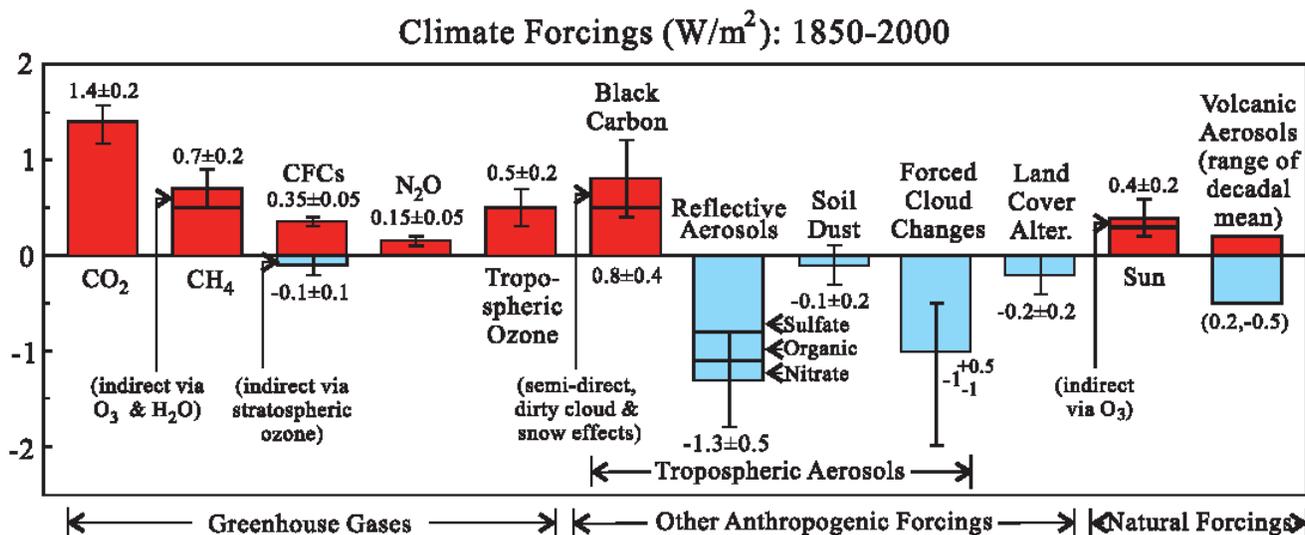


US EPA ARCHIVE DOCUMENT



**Figure 1.** Radiative forcings since 1850 due to changes in GHGs, aerosols (including indirect effects; e.g., “forced cloud changes”), land use, solar activity, and volcanoes. From Hansen, J.E.; Sato, M. Trends of Measured Climate Forcing Agents; *Proc. Nat. Ac. Sci.* 2001, 98, 14,478-14,483.

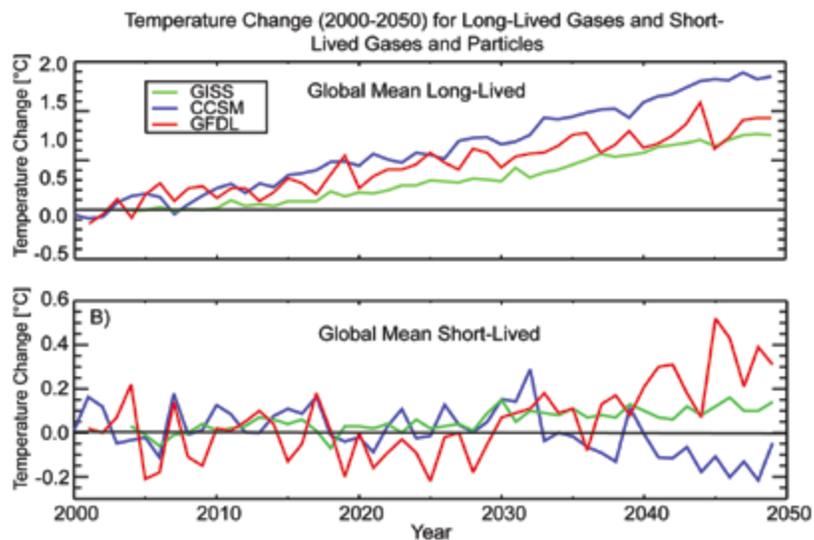
Note – this figure is a little simpler and may be better for the webcast. I also like the uncertainty bars...

The AR4 plot (next slide) is nice as well, but a little busier? Generally, it looks like the forcing levels are similar.

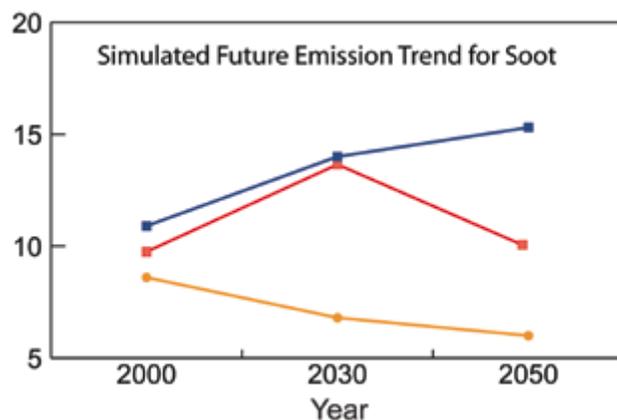
# RADIATIVE EFFECT OF AEROSOL PARTICLES



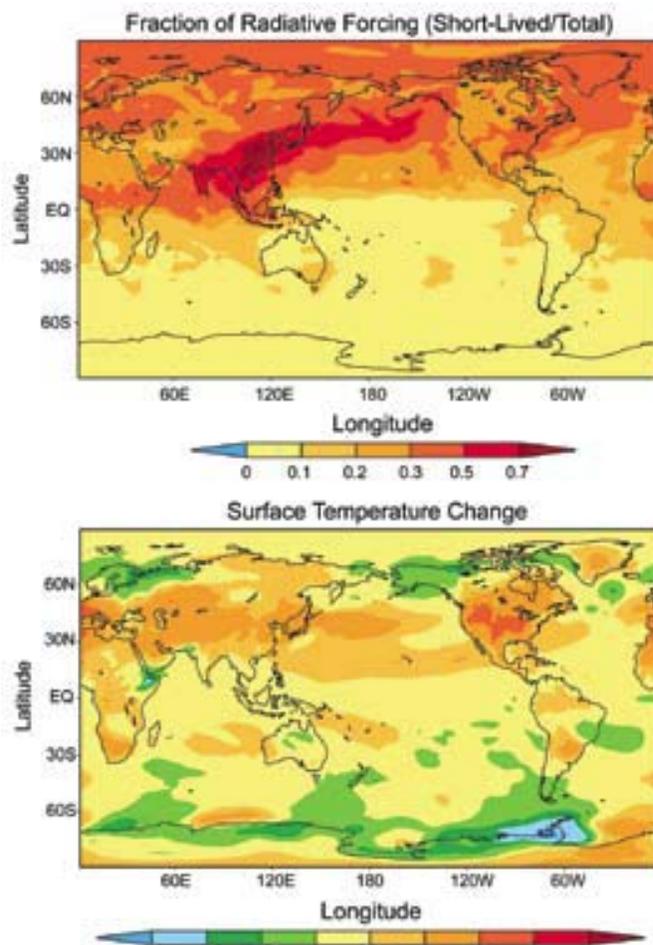
Note: Figure from Rudy Husar.



**Figure 3.5** Global mean annual average temperature change (°C) in the simulations with time-varying long-lived (top) and short-lived (bottom) gases and aerosols. Results are three-member ensemble means for GFDL and GISS and single-member simulations for CCSM. Results for the short-lived gases and aerosols are obtained by subtraction of the (long-lived) calculations from the (short + long-lived) calculations. From Shindell, D.T., H. Levy II, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, 2008: Climate Change From Short-Lived Emissions Due to Human Activities in Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols. H. Levy II, D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, (eds.). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C.



**Figure ES.3** The three plausible but very different emissions trends projected for black carbon particles (soot). Each of the three groups in this study used a different trend. The units are million metric tons of carbon per year. From Levy II, H., D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, 2008: Executive Summary in *Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols*. H. Levy II, D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, (eds.). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C.



**Figure ES.2** The fraction of summertime (June-August) radiative forcing\* due to changing levels of short-lived gases and particles and the resulting summertime surface temperature change (degrees Centigrade) for year 2100. From Levy II, H., D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, 2008: Executive Summary in Climate Projections Based on Emissions Scenarios for Long-Lived and Short-Lived Radiatively Active Gases and Aerosols. H. Levy II, D.T. Shindell, A. Gilliland, M.D. Schwarzkopf, L.W. Horowitz, (eds.). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, D.C.