

Planned Climate Change Sensitivity Simulations with the RCP 4.5 Scenario

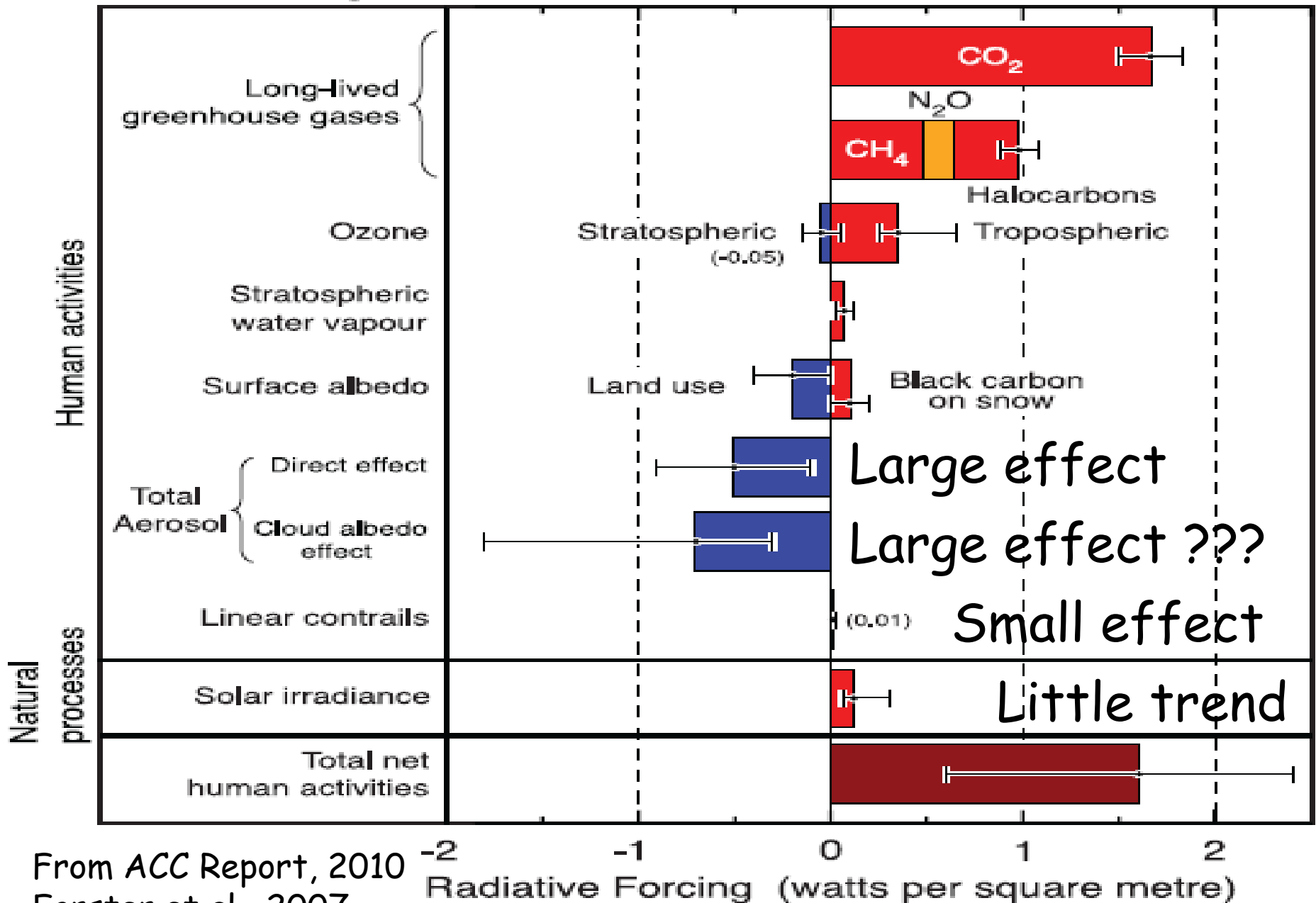
Warren M. Washington
National Center for Atmospheric Research

June 2010
Climate Change Working Group

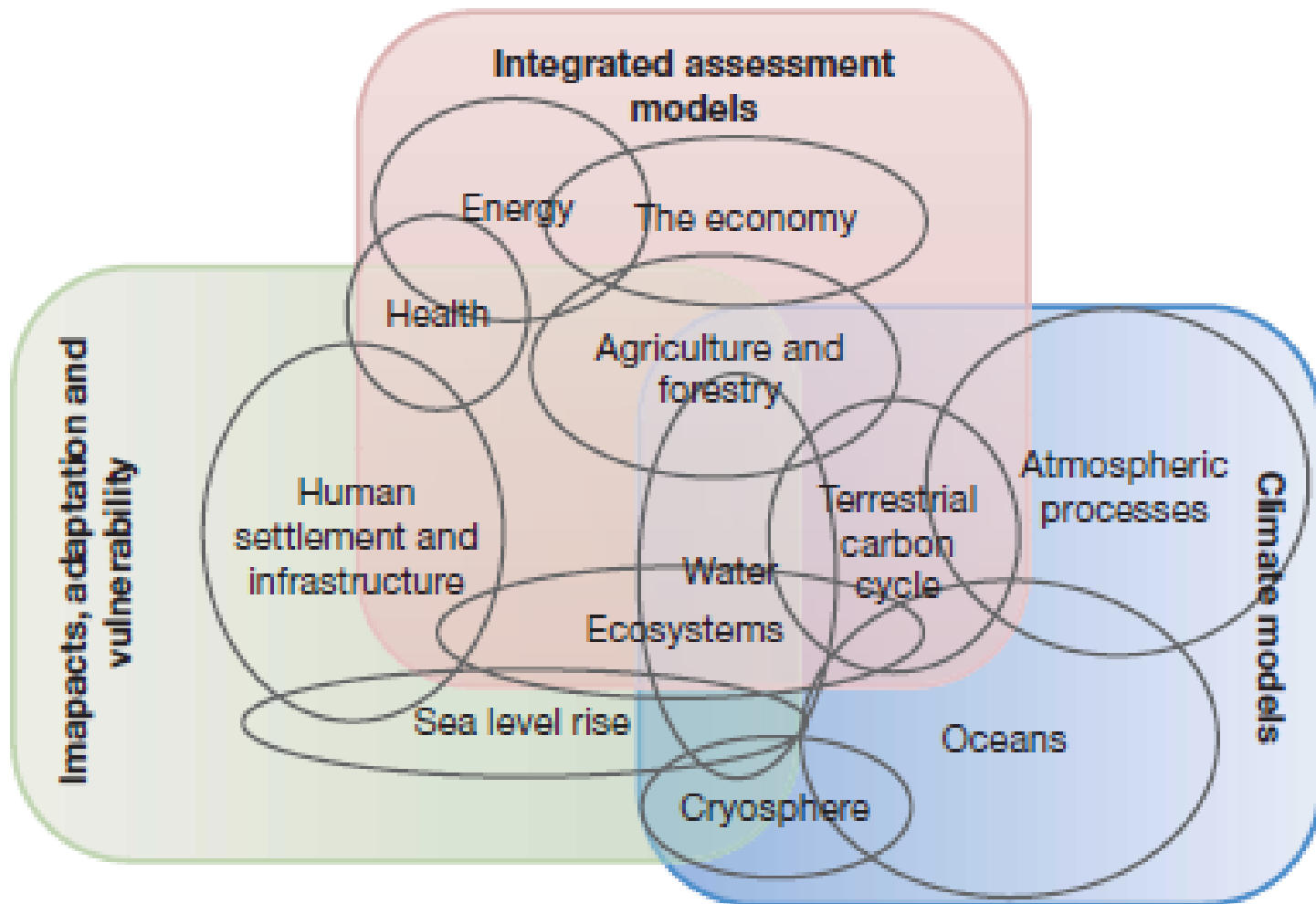


Radiative forcing of climate between 1750 and 2005

Radiative Forcing Terms



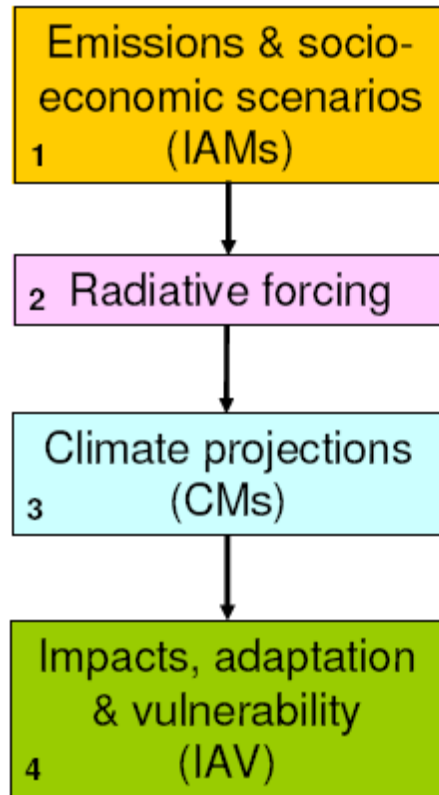
From ACC Report, 2010
Forster et al, 2007



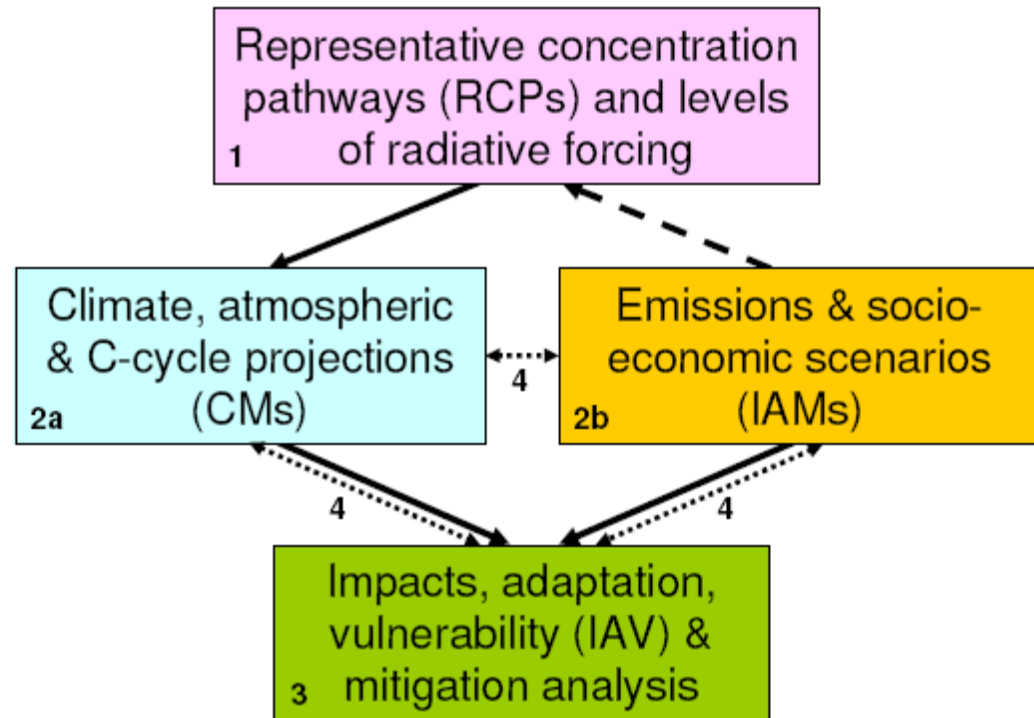
Moss et al. 2010

New scenarios development process - parallel vs. sequential approach

(a) Sequential approach



(b) Parallel approach

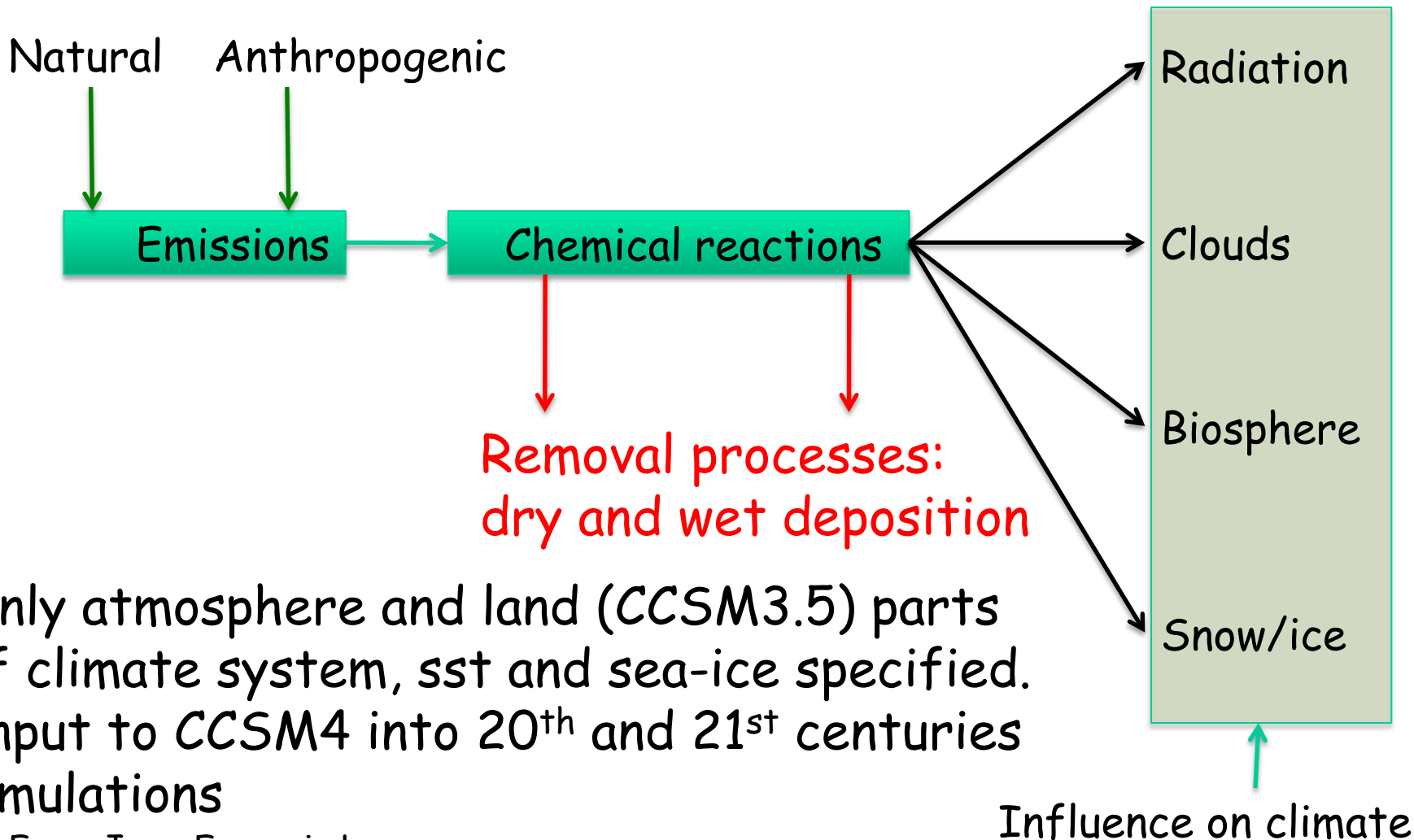


Representative Concentration Pathways (RCPs) *Forcing Agents*

GHG Emissions and Concentrations from IAMs

- Greenhouse gases: CO_2 , CH_4 , N_2O , CFCs, HFC's, PFC's, SF_6
- Emissions of chemically active gases: CO , NO_x , NH_3 , VOCs
- Derived GHG's: tropospheric O_3
- Emissions of aerosols: SO_2 , Black Carbon (BC), Organic Carbon (OC)
- Land use and land cover

Chemistry in an atmospheric model: Computes concentrations of GHGs and aerosols from emissions



Only atmosphere and land (CCSM3.5) parts of climate system, sst and sea-ice specified. Input to CCSM4 into 20th and 21st centuries simulations

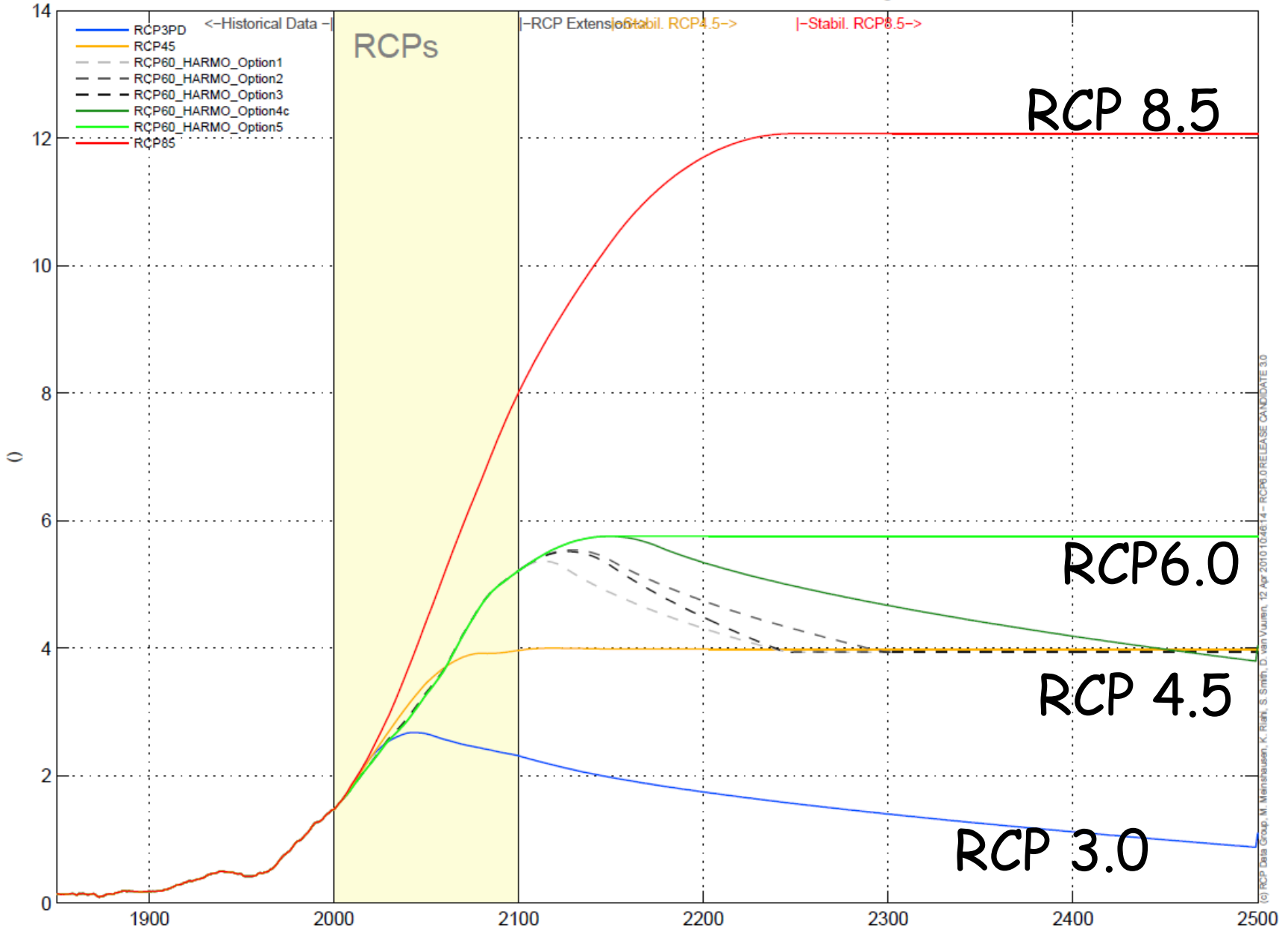
Which RCP will the world take?

or



Antro Radiative Forcing

Global TOTAL ANTHRO EFF Radiative Forcing

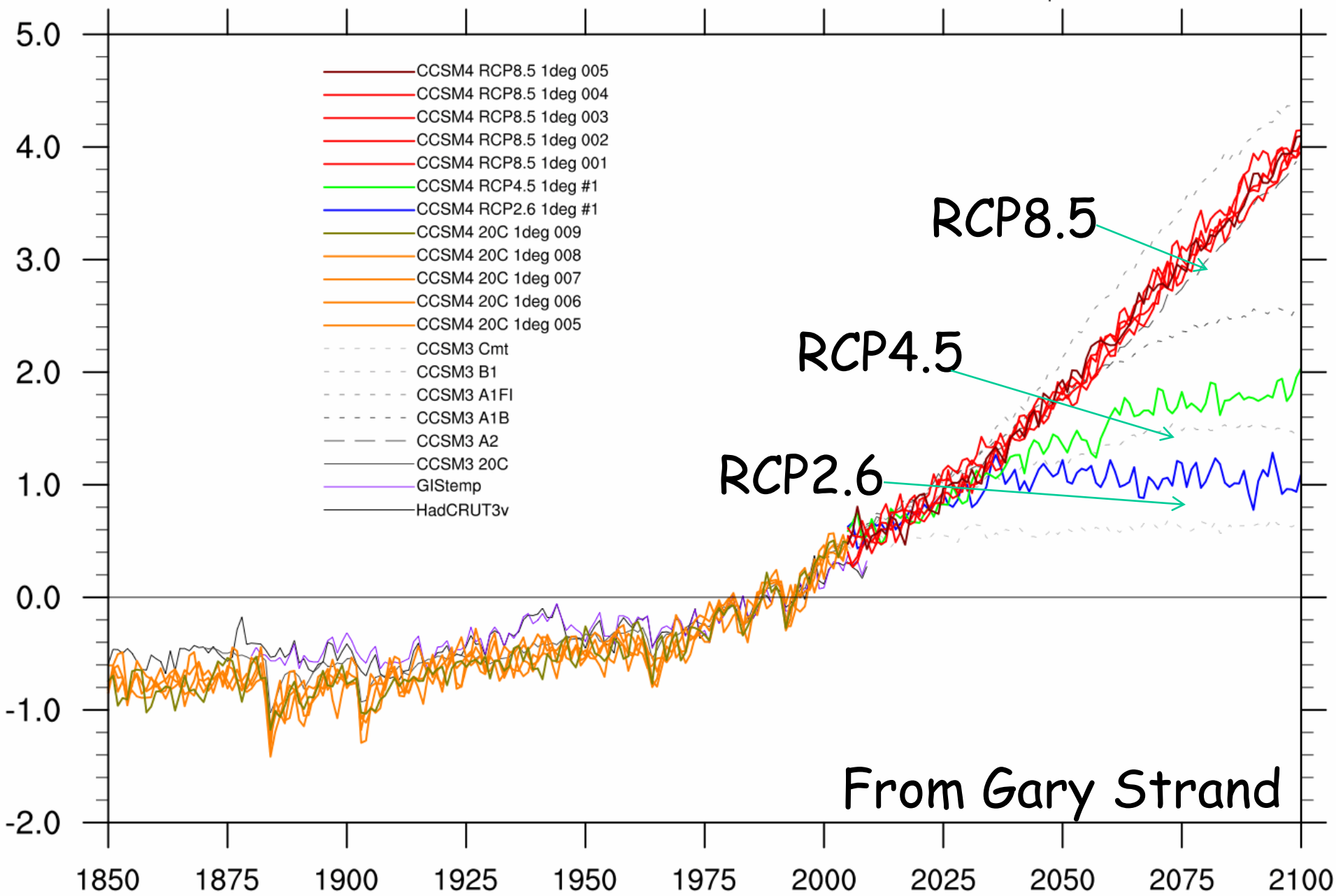


Surface temperature

CCSM4 (CESM1) Simulations

anomaly from 1980-1999, annual and global mean

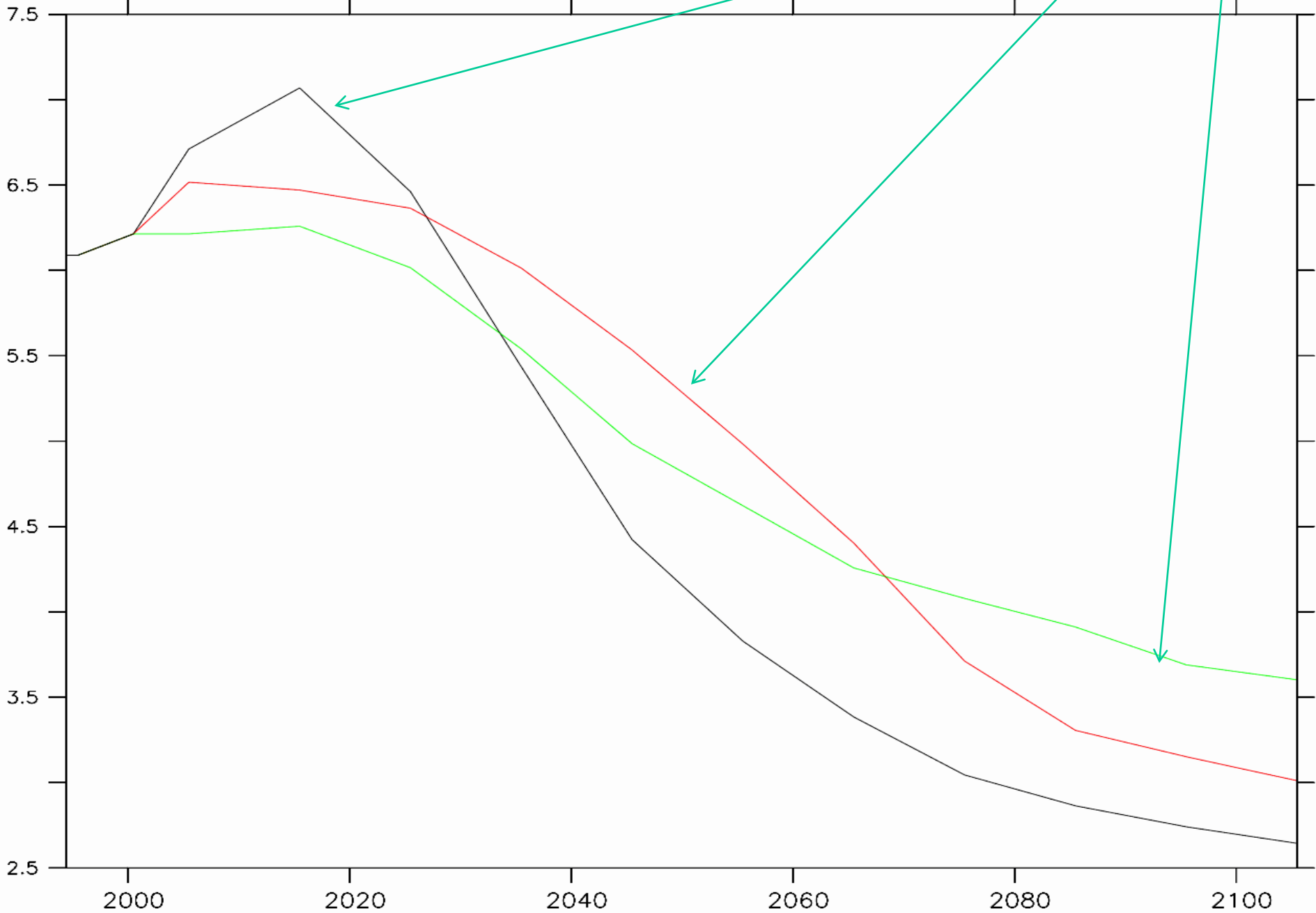
Fri Apr 30 08:05:07 MDT 2010



Total black carbon

08-JUN-2010 13:27:15

RCP2.6 RCP4.5 RCP8.5
(sum over all dimensions, scaled by 1e6)

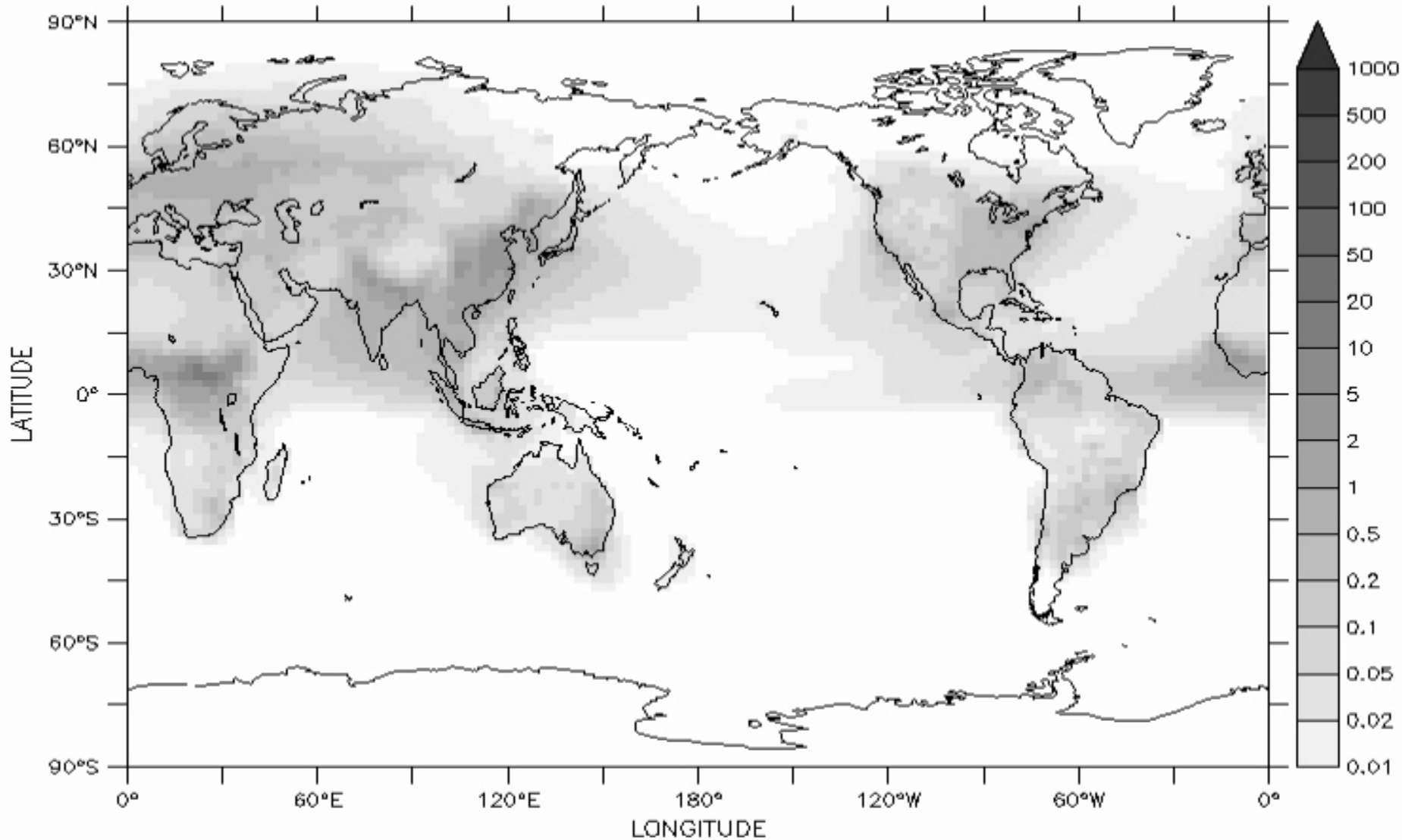


Black Carbon Aerosols (Kg/Kg)

Z (level) : 992.6

TIME : 15-JAN-1994 00:00 NOLEAP

8



From Gary Strand RCP4.5 lowest level total BC (* 1e9)

Sensitivity Simulations

- Aerosol/cloud forcing highly uncertain
- Murphy et al. paper using only observations strongly suggests indirect effect is small
- Investigate regional effects (e.g. monsoons) have large uncertainty (working with V. Ramanathan et al.)
- Conduct climate change sensitivity simulations with various aerosol concentrations including black carbon

The End

This work is sponsored by the
National Science Foundation and
the U. S. Department of Energy