so2-at-height: 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 6.1e-19 ∆ mmrso4 (kg kg −1) Δ emibc (kg m⁻² s⁻¹) emiso2 (kg m⁻² s⁻ 0.0e+00 Δ so2 (kg kg – 1) △ mmrbc (kg kg – 9.2e-20 2.5e-13 0.0e+00 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 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 0e+00 1e-01 Δ rlut + rsut (W m⁻²) Δ rlutcs (W m-2) Δ rlut (W m – 2) 1e-01 56-02 ∆ rsut (W m – rsdt (W m-0e+00 4e-0 -5e-02 -4e-01 -1e-01 _6e_01 -6e-0 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 upwelling clear-sky shortway flux at TOA - land dry deposition rate of BC – land clear-sky net radiative $\rm rsutcs \ (W\ m^{-2})$ implied cloud response wet deposition rate flux at TOA - land at TOA - land of BC - land 3.4e-15 3.5e-15 m^{-2} 00+00 0e+00 Δ rsutcs (W m – 2) 2e-0 drybc (kg $m^{-2} s^{-1}$ rlutcs + rsutcs (W 2 20-15 -2e-01 wetbc (kg m⁻² 1e-01 rlutcs --4e-00e+00 -4e-0 -6e-01 rsut 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 dry deposition rate total deposition rate wet deposition rate of BC - land of SO2 - land of SO2 - land Δ drybc + wetbc (kg m⁻² s⁻¹ 2.9e-15 wetso2 (kg m⁻² s⁻ ∆ dryso2 (kg m⁻² s⁻ ∆ dryso4 (kg m⁻² s⁻ $_{ m \Delta}$ wetso4 (kg m $^{-2}$ -6.2e-16 2e-12 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year Year dryso2 + wetso2)/2 + (dryso4 + wetso4)/3total deposition rate ambient aerosol optical total cloud cover - land convective cloud cover - lan surface cloud cover - land of S - land thickness at 550nm - land ∆ cltc (percent) ∆ clt (percent) ∆ cl (percent) 4e-02 $(kg m^{-2} s^{-1})$ ∆ od550ae 0e+00 -5e-02 0e+00 -5.0e-13 1e+35 -4e-02 0e+00 200@001200220032004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year Year ice water path - land surface concentration column mass burden column mass burden column mass burden of DMS - land of SO2 - land of SO4 - land 0e+00 Δ loadso4 (kg m⁻²) Δ clivi (kg m⁻²) Δ loadbc (kg m $^{-2}$) Δ loadso2 (kg m $^{-2}$ Δ dms (kg kg – 1) 1e-06 0e+00 -2e-04 1.0e-06 -4e-04 -1e-09 5e-07 5.0e-07 0e+00 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year Year CAM5 E3SM **GISS** OsloCTM3

CESM1

CESM2

GEOS

GFDL

MIROC

NorESM2

UKESM