Reference – absolute land averages surface flux of BC – land surface flux of SO2 – land surface concentration of BC – land surface concentration of SO4 – land surface concentration of SO2 – land 4.0e-09 $\mathrm{emibc}\left(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1}\right)$ emiso2 $(kg m^{-2} s^{-1})$ 1.6e-12 3.5e-09 mmrbc (kg kg⁻¹) nmrso4 (kg kg¯ so2 (kg kg⁻¹ 3.0e-09 1.5e-12 2.5e-09 2.0e-09 1.5e-09 2001 2002 2003 2001 2002 2003 2001 2002 2003 2001 2002 2003 2001 2002 2003 Year Year Year Year Year net radiative flux at TOA –land incident shortwave flux at TOA – land clear-sky longwave flux at TOA - land longwave flux at TOA shortwave flux at TOA land land -224 -340 327.0 $rlut + rsut (W m^{-2})$ -228 rlutcs $(W m^{-2})$ rlut ($W \, m^{-2}$) $rsut (W m^{-2})$ $rsdt (W m^{-2})$ 326.5 -254 -350 326.0 -232 -120 _256 325.5 -236 -258 -360 2001 2003 2001 2002 2003 2001 2003 2001 2002 2003 2001 2003 Year Year Year Year Year dry deposition rate of BC – land wet deposition rate of BC – land clear-sky shortwave clear-sky net radiative implied cloud response flux at TOA - land flux at TOA - land at TOA - land rlut + rsut – rlutcs – rsutcs (W m $^{-2}$) 5e-13 -320 rlutcs + rsutcs (W m⁻²) $drybc (kg m^{-2} s^{-1})$ wetbc (kg m⁻² s⁻¹) -325 $\rm rsutcs \ (W\ m^{-2})$ -330 -30 -80 2003 2003 2001 2003 2001 2003 2001 2002 2003 2001 2001 2002 Year Year Year Year Year total deposition rate dry deposition rate wet deposition rate dry deposition rate wet deposition rate of BC - land of SO2 – land of SO2 – land of SO4 – land of SO4 – land $drybc + wetbc (kg m^{-2} s^{-1})$ wetso2 $(kg m^{-2} s^{-1})$ dryso2 (kg $m^{-2} s^{-1}$) wetso4 (kg m⁻² s⁻¹ dryso4 (kg m $^{-2}$ s $^{-1}$ 5.0e-12 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2001 2002 2003 Year Year total deposition rate of S – land ambient aerosol optical convective cloud cover total cloud cover (dryso2 + wetso2)/2 + (dryso4 + wetso4)/3thickness at 550nm - land percentage - land percentage - land 1.4e-11 60 0.200 $(kg m^{-2} s^{-1})$ od550aer 56 % clt (%) cltc 52 8.0e-12 2002 2001 2002 2003 2004 2002 2003 2002 2003 2003 2001 2004 2001 2004 2001 2004 Year Year Year Year

CFSM1

CESM2

F3SM

GEOS

GFDI

GISS

MIROC

NorESM2

OsloCTM3

UKESM