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Signal, noise and skill in sub-seasonal forecasts: the role of teleconnections

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Supplementary Materials

Table S1: *Spatial correlation coefficients (30°N-90°N) between the forecast skill (ρ) and the forecast properties (σ_{EM}^2, σ_{ES}^2, STN, ρ_{perf}^{STN}, ρ_{perf}^{ACC}) for T2M in CTRL. The values above the diagonal are for Weeks 3-4. The values below the diagonal are for Weeks 5-6.*

	ρ	ρ_{perf}^{STN}	ρ_{perf}^{ACC}	STN	σ_{EM}^2	σ_{ES}^2
ρ	1	0.77	0.77	0.75	-0.23	-0.39
ρ_{perf}^{STN}	0.70	1	1	0.97	-0.21	-0.46
ρ_{perf}^{ACC}	0.69	1	1	0.96	-0.21	-0.46
STN	0.69	0.97	0.96	1	-0.21	-0.43
σ_{EM}^2	-0.28	-0.30	-0.30	-0.28	1	0.91
σ_{ES}^2	-0.45	-0.54	-0.55	-0.48	0.90	1

Table S2: *Spatial correlation coefficients (30°N-90°N) between the changes in the forecast skill ($\Delta\rho$) and changes in the forecast properties ($\Delta\sigma_{EM}^2$, $\Delta\sigma_{ES}^2$, ΔSTN, $\Delta\rho_{perf}^{STN}$, $\Delta\rho_{perf}^{ACC}$) for T2M in the relaxation experiments.*

	TROP					STRAT				
	$\Delta\sigma_{EM}^2$	$\Delta\sigma_{ES}^2$	ΔSTN	$\Delta\rho_{perf}^{STN}$	$\Delta\rho_{perf}^{ACC}$	$\Delta\sigma_{EM}^2$	$\Delta\sigma_{ES}^2$	ΔSTN	$\Delta\rho_{perf}^{STN}$	$\Delta\rho_{perf}^{ACC}$
Weeks 1-2	-0.03	-0.05	0.25	0.42	0.41	0.04	-0.09	-0.03	0.01	0.02
Weeks 3-4	0.10	-0.06	0.44	0.51	0.50	0.29	-0.15	0.16	0.28	0.28
Weeks 5-6	0.03	-0.23	0.34	0.36	0.34	0.14	0.00	0.08	0.16	0.16

Table S3: *Spatial correlation coefficients (30°N-90°N) between the forecast skill (ρ) and the forecast properties (σ_{EM}^2, σ_{ES}^2, STN, ρ_{perf}^{STN}, ρ_{perf}^{ACC}) for TP in CTRL. The values above the diagonal are for Weeks 3-4. The values below the diagonal are for Weeks 5-6.*

	ρ	ρ_{perf}^{STN}	ρ_{perf}^{ACC}	STN	σ_{EM}^2	σ_{ES}^2
ρ	1	0.42	0.41	0.42	0.23	0.16
ρ_{perf}^{STN}	0.43	1	1	0.99	0.43	0.30
ρ_{perf}^{ACC}	0.42	1	1	0.98	0.43	0.30
STN	0.42	0.99	0.98	1	0.43	0.30
σ_{EM}^2	0.22	0.46	0.46	0.45	1	0.96
σ_{ES}^2	0.14	0.30	0.30	0.28	0.96	1

Table S4: *Spatial correlation coefficients between the changes in the forecast skill (Δρ) and changes in the forecast properties ($\Delta\sigma_{EM}^2$, $\Delta\sigma_{ES}^2$, ΔSTN, $\Delta\rho_{perf}^{STN}$, $\Delta\rho_{perf}^{ACC}$) for TP in the relaxation experiments.*

| | TROP | | | | | STRAT | | | | |
	$\Delta\sigma_{EM}^2$	$\Delta\sigma_{ES}^2$	ΔSTN	$\Delta\rho_{perf}^{STN}$	$\Delta\rho_{perf}^{ACC}$	$\Delta\sigma_{EM}^2$	$\Delta\sigma_{ES}^2$	ΔSTN	$\Delta\rho_{perf}^{STN}$	$\Delta\rho_{perf}^{ACC}$
Weeks 1-2	0.06	-0.12	0.15	0.13	0.13	0.01	-0.03	0.02	0.04	0.04
Weeks 3-4	0.26	-0.26	0.33	0.34	0.33	0.02	0.02	0.07	0.07	0.07
Weeks 5-6	0.33	-0.22	0.39	0.41	0.40	0.08	-0.08	0.14	0.15	0.15
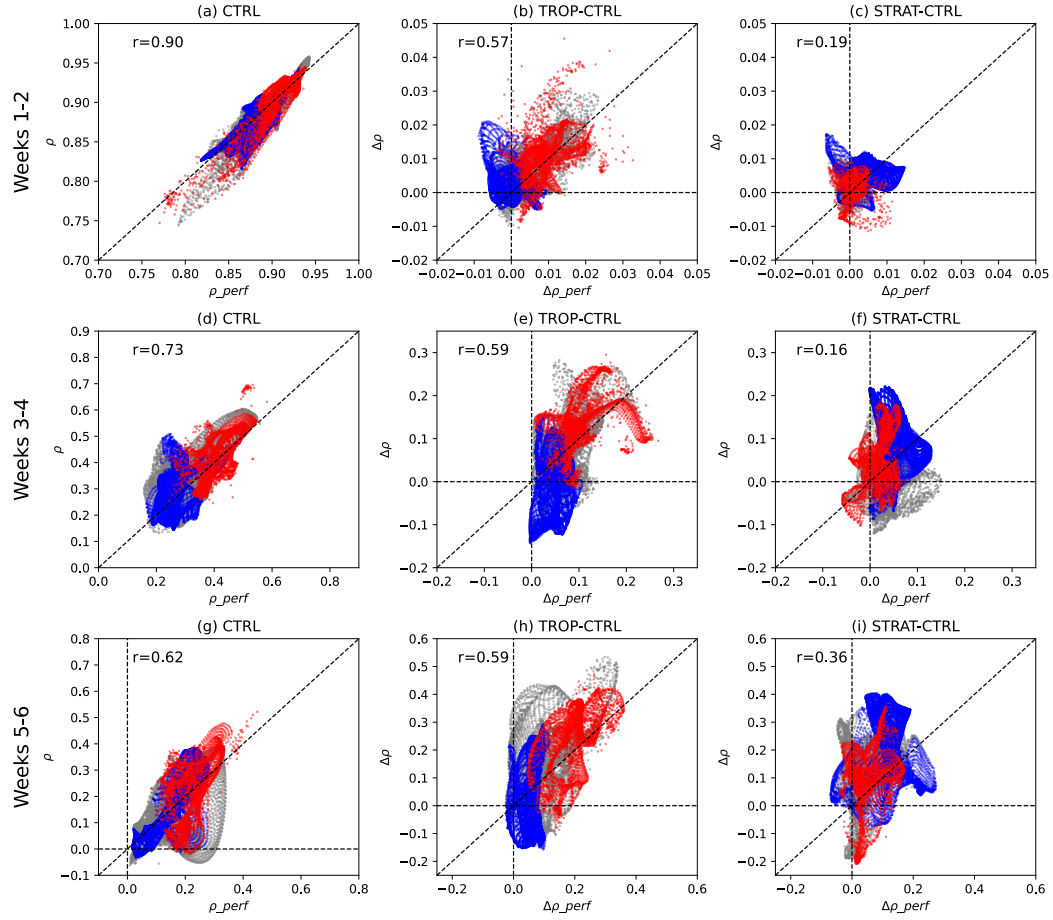
Figure S1: *(a,d,g) Scatterplots between ρ and ρ_{perf}^{ACC} for SLP anomalies at each grid point between 30°N and 90°N in CTRL. 2nd and 3rd columns show differences for ρ and ρ_{perf}^{ACC} between relaxation experiments (TROP and STRAT respectively) and CTRL. Spatial correlation coefficients between ρ and ρ_{perf}^{ACC} fields are shown as r-values in each panel. Red do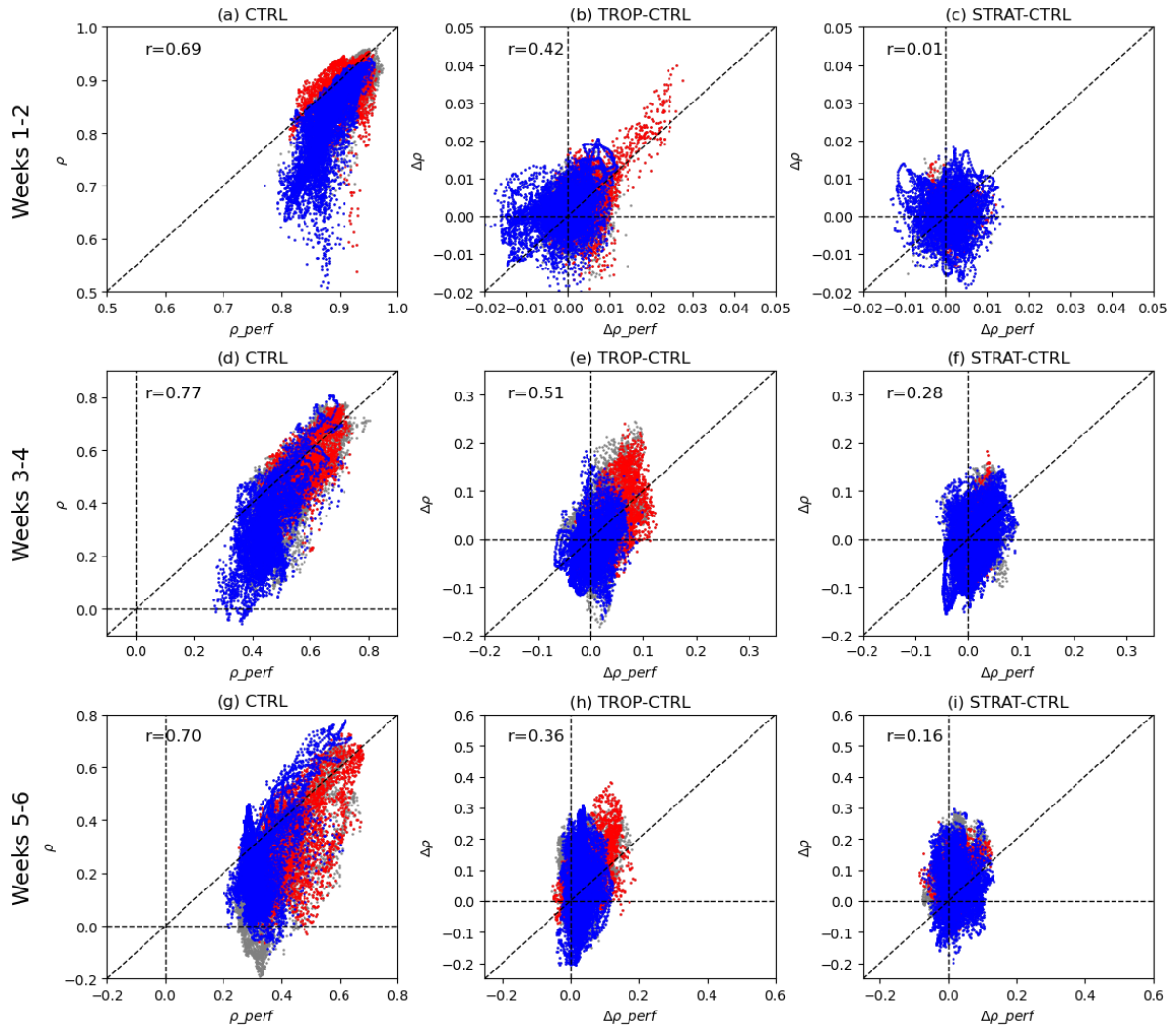ts mark grid points south of 40°N, blue dots mark grid points north of 60°N, and grey dots mark grid points between 40°N-60°N.*
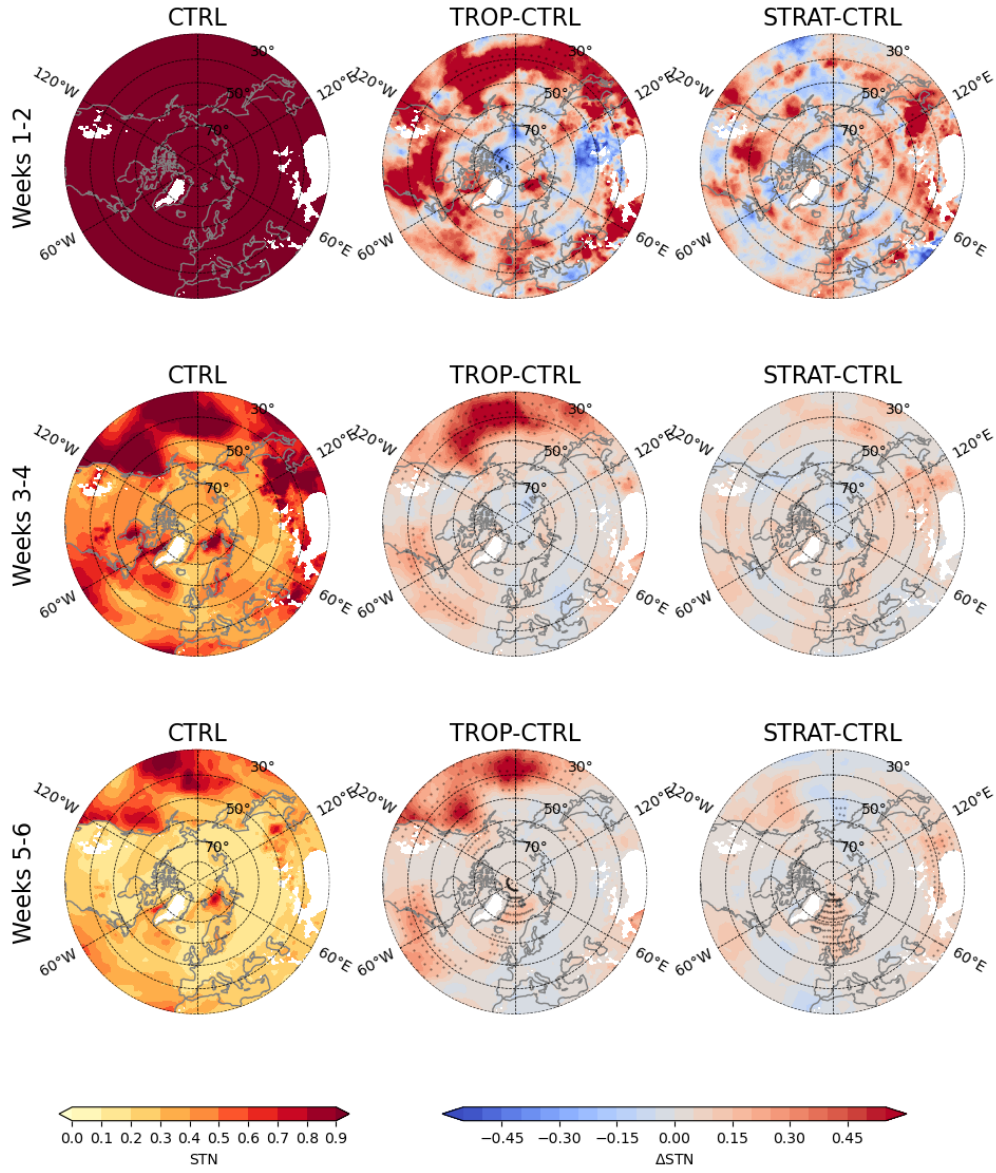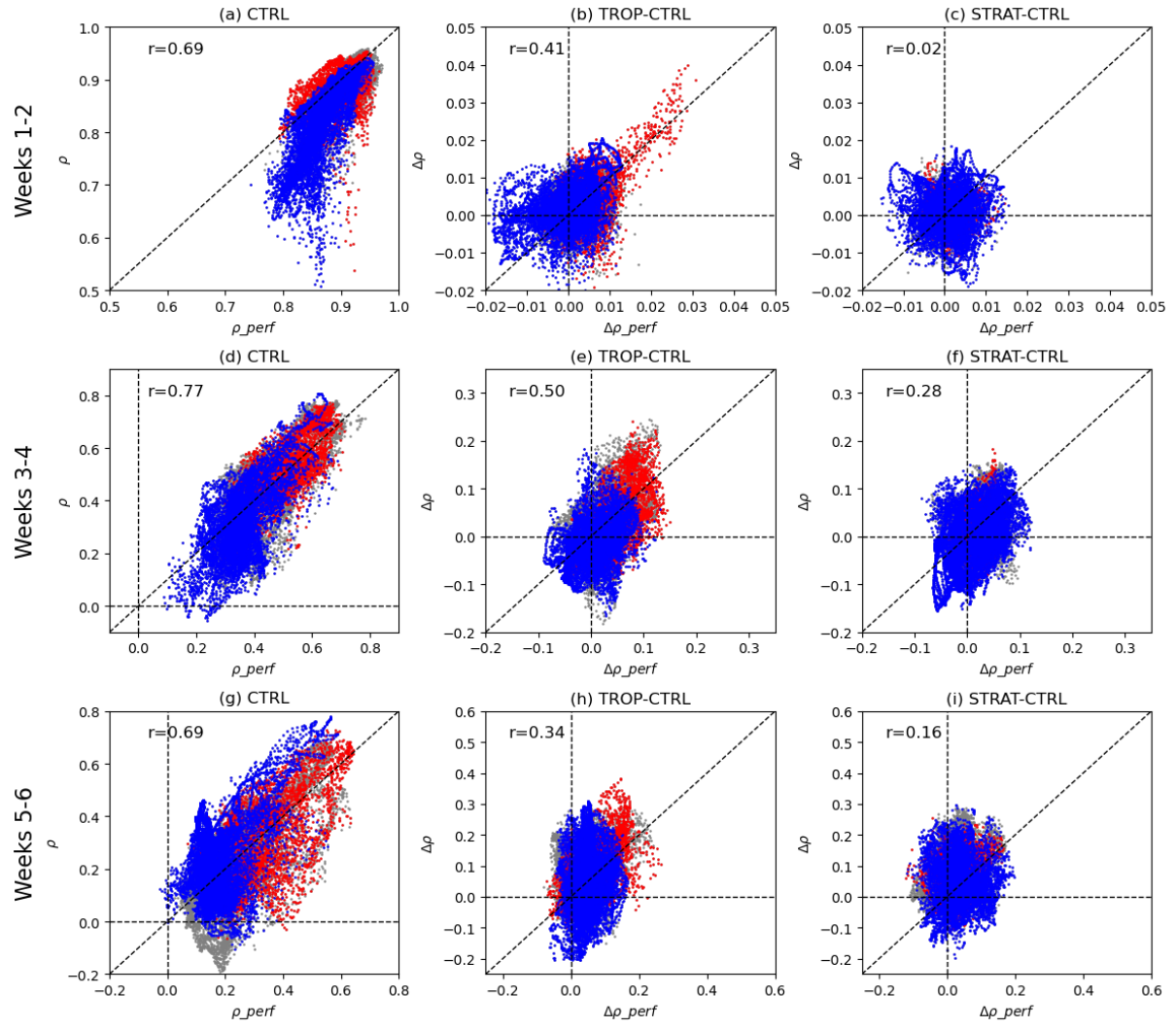
Figure S2: *Signal to noise ratio (STN) for bi-weekly mean T2M anomalies for (left) CTRL; and the differences between ρ in (center) TROP and (right) STRAT experiments with respect to CTRL. Stippling in (center, right) indicates significant differences between CTRL and the respective relaxation experiments.*

Figure S3: *(a,d,g) Scatterplots between ρ and $\Delta\rho_{perf}^{STN}$ for T2M anomalies at each grid point between 30 °N and 90 °N in CTRL. 2nd and 3rd columns show differences for ρ and $\Delta\rho_{perf}^{STN}$ between relaxation experiments (TROP and STRAT respectively) and CTRL. r-values show spatial correlation coefficients between ρ and $\Delta\rho_{perf}^{STN}$ fields. Red dots mark grid points south of 40 °N, blue dots mark grid points north of 60 °N, and grey dots mark grid points between 40 °N-60 °N.*

Figure S4: *The same as Fig.S2 but for ρ_{perf}^{ACC} instead of ρ_{perf}^{STN}.*
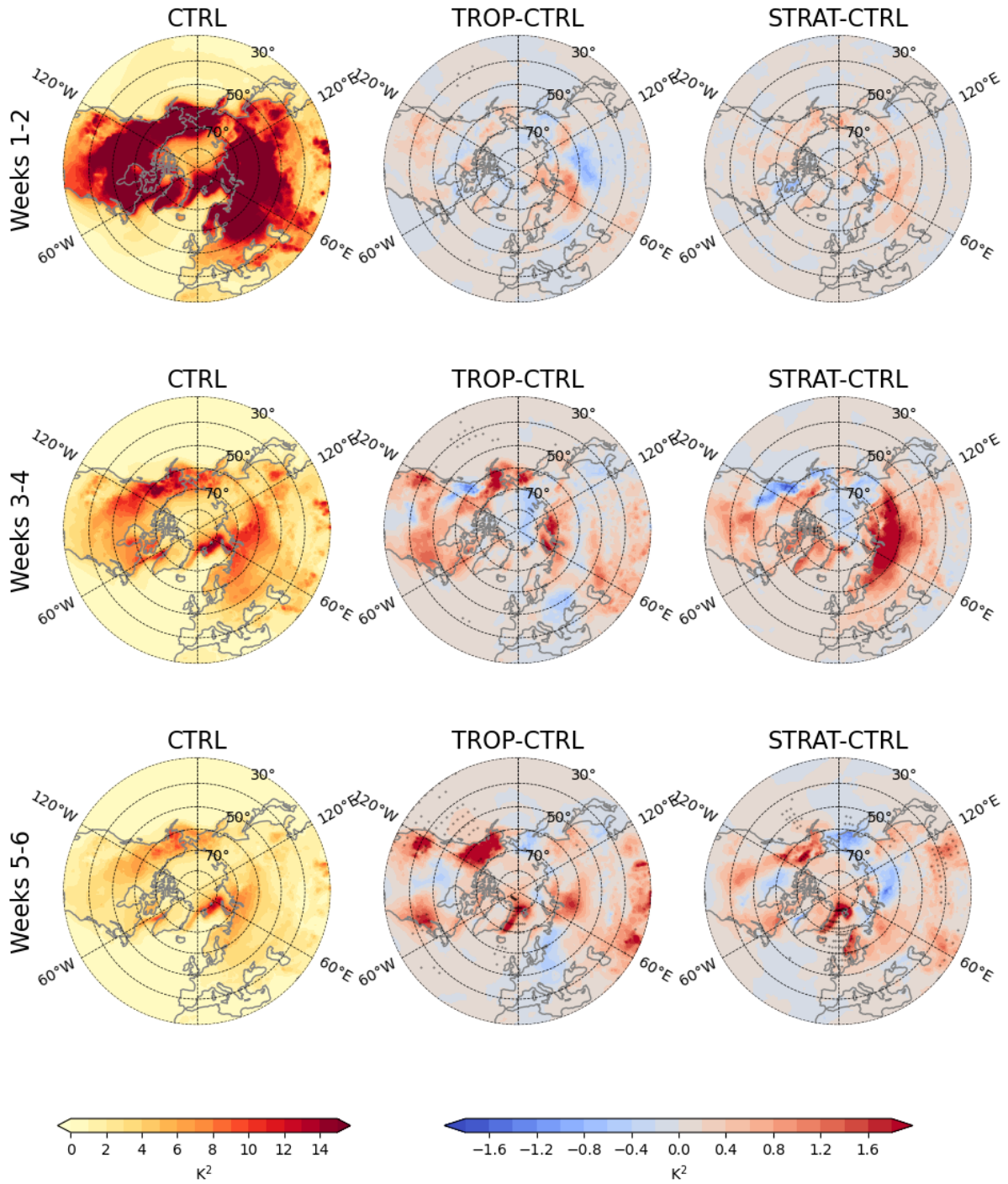
Figure S5: *Variability of ensemble mean (σ^2_{EM}) for bi-weekly mean T2M anomalies for (left) CTRL; and the differences between σ^2_{EM} in (center) TROP and (right) STRAT experiments with respect to CTRL. Stippling in (center, right) indicates significant differences between CTRL and the respective relaxation experiments.*
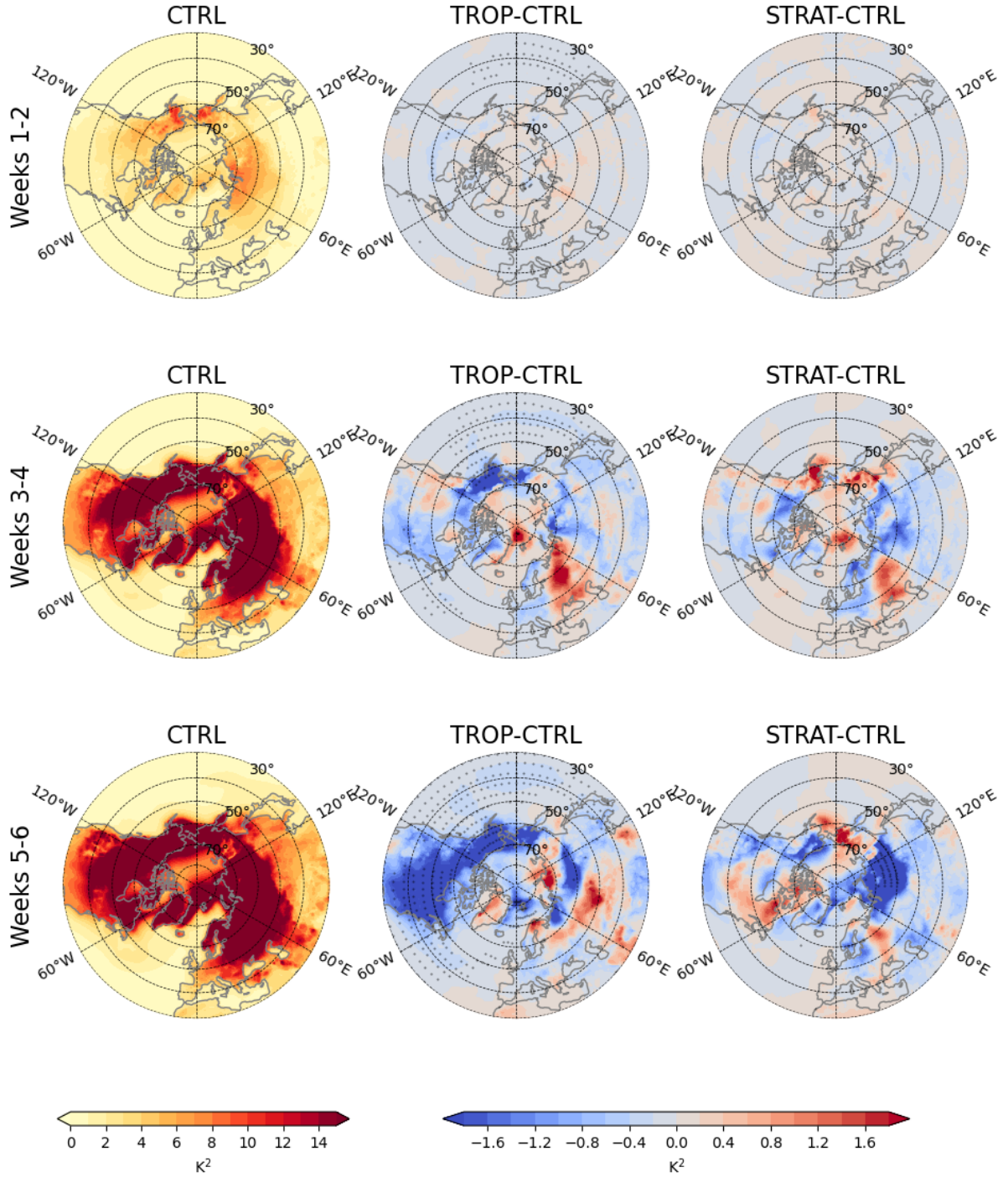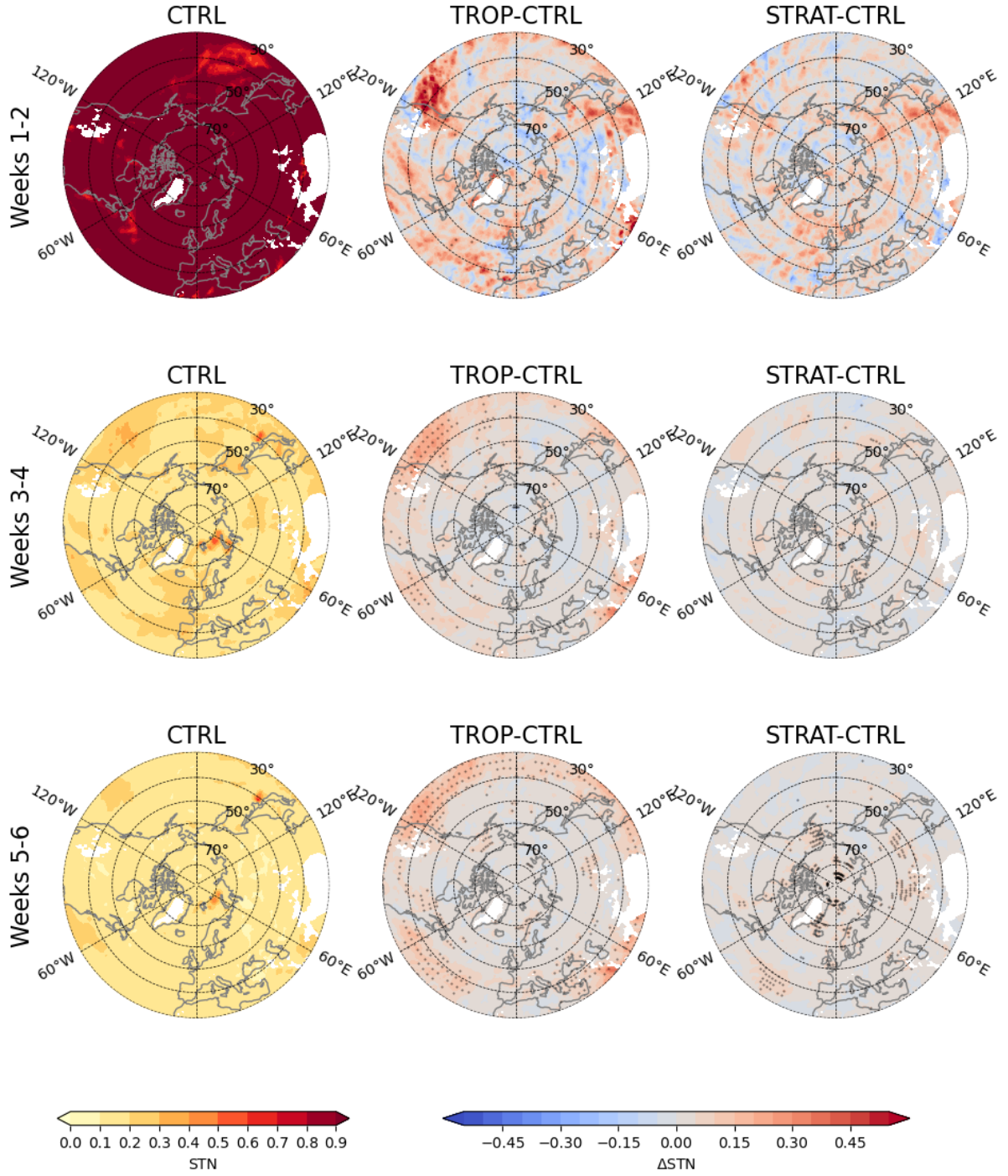
Figure S6: *Ensemble spread (σ^2_{ES}) for bi-weekly mean T2M anomalies for (left) CTRL; and the differences between σ^2_{ES} in (center) TROP and (right) STRAT experiments with respect to CTRL. Stippling in (center, right) indicates significant differences between CTRL and the respective relaxation experiments.*
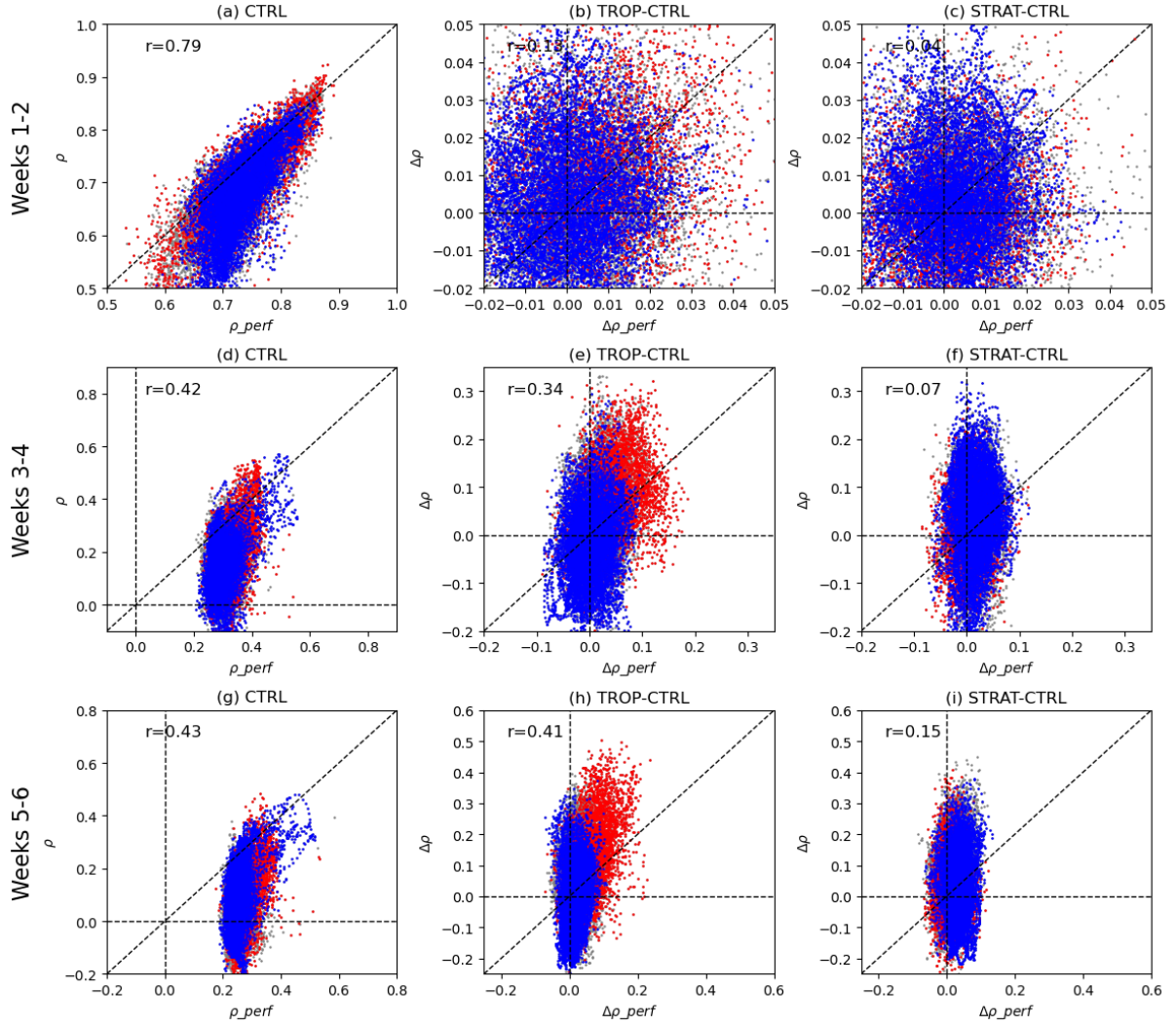
Figure S7: *Signal to noise ratio (STN) for bi-weekly mean TP anomalies for (left) CTRL; and the differences between ρ in (center) TROP and (right) STRAT experiments with respect to CTRL. Stippling in (center, right) indicates significant differences between CTRL and the respective relaxation experiments.*

Figure S8: *(a,d,g) Scatterplots between ρ and ρ_{perf}^{STN} for TP anomalies at each grid point between 30°N and 90°N in CTRL. 2nd and 3rd columns show differences for ρ and ρ_{perf}^{STN} between relaxation experiments (TROP and STRAT respectively) and CTRL. r-values show spatial correlation coefficients between ρ and ρ_{perf}^{STN} fields. Red dots mark grid points south of 40°N, blue dots mark grid points north of 60°N, and grey dots mark grid points between 40°N-60°N.*
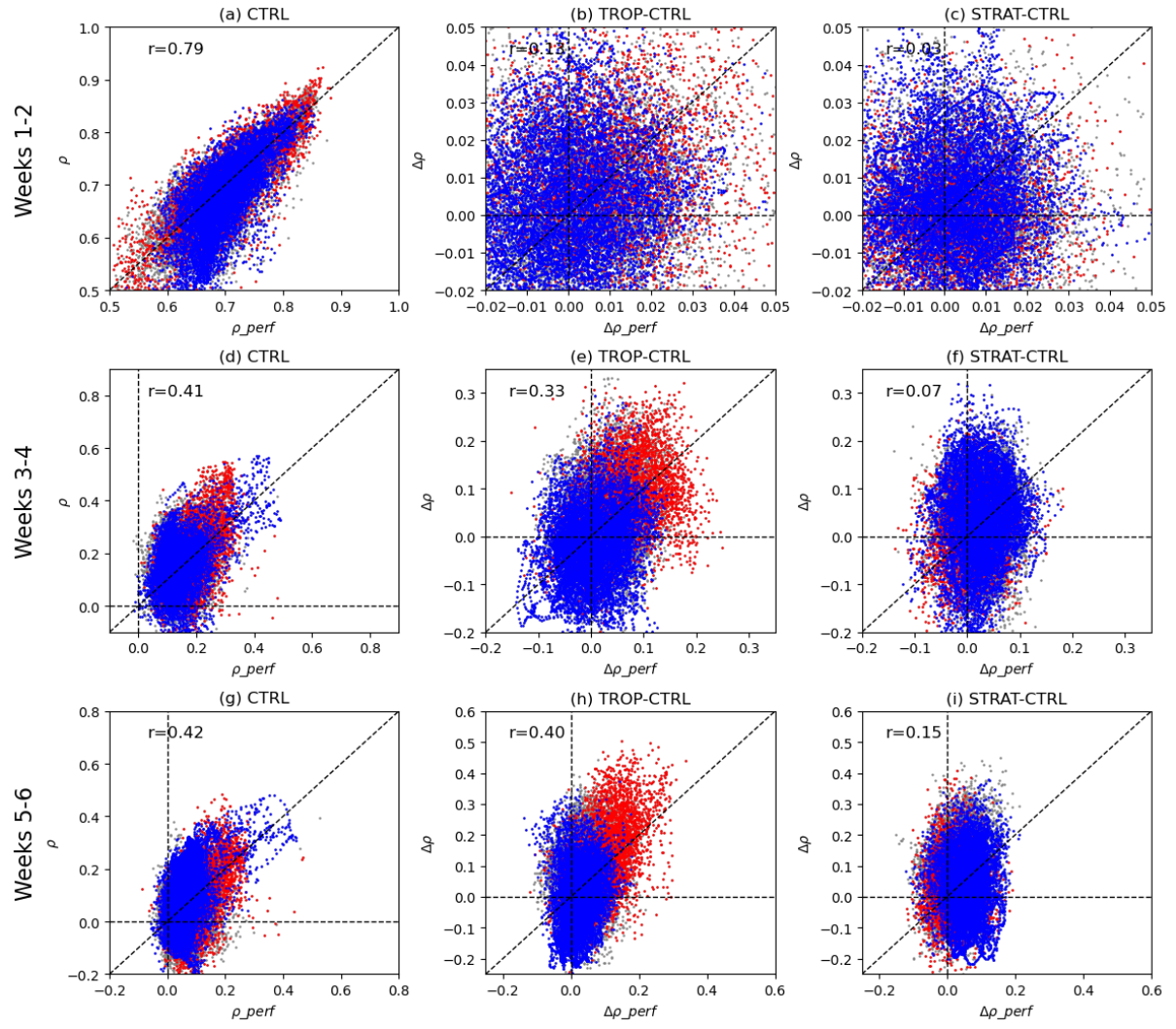
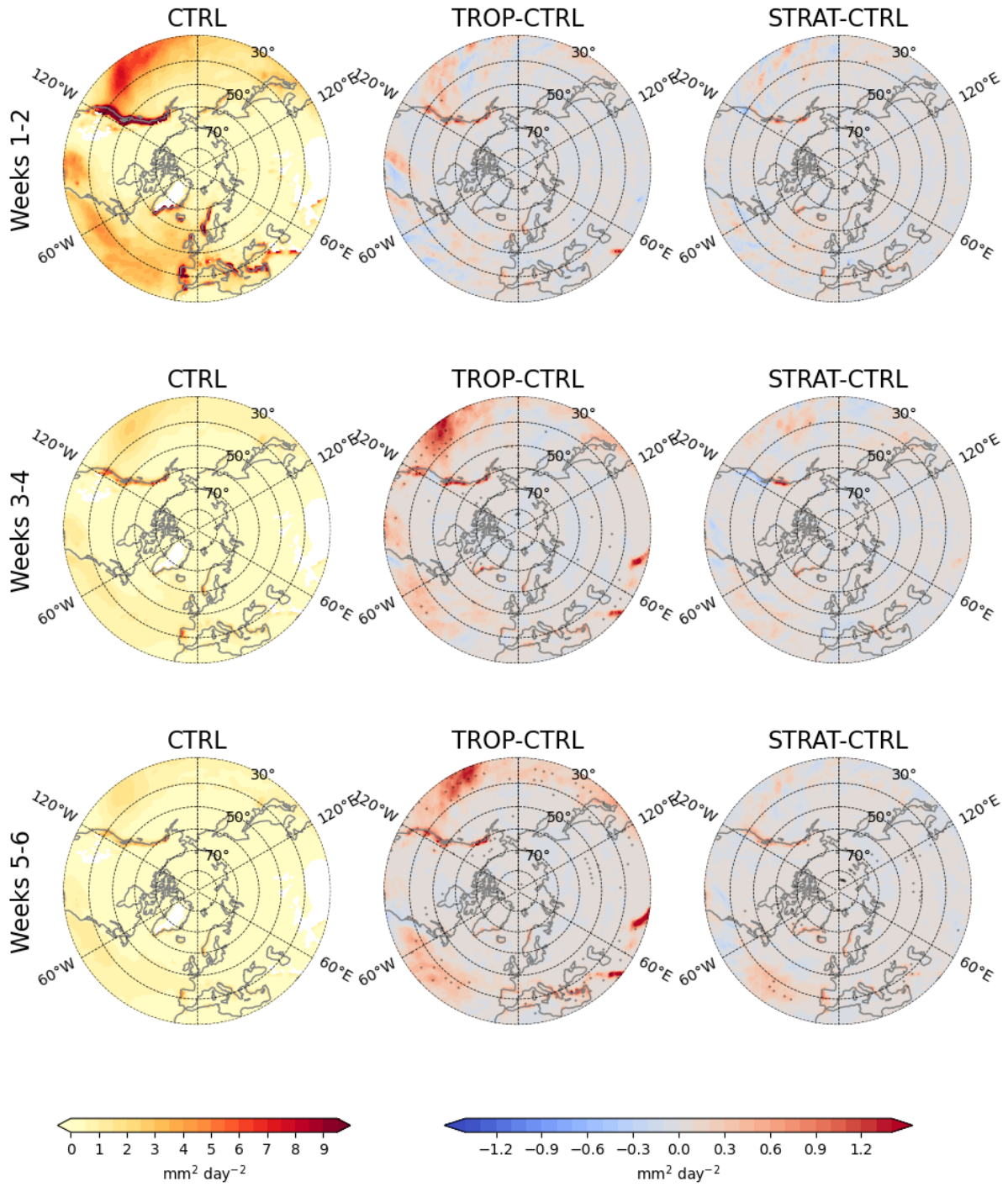**Figure S9**: *The same as Fig.S7 but for ρ_{perf}^{ACC} instead of ρ_{perf}^{STN}.*

Figure S10: *Variability of ensemble mean (σ^2_{EM}) for bi-weekly mean TP anomalies for (left) CTRL; and the differences between σ^2_{EM} in (center) TROP and (right) STRAT experiments with respect to CTRL. Stippling in (center, right) indicates significant differences between CTRL and the respective relaxation experiments.*
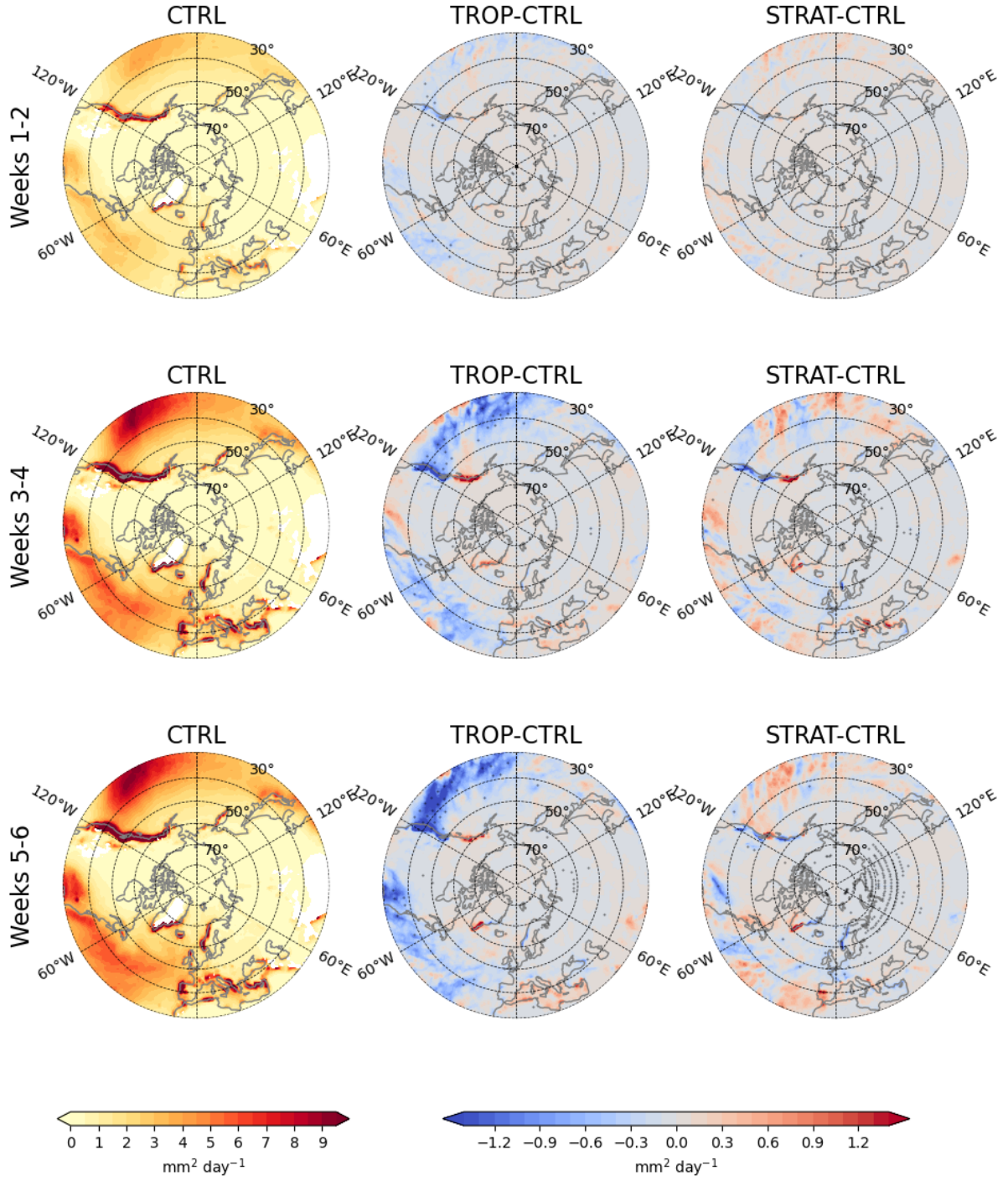
Figure S11: *Ensemble spread (σ_{ES}^2) for bi-weekly mean TP anomalies for (left) CTRL; and the differences between σ_{ES}^2 in (center) TROP and (right) STRAT experiments with respect to CTRL. Stippling in (center, right) indicates significant differences between CTRL and the respective relaxation experiments.*