a model trained on CanESM5, but scaled to the global mean timeseries of CESM2-WACCM, for global, regional and point scale. Results for the models trained directly on the two models are shown for comparison in the top two rows.



Supplemental Figure 14: Temperature anomaly results for ssp245 with a model trained on CanESM5, but scaled to the global mean timeseries of CESM2-WACCM, for global, regional and point scale. Results for the models trained directly on the two models are shown for comparison in the top two rows.