high-so4: absolute difference surface flux of BC – land surface flux surface concentration surface concentration of SO2 - land of BC - land of SO4 - land of SO2 - land 5.9e-19 00+00 2 0e-12 $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$ Δ emiso2 (kg m $^{-2}$ s $^{-1}$ _1 0e_10 ∆ mmrbc (kg kg – (kg kg (kg kg – -1.4e-10 -1.8e-19 -6e-13 ∆ mmrso4 ∆ so2 (2 0e-10 5.0e -5.6e-19 -1.8e-10 -9e-13 0.0e+002000 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 upwelling longwave flux at TOA – land upwelling shortwave flux at TOA – land upwelling clear-sky longway flux at TOA - land net radiative flux incident shortwave flux at TOA – land at TOA – land 2e-01 Δ rlut + rsut (W m⁻²) Δ rlutcs (W m-2) Δ rlut (W m – 2) 1e-01 ∆ rsut (W m – E -2e-01 0e+00 0e+00 rsdt (W 4e-0 -1e-01 -4e_01 -2e-0 -3e-01 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 clear-sky shortway flux at TOA - land dry deposition rate of BC – land clear-sky net radiative rsutcs (W m⁻²) implied cloud response wet deposition rate flux at TOA - land at TOA - land of BC - land 2.3e-15 0e+00 7.4e-15 m^{-2} Δ rsutcs (W m – 2) drybc (kg m^{-2} s $^{-1}$ 0e+00 rlutes + rsutes (W wetbc (kg m⁻² -2e-01 rlutcs -2e-01 -3e-01 -3e-01 rsut -4e-01 4e-0 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 dry deposition rate of SO4 – land wet deposition rate of SO4 – land wet deposition rate total deposition rate dry deposition rate of BC - land of SO2 - land of SO2 - land Δ drybc + wetbc (kg m⁻² s⁻¹ 3.4e-15 Δ wetso4 (kg m⁻² s⁻ dryso2 (kg m⁻² s⁻ wetso2 (kg m⁻² s⁻ ∆ dryso4 (kg m⁻² s⁻ 9.3e--1.5e-15 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 dryso2 + wetso2)/2 + (dryso4 + wetso4)/3total deposition rate ambient aerosol optical total cloud cover - land convective cloud cover - la surface cloud cover - land of S - land thickness at 550nm - land 0.0e + 00(percent ∆ clt (percent) ∆ cl (percent) -2 5e-02 $(kg m^{-2} s^{-1})$ -4 0e-02 5.0e -5.0e-02 △ cltc 2.5e-14 -8.0e-02 -7.5e-02 0.0e+00 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 20002001200220032004 2000 2001 2002 2003 2004 Year Year Year Year Year ice water path - land column mass burden column mass burden surface concentration column mass burden of DMS - land of SO2 - land of SO4 - land 1e-04 8e-07 2e-09 5e-05 Δ loadso4 (kg m⁻²) $loadbc (kg m^{-2})$ Δ clivi (kg m $^{-2}$) ∆ dms (kg kg –1) ∆ loadso2 (kg m⁻ 6e-07 1.5e-13 0e+00 1e-09 1.0e-13 -5e-05 5.0e-14 0e+00 -1e-04 2e-07 0.0e+00

2000 2001

E3SM

GEOS

GFDL

2002 2003 2004

OsloCTM3

UKESM

Year

GISS

MIROC

NorESM2

2000 2001 2002 2003 2004

Year

2002 2003 2004

Year

2000 2001 2002 2003 2004

Year

2000 2001 2002 2003 2004

Year

CAM5

CESM1

CESM2