

CAM simulations for CCSP

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Goal of the study

Knowing that it might be possible to have reduction on the order of 30% for specific sectors responsible for anthropogenic emissions of aerosols and ozone precursors, why would be the impact (on chemistry and climate) of such changes?

Only GISS and NCAR are involved in this study

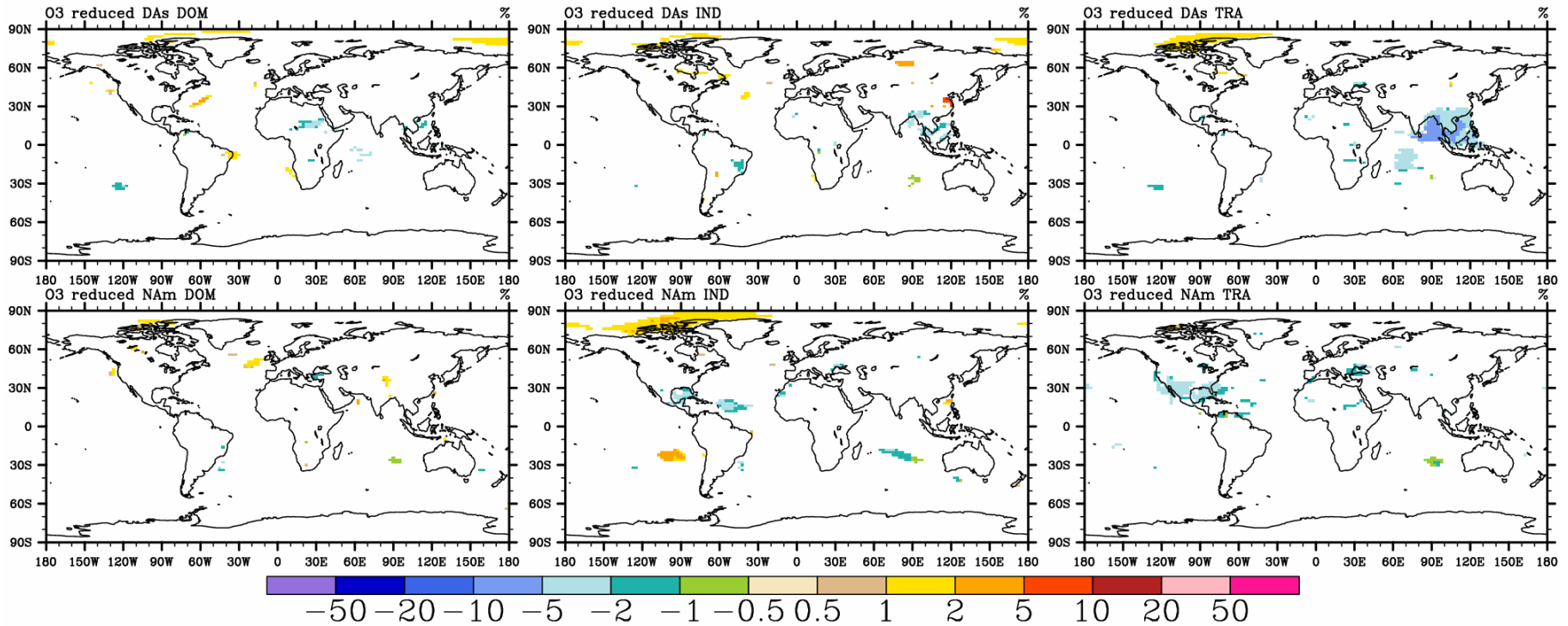
Setup

- CAM3, 2x2.5, 26 levels to 4 hPa
- Climatological SSTs
- Emissions from AR4; perturb by 30% one sector at a time over NA and SE Asia
- Full chemistry, including aerosols
- Stratosphere is overwritten
- Methane is fixed as a lower boundary condition
- 10-yr simulation, dropping first 2 as spin-up
- No indirect effects

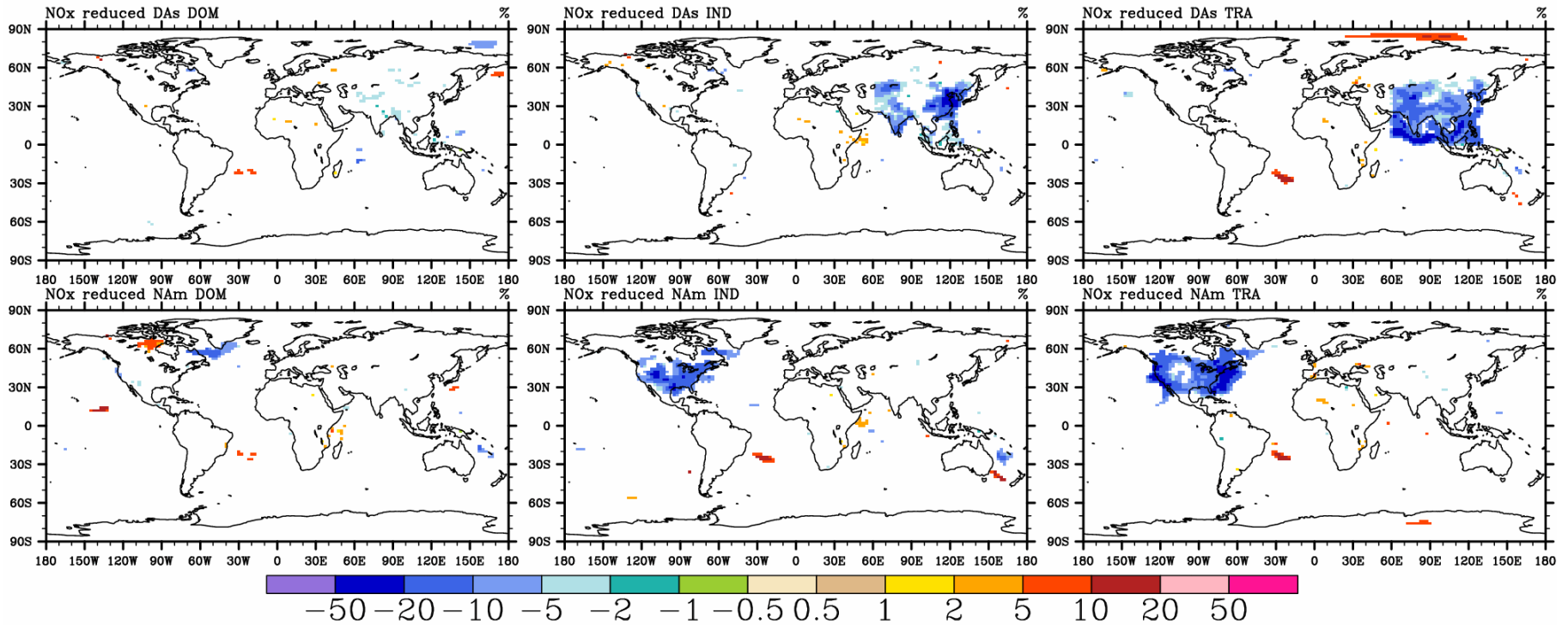
Analysis

- Look at annual/seasonal averages (use statistical significance for differences larger in absolute values to $1.5 * \text{standard deviation}$)
- Focus on chemical species, and a few climate parameters

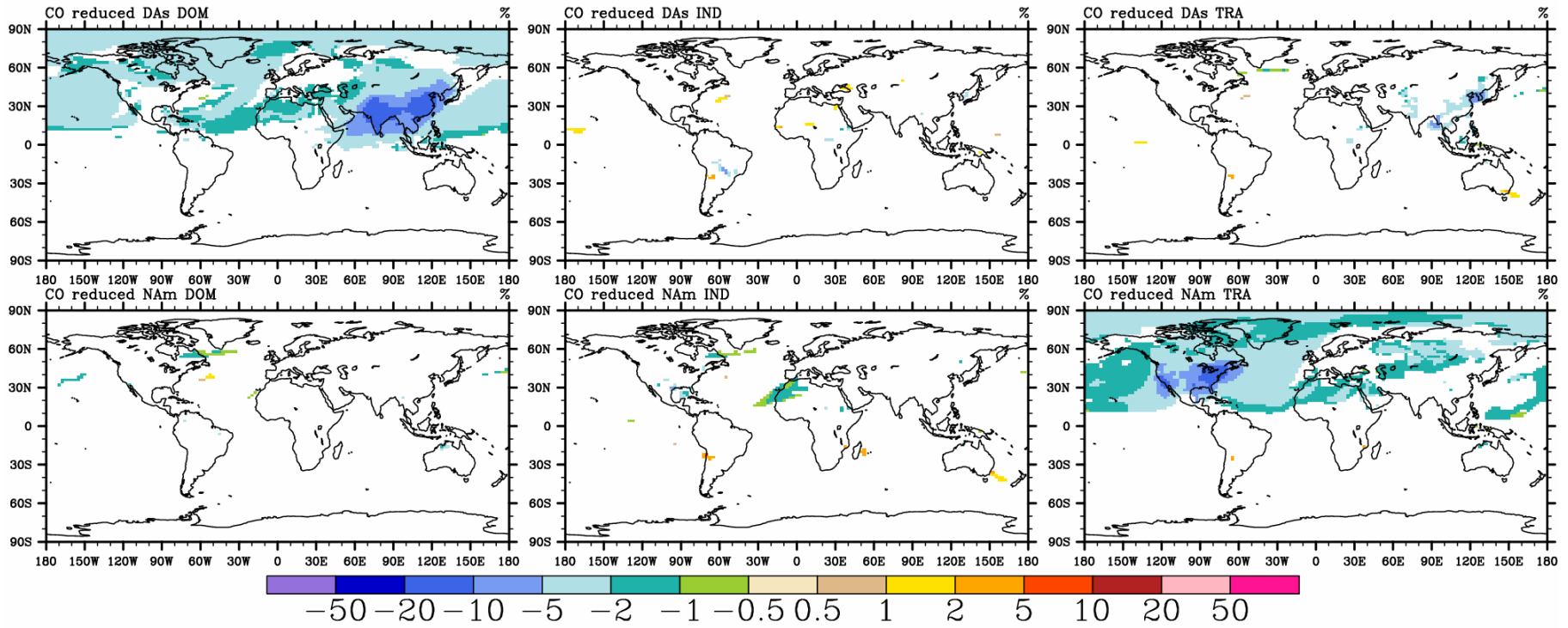
Surface ozone



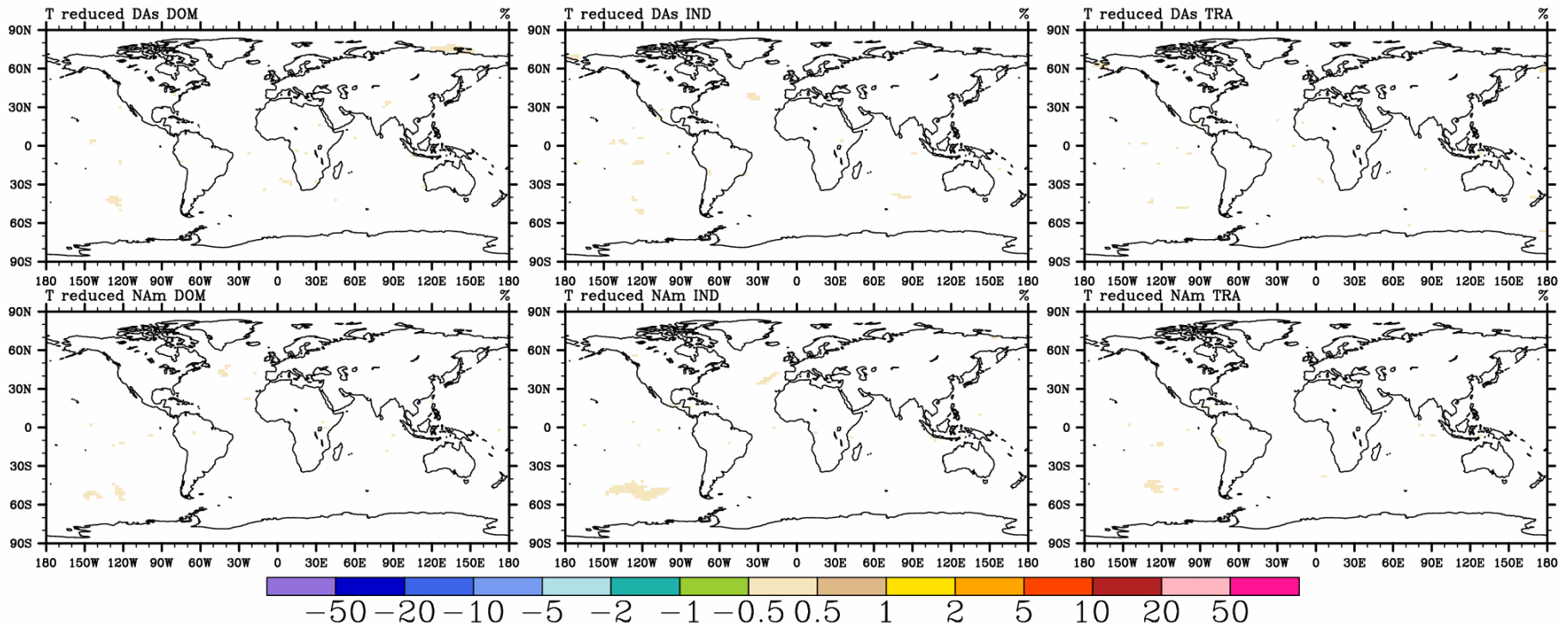
Surface NOx



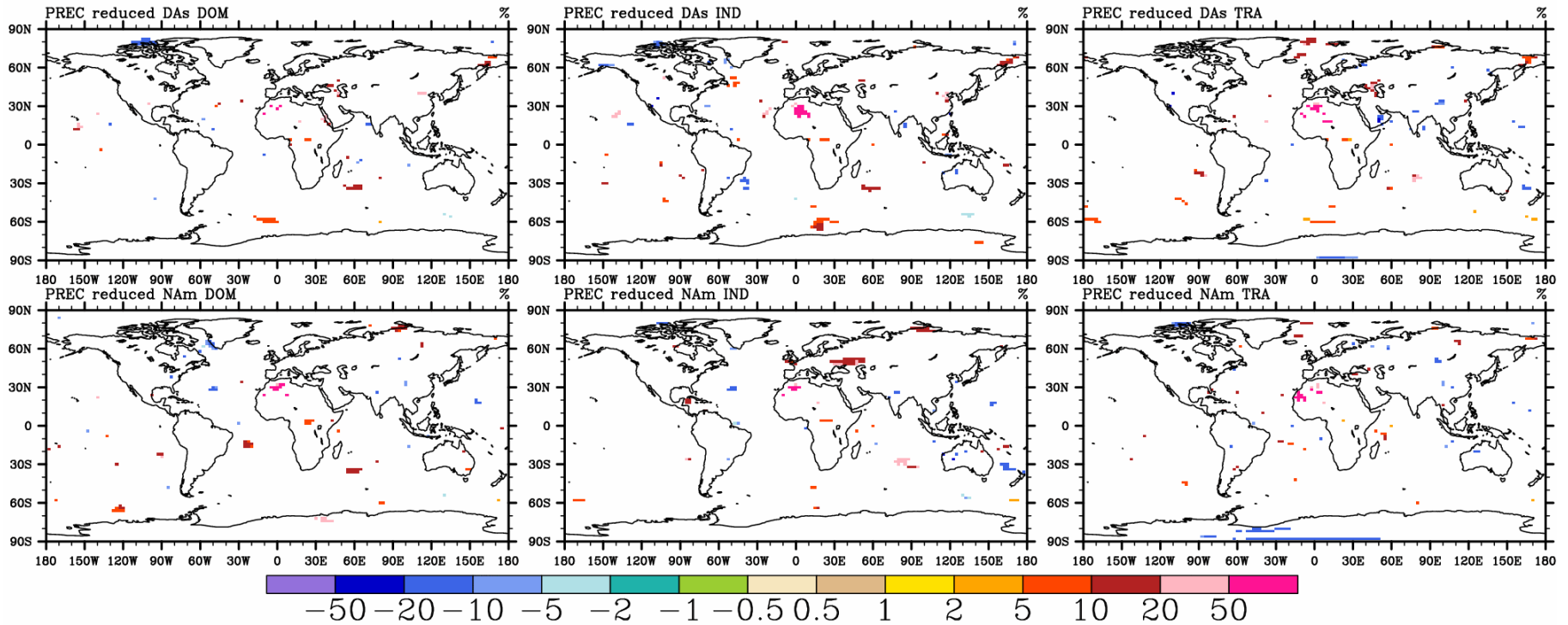
Surface CO



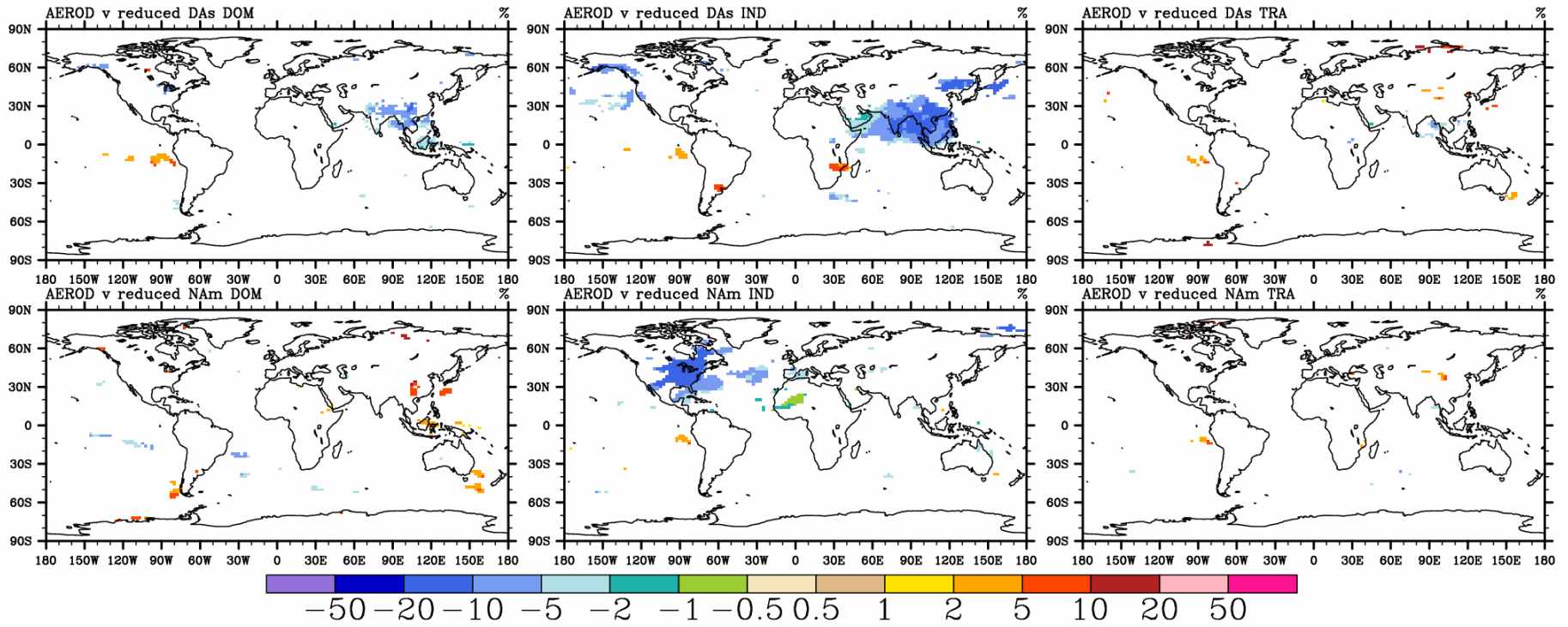
Surface temperature



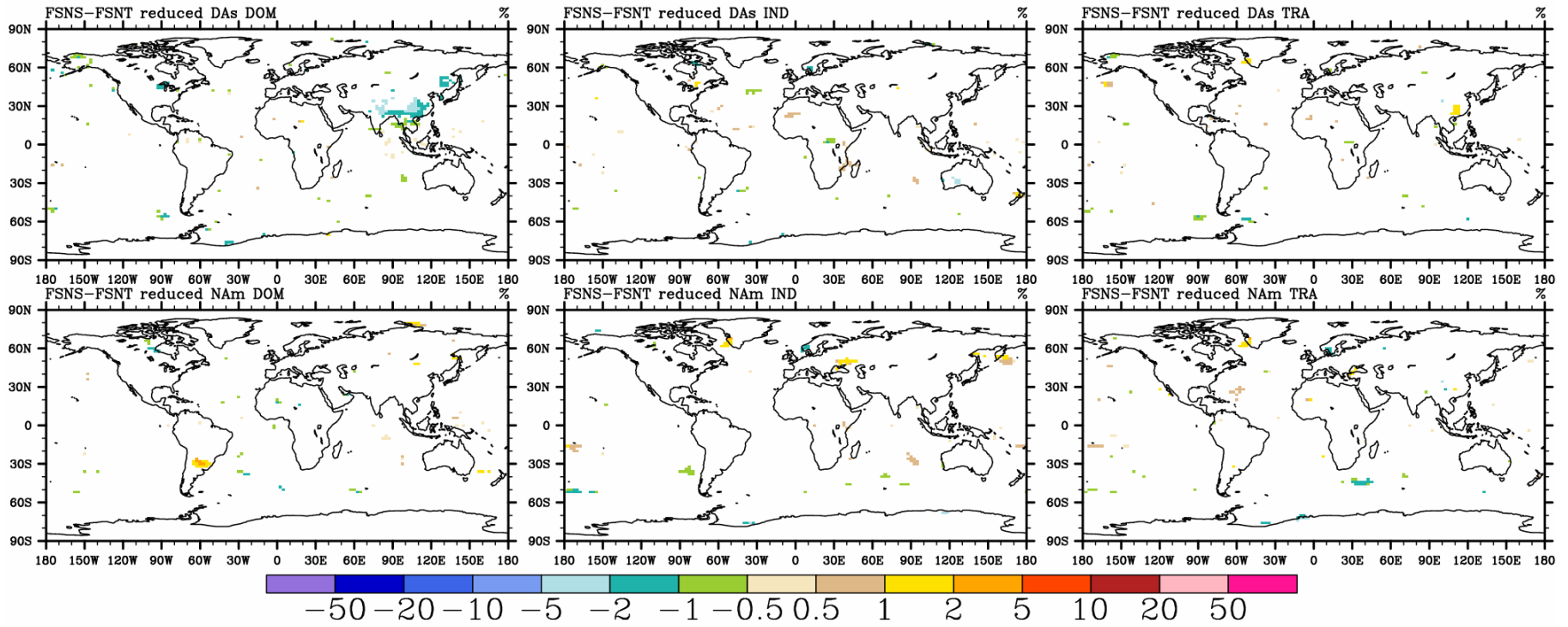
Precipitations



AOD



FSNS-FSNT



Conclusions

- Significant changes on CO, OH, NO_x, AEROD
- No significant change on ozone (surface or 500 hPa)
- No significant change on climate variables

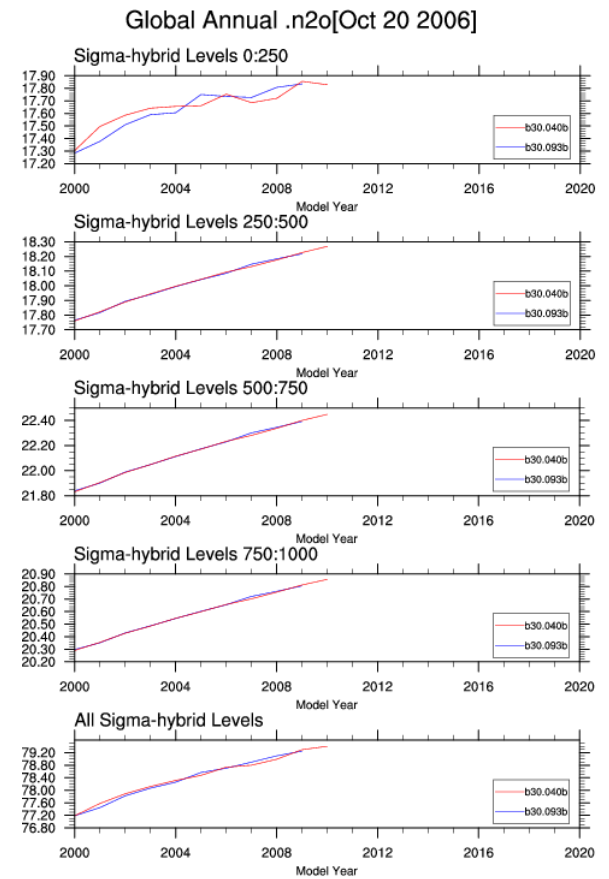
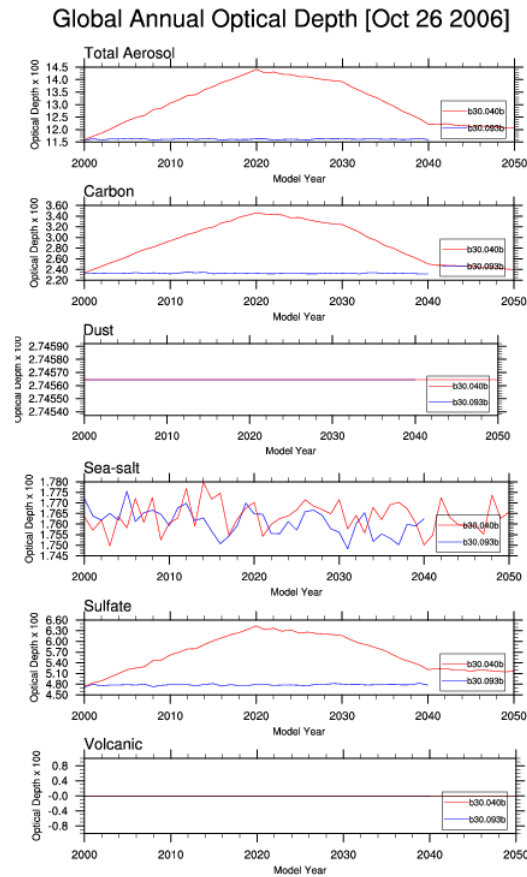
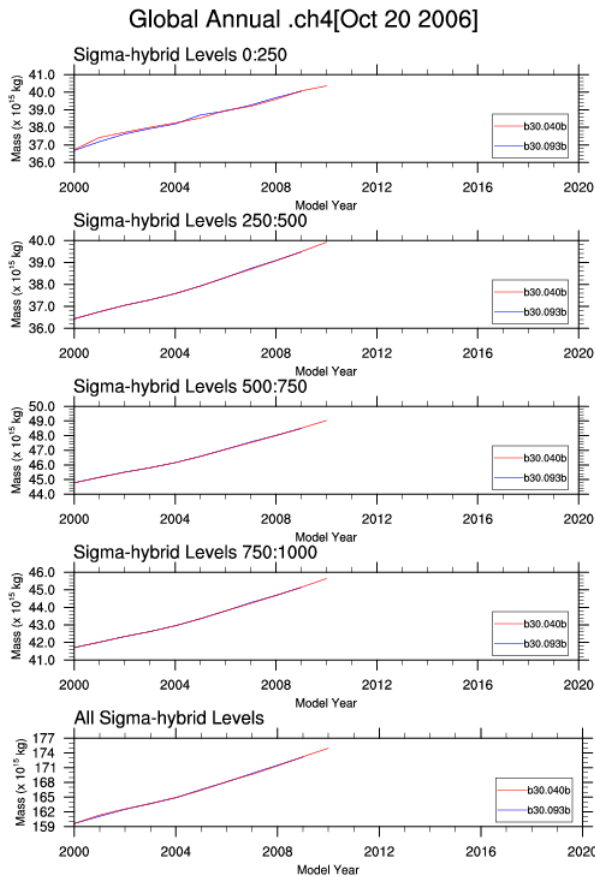
SIM1 simulations

With the help from Lawrence Buja and Hayian Teng

Setup

- CCSM, T85x1
- Start from 2000 (simulation A1b), 3 members (from different IC); one simulation done at this point (ORNL)
- Keeps the ozone and aerosols distributions at their 2000 levels
- Can be compared with a set of simulations (3 members) where these were evolving following A1B

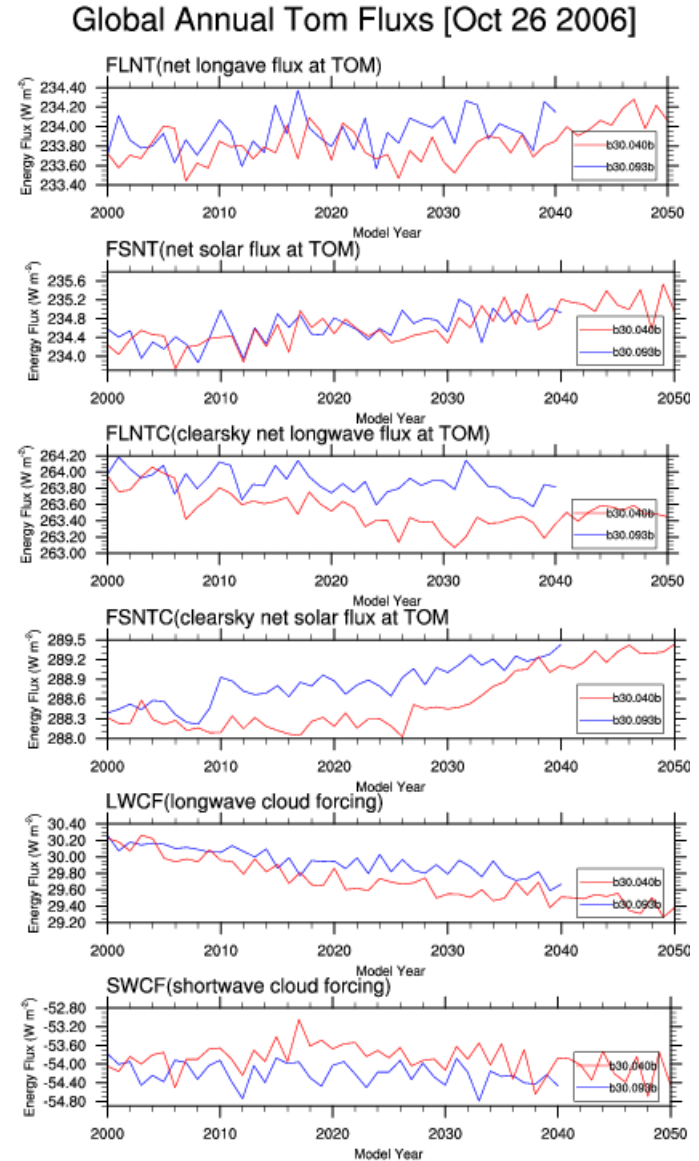
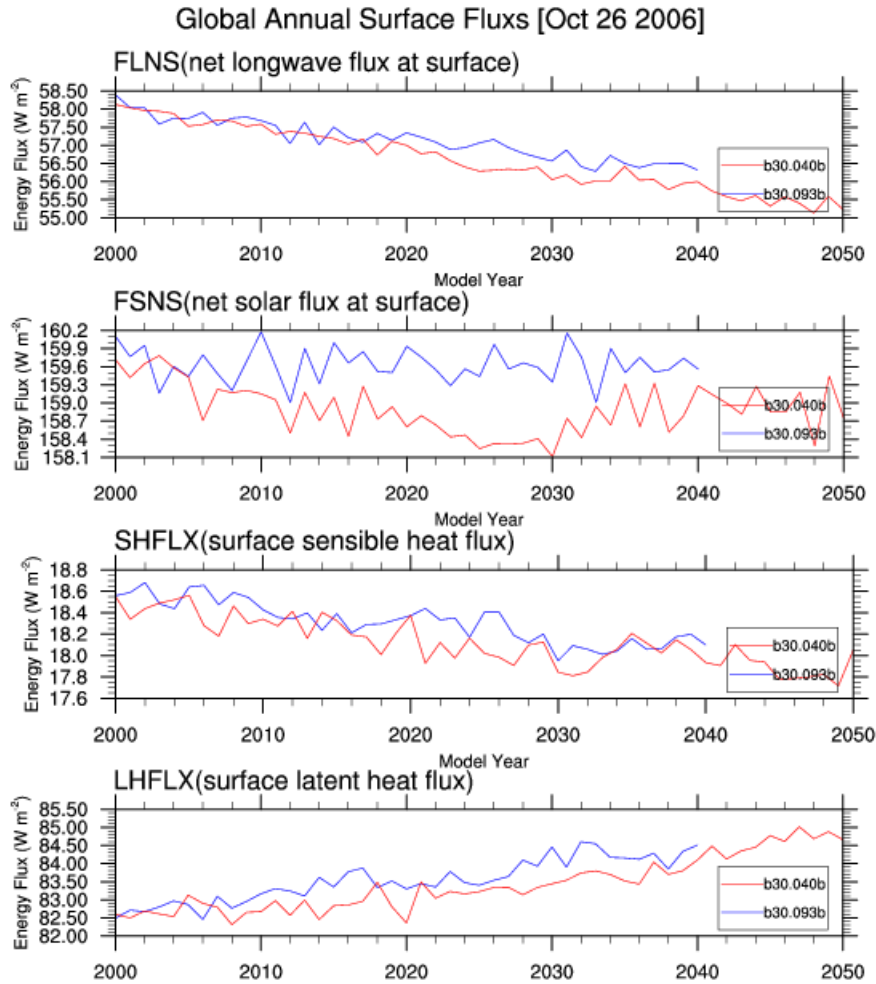
Timeseries (forcings)



All forcings time-varying

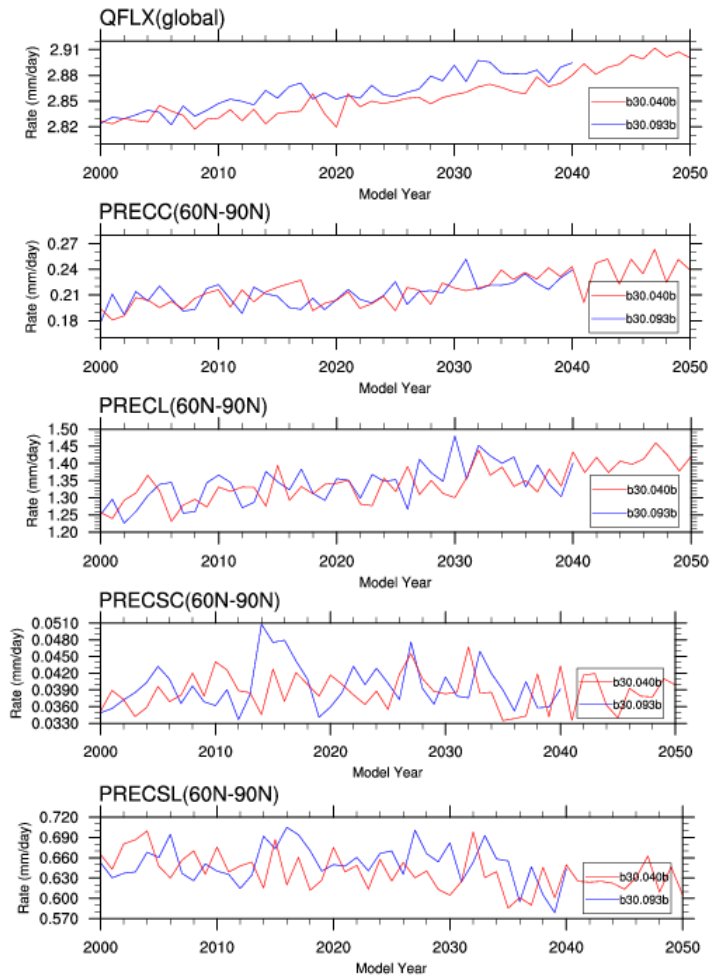
Short-lived constant

Timeseries (radiation)

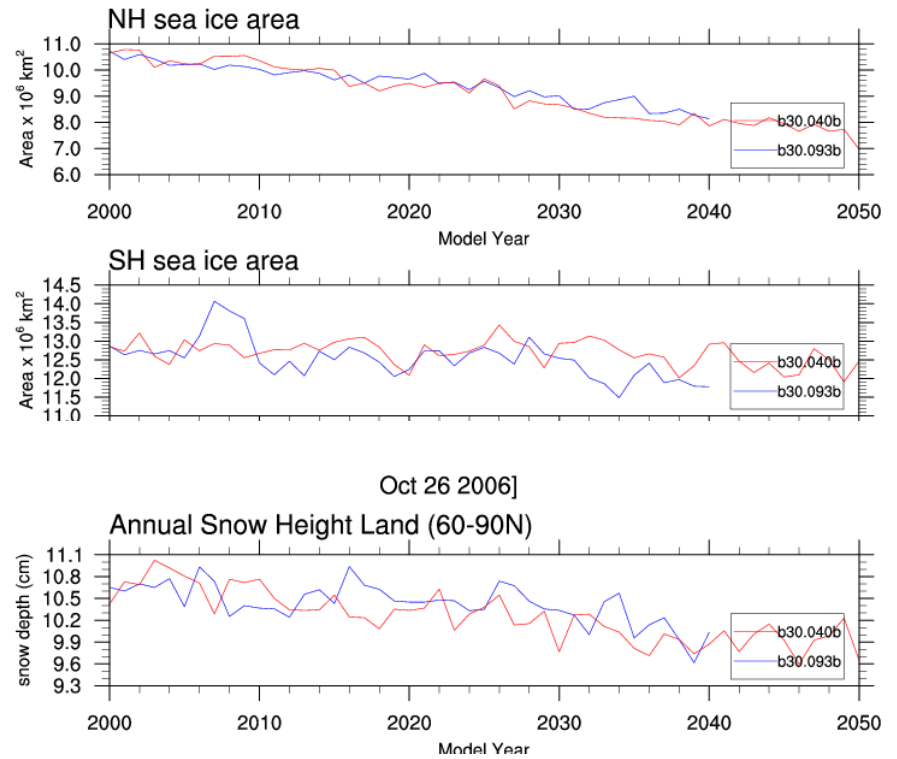


Timeseries (hydrological cycle)

Annual Hydrologic Cycle [Oct 26 2006]

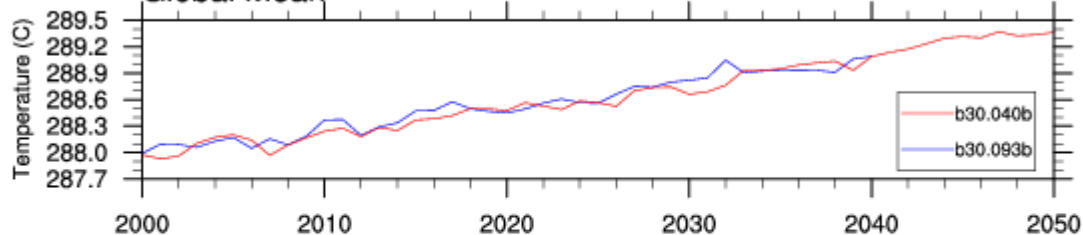


Global Annual Surface sea ice area [Oct 26 2006]

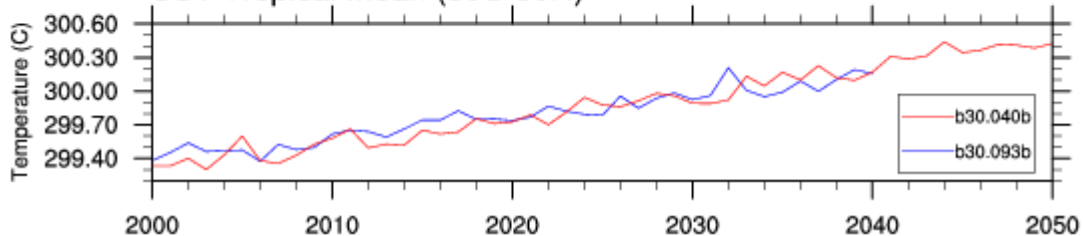


Global Annual Surface Temperature [Oct 26 2006]

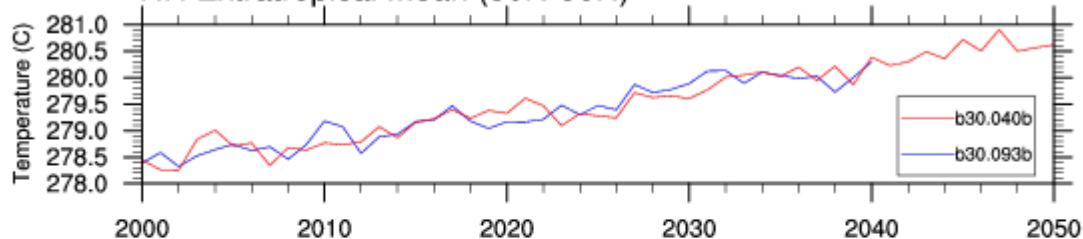
Global Mean



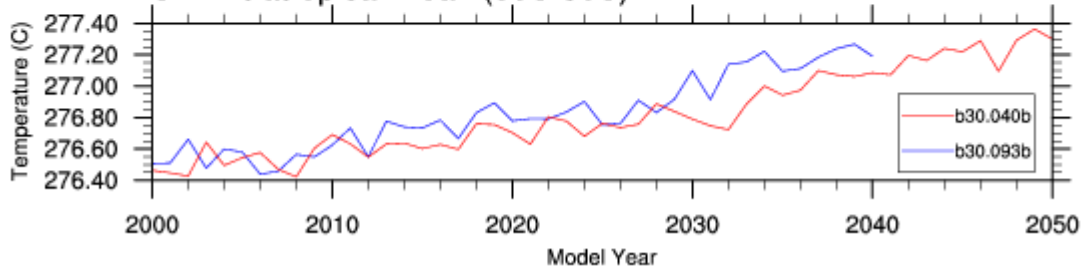
SST Tropical Mean (30S-30N)



NH Extratropical Mean (30N-90N)



SH Extratropical Mean (30S-90S)



Conclusions

- Removing aerosols and ozone trends (but mostly aerosols) leads to significant (regional and global) changes to radiative and hydrological fluxes, consistent with previous studies
- Impact on surface temperature and precipitation less clear; maybe a sign of change in outflow pattern

Conclusions

- Change in the zonally-averaged distribution of temperature and specific humidity
- Largest changes are found in the 2020-2030 decade
- Beyond that, changes in short-lived forcings are smaller (compared to 2000)