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*Supplement of*

# How aerosols and greenhouse gases influence the diurnal temperature range

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**Table S1:** Multi-model median cloud cover changes, normalized by global mean temperature change [% per K].

| | CO2x2 | | BCx10 | | SO4x5 | |
|---|---|---|---|---|---|---|
| | **DJF** | **JJA** | **DJF** | **JJA** | **DJF** | **JJA** |
| **USA** | +0.15 | -0.12 | +0.44 | -3.10 | -0.26 | -1.04 |
| **EUR** | +0.10 | -0.75 | -0.85 | -6.60 | +0.45 | -1.18 |
| **IND** | -0.09 | -0.0 | -0.24 | +5.65 | -0.56 | +2.16 |
| **CHI** | +0.03 | -0.29 | +1.45 | +0.71 | -0.17 | +0.15 |
| **ARC** | +1.04 | -0.51 | +1.27 | +0.71 | +0.88 | +0.55 |

**Table S2:** Multi-model median correlations (i.e., the median of the 9 individual model correlation coefficients) between changes in DTR and a selection of variables, for the Europe (EUR) region. Correlations are based on 50 yearly (the last 50 years of the 100-year simulations) values of seasonal, regional mean changes. The table only includes coefficients for relationships that were statistically significant ($p < 0.05$ by the Student's t-test) for at least 75 % of the models. Note that we also calculated correlations to surface evaporation, but as correlation coefficients were nearly identical to that of latent heat, it is not included here.

| | | **Cloud cover** | **Latent heat** | **Sensible heat** | **Clear-sky downwelling SW radiation** | **All-sky downwelling SW radiation** | **All-sky downwelling LW radiation** |
|---|---|---|---|---|---|---|---|
| **CO2x2** | **DJF** | -0.51 | | | | +0.50 | -0.50 |
| | **JJA** | -0.77 | -0.58 | **+0.84** | | **+0.80** | |
| **BCx10** | **DJF** | -0.53 | | | +0.48 | +0.57 | -0.53 |
| | **JJA** | -0.70 | -0.57 | +0.77 | | +0.77 | |
| **SO4x5** | **DJF** | -0.38 | | | +0.55 | +0.51 | -0.61 |
| | **JJA** | -0.70 | | **+0.84** | +0.37 | **+0.83** | |

**Table S3:** Multi-model median changes in downwelling clear-sky SW radiation at the surface, normalized by global mean temperature change [W/m2 per K].

| | CO2x2 | | BCx10 | | SO4x5 | |
|---|---|---|---|---|---|---|
| | **DJF** | **JJA** | **DJF** | **JJA** | **DJF** | **JJA** |
| **LND** | -0.97 | -1.05 | -13.64 | -20.63 | +1.34 | +2.96 |
| **USA** | -1.18 | -0.93 | -10.15 | -20.60 | +1.82 | +5.40 |
| **EUR** | -0.79 | -0.74 | -10.88 | -33.71 | +1.90 | +8.34 |
| **IND** | -1.21 | -1.49 | -53.65 | -43.68 | +3.21 | +4.92 |
| **CHI** | -1.33 | -1.16 | -46.07 | -49.48 | +3.50 | +9.23 |
| **ARC** | -0.34 | -1.21 | -2.20 | -11.50 | +0.27 | +0.47 |

**Table S4:** Like Table S1, for the USA region.

| | | Cloud cover | Latent heat | Sensible heat | Clear-sky downwelling SW radiation | All-sky downwelling SW radiation | All-sky downwelling LW radiation |
|---|---|---|---|---|---|---|---|
| **CO2x2** | **DJF** | -0.64 | -0.30 | | | +0.51 | |
| | **JJA** | -0.74 | -0.76 | **+0.84** | | **+0.83** | |
| **BCx10** | **DJF** | -0.67 | -0.24 | | | +0.63 | -0.30 |
| | **JJA** | -0.74 | -0.74 | **+0.88** | | **+0.86** | |
| **SO4x5** | **DJF** | -0.56 | | | | +0.58 | |
| | **JJA** | -0.78 | -0.66 | **+0.85** | +0.40 | +0.80 | |

**Table S5:** Like Table S1, for the India region.

| | | Cloud cover | Latent heat | Sensible heat | Clear-sky downwelling SW radiation | All-sky downwelling SW radiation | All-sky downwelling LW radiation |
|---|---|---|---|---|---|---|---|
| **CO2x2** | **DJF** | -0.61 | -0.54 | +0.67 | +0.68 | **+0.82** | -0.66 |
| | **JJA** | **-0.85** | -0.70 | **+0.87** | +0.59 | **+0.85** | -0.28 |
| **BCx10** | **DJF** | -0.67 | -0.66 | +0.64 | +0.56 | +0.70 | -0.67 |
| | **JJA** | **-0.84** | -0.65 | **+0.84** | +0.71 | **+0.90** | -0.30 |
| **SO4x5** | **DJF** | -0.67 | -0.64 | +0.75 | +0.64 | **+0.81** | -0.58 |
| | **JJA** | **-0.83** | -0.78 | **+0.87** | +0.76 | **+0.89** | -0.63 |

**Table S6:** Like Table S1, for the China region.

| | | Cloud cover | Latent heat | Sensible heat | Clear-sky downwelling SW radiation | All-sky downwelling SW radiation | All-sky downwelling LW radiation |
|---|---|---|---|---|---|---|---|
| **CO2x2** | **DJF** | -0.78 | | +0.43 | +0.53 | **+0.87** | -0.39 |
| | **JJA** | -0.75 | | +0.77 | | **+0.85** | |
| **BCx10** | **DJF** | -0.73 | | +0.31 | +0.32 | +0.75 | |
| | **JJA** | -0.78 | | +0.70 | | **+0.86** | |
| **SO4x5** | **DJF** | -0.67 | | | | +0.79 | |
| | **JJA** | -0.75 | | +0.77 | +0.64 | **+0.81** | -0.41 |

**Table S7:** Like Table S1, for the Arctic region.

| | | Cloud cover | Latent heat | Sensible heat | Clear-sky downwelling SW radiation | All-sky downwelling SW radiation | All-sky downwelling LW radiation |
|---|---|---|---|---|---|---|---|
| **CO2x2** | **DJF** | | | -0.39 | | | |
| | **JJA** | -0.73 | +0.52 | +0.60 | | +0.77 | |
| **BCx10** | **DJF** | | | -0.38 | | | |
| | **JJA** | -0.76 | | +0.59 | | +0.72 | |
| **SO4x5** | **DJF** | | | | | | |
| | **JJA** | -0.77 | | +0.58 | | +0.70 | |

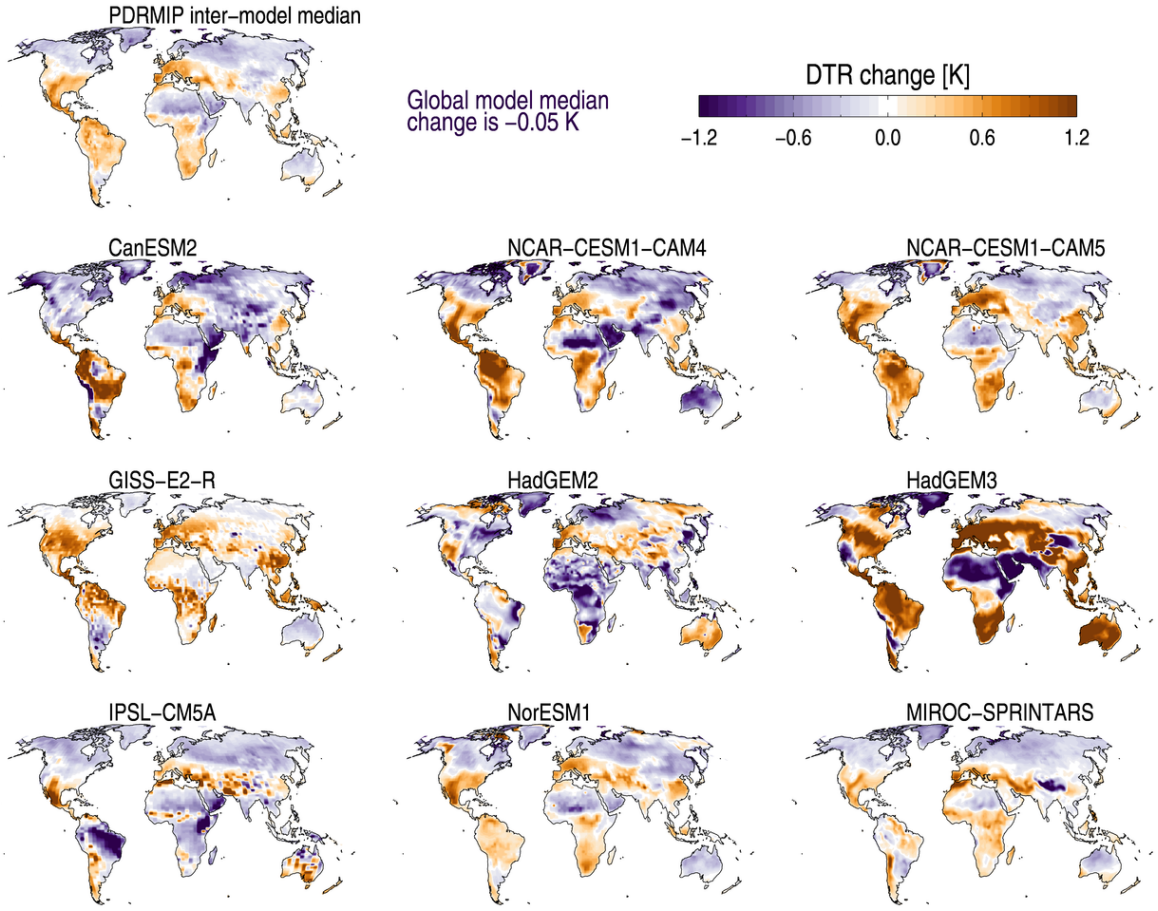


**Figure S1:** Annual mean DTR change (not normalized by global mean temperature change as in the main manuscript) for the CO2x2 experiment for all nine models.

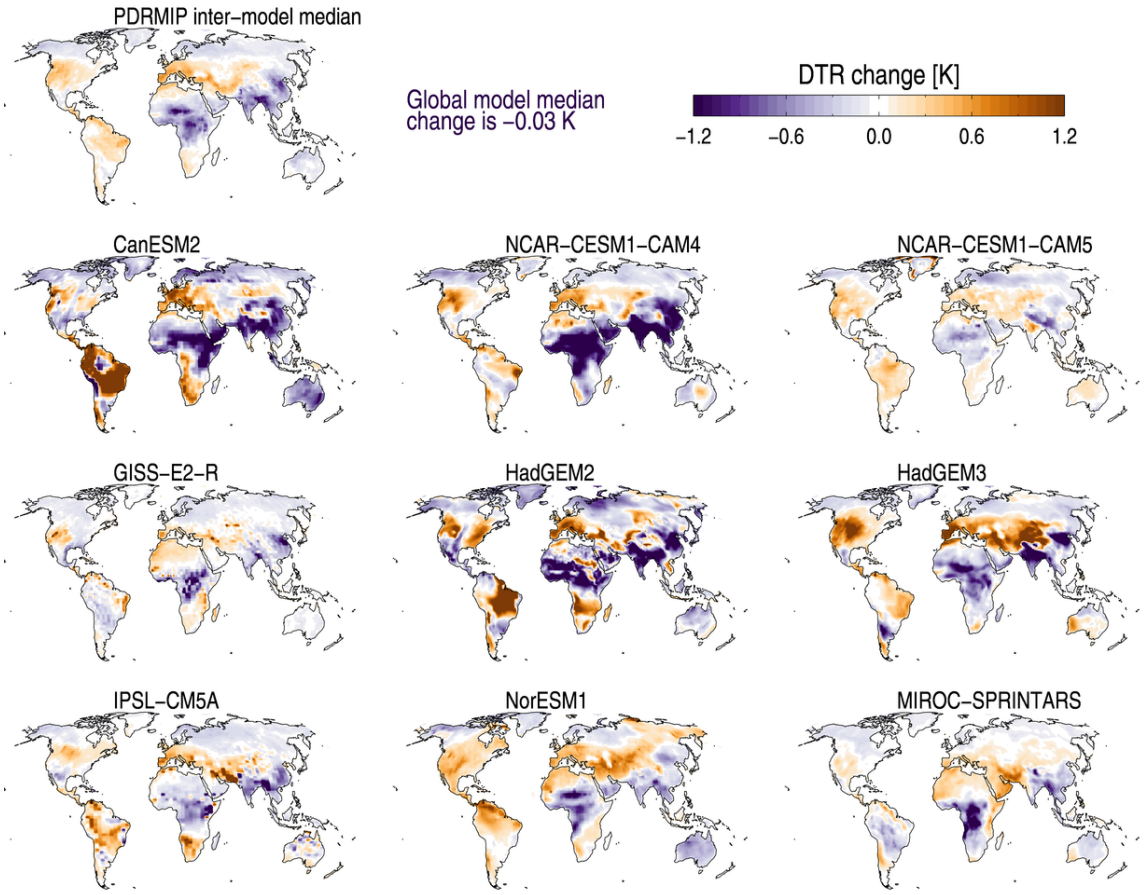


**Figure S2:** Annual mean DTR change (not normalized by the global mean temperature change as in the main manuscript) for the BCx10 experiment for all nine models.

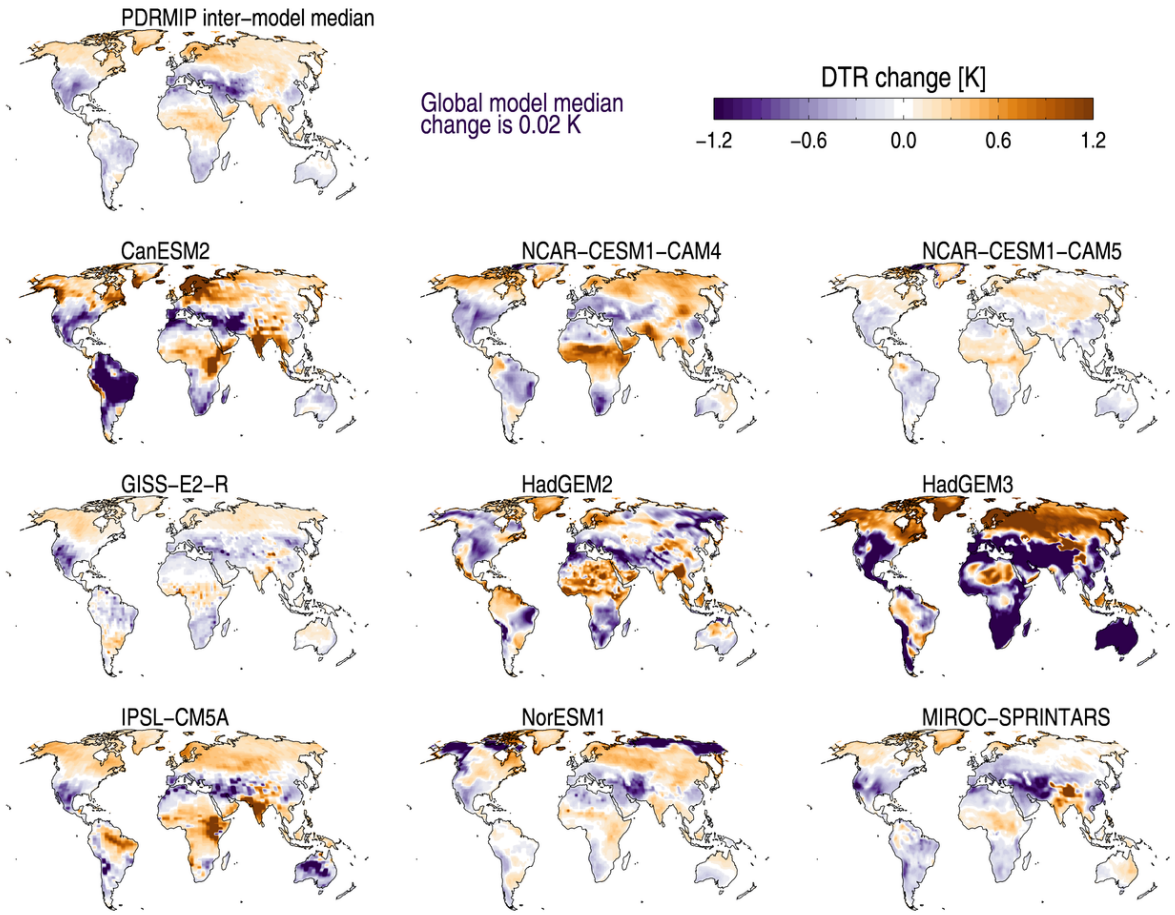


**Figure S3:** Annual mean DTR change (not normalized by the global mean temperature change as in the main manuscript) for the SO4x5 experiment for all nine models. Note that as $SO_4$ cools the climate, normalization by the global mean temperature change turns the sign of the DTR change expected from an increase in $SO_4$. An increase in $SO_4$ causes, e.g., reduced DTR over China and increased DTR over India, as seen in the maps above, but opposite to the signals seen in the maps of the main manuscript.

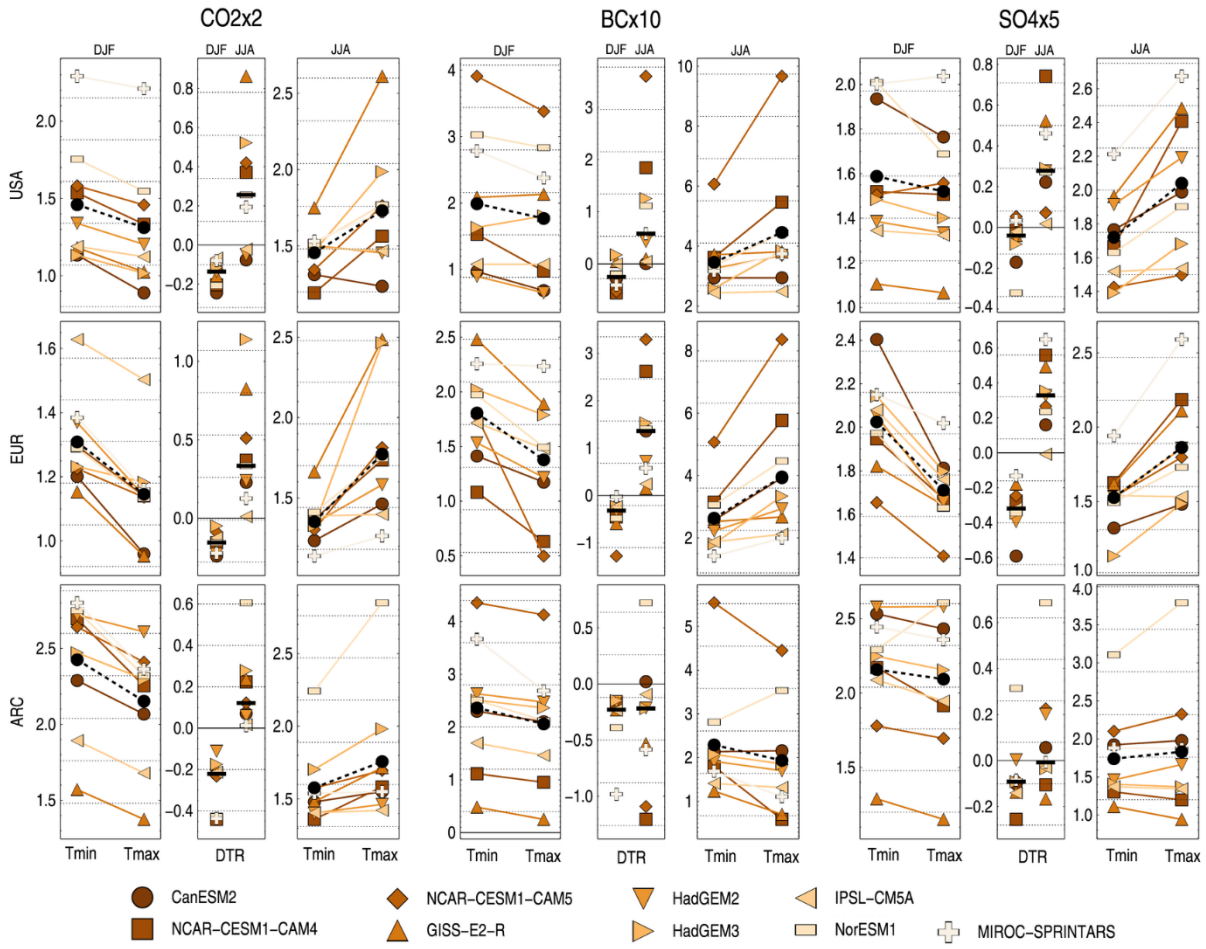


**Figure S4:** Regional changes in DTR, Tmin and Tmax for the three drivers (columns) in the three mid- and high-latitude northern hemisphere regions USA, EUR and ARC (rows). For each driver and region subpanels show, respectively, wintertime changes in Tmin and Tmax, wintertime and summertime changes in DTR, and summertime changes in Tmin and Tmax. The black horizontal bars and circles show the multi-model median changes.