## Reference – absolute SH–land averages surface flux of BC - SH-lar surface flux of SO2 - SH-lar surface concentration surface concentration of BC – SH–land of SO4 - SH-land of SO2 - SH-land 1.2e-12 $\mathrm{emibc}\left(\mathrm{kg}\;\mathrm{m}^{-2}\;\mathrm{s}^{-1}\right)$ əmiso2 (kg m $^{-2}$ s $^{-1}$ 1.0e-12 mmrbc (kg kg<sup>-1</sup> mmrso4 (kg kg $so2 (kg kg^{-1})$ 1.00e-10 2e-10 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 Year Year Year Year longwave flux at TOA - SH-Ia clear-sky longwave flux at TOA - SH-land shortwave flux at TOA - SH-la net radiative flux at TOA - SH-I incident shortwave flux at TOA - SH-land -220.0 -340 -240.0 300 -222.5 rlut + rsut $(W m^{-2})$ $rsut (W m^{-2})$ 200 rlut $(W m^{-2})$ -350 rlutcs $(W m^{-2})$ $rsdt (W m^{-2})$ -225.0 -245 0 -130 100 -247.5 -227.5 -360 -140 -230.0 -100 -370 -252.52000 2001 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year clear-sky net radiative flux at TOA - SH-land dry deposition rate of BC – SH–land clear-sky shortwave flux at TOA - SH-land implied cloud response at TOA – SH-land wet deposition rate of BC – SH–land rsutcs (W m<sup>-2</sup>) -320 rlutcs + rsutcs (W m<sup>-2</sup>) wetbc $(kg m^{-2} s^{-1})$ $\rm rsutcs \, (W \, m^{-2})$ -325 drybc (kg $m^{-2} s^{-1}$ -80.0 rsut - rlutcs --30 -330 -82.5 -40 -335 rlut + 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year Year total deposition rate of BC – SH–land dry deposition rate of SO2 – SH–land dry deposition rate of SO4 – SH–land wet deposition rate wet deposition rate of SO2 - SH-land of SO4 - SH-land $drybc + wetbc (kg m^{-2} s^{-1})$ 0.020 wetso2 $(kg m^{-2} s^{-1})$ $dryso4 (kg m^{-2} s^{-1})$ wetso4 (kg m<sup>-2</sup> s<sup>-1</sup>) dryso2 (kg $\mathrm{m}^{-2} \mathrm{s}^{-1}$ 0.015 6 0e-13 0.010 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 Year Year Year total deposition rate of S – SH–land (dryso2 + wetso2)/2 + (dryso4 + wetso4)/30.012 0.009 $(kg m^{-2} s^{-1})$ 0.006 0.003 0.000 2000 2001 2002 2003 2004 Year CAM-ATRAS CESM1-1950 **GEOS** GISS-1950

GEOS-1950

**GISS** 

E3SM-1950

NorESM2

NorESM2-1950

CAM-ATRAS-1950

CESM1