so2-at-height: absolute difference surface flux of BC – land surface concentration of BC – land surface flux surface concentration surface concentration of SO2 - land of SO4 - land of SO2 - land -2.5e-10 $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$ emiso2 $(kg m^{-2} s^{-1})$ mmrso4 (kg kg-1) mmrbc (kg kg-1) (kg kg – 1) -5.0e-10 5.0e-13 9.2e-20 -7.5e-10 2.5e-13 so₂ (-1.2e-09 -4.2e-19 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 upwelling longwave flux at TOA – land upwelling shortwave flux at TOA – land net radiative flux incident shortwave flux upwelling clear-sky longway flux at TOA - land at TOA – land at TOA – land 0e+00 1e-01 0e+00 1e-01 rlut + rsut $(W m^{-2})$ rlutcs (W m-2) rlut (Wm-2)2e_0° rsut (Wm-2)rsdt (W m – 2) 0e+00 0e+00 -4e-01 0e+00 -5e-02 -4e-01 -3e-07 -1e-01 -6e -6e-01 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2000 2001 2000 2001 Year Year Year Year Year upwelling clear-sky shortway flux at TOA - land clear-sky net radiative flux at TOA – land implied cloud response at TOA – land dry deposition rate of BC – land wet deposition rate of BC – land rlutcs - rsutcs (W m⁻²) 0e+00 0e+00 2e-0 rlutcs + rsutcs (W m⁻²) 2.2e-15 wetbc (kg m^{-2} s⁻¹) $drybc (kg m^{-2} s^{-1})$ -2e-01 rsutcs (W m-2) 1e-01 -2e-01 -4e-01 9.5e-16 -9.5e-16 -4e-01 + rsut --1e-01 -6e-01 -2e-0° 큳 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 dry deposition rate of SO2 – land wet deposition rate of SO2 – land total deposition rate of BC – land dry deposition rate of SO4 – land wet deposition rate of SO4 – land 2.9e-15 1.0e-12 $drybc + wetbc (kg m^{-2} s^{-1})$ wetso2 $(kg m^{-2} s^{-1})$ wetso4 (kg m⁻² s⁻¹) dryso2 (kg m $^{-2}$ s $^{-1}$ dryso4 (kg m⁻² s⁻ 5.0e-13 -5e-12 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 total deposition rate of S – land ambient aerosol optical total cloud cover convective cloud cover (dryso2 + wetso2)/2 + (dryso4 + wetso4)/3thickness at 550nm - land percentage - land percentage - land -2.5e-13 1e-01 0e+003e+35 expression clt (%) $(kg m^{-2} s^{-1})$ 양 -5.0e-13 2e+35 0e+00 expression 1e+35 -7.5e-13 -1e-01 -1e-01 200@001200220032004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2001 2002 2003 2004 2000 Year Year Year Year

CAM-ATRAS

CESM

CESM2

E3SM

GEOS

GFDL-ESM4

GISS modelE

NorESM2

MIROC-SPRINTARS

OsloCTM3

UKESM1