global: absolute difference surface concentration of SO4 – high–so4 surface flux surface flux surface concentration surface concentration of BC - high-so4 of SO2 - high-so4 of BC - high-so4 of SO2 - high-so4 1.4e-19 1.0e-10 00+00 Δ emibc (kg m⁻² s⁻¹) (kg kg - 1)∆ mmrbc (kg kg − 1) emiso2 (kg m⁻² s⁻ (kg kg – ' -3.4e-20 ∆ mmrso4 $\Delta so2$ (2e-13 -1 2e-19 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 upwelling longwave flux at TOA – high–so4 upwelling shortwave flux at TOA – high–so4 incident shortwave flux at TOA – high–so4 upwelling clear-sky longwav flux at TOA - high-so4 net radiative flux at TOA - high-so4 1.5e-01 Δ rlut + rsut (W m⁻²) 0e+00 1e-07 Δ rlutcs (W m-2) Δ rlut (W m – 2) 0e+00 E E _2e_01 rsut (W I rsdt (W 0e+00 0.0e+00 _4e_01 -5.0e-02 -1e-01 -4e_01 -1.0e-0.12000 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 clear-sky net radiative flux at TOA - high-so4 dry deposition rate of BC – high–so4 upwelling clear-sky shortwa rsutcs (W m⁻²) implied cloud response wet deposition rate flux at TOA - high-so4 at TOA - high-so4 of BC - high-so4 2.2e-15 0.0e+00 1e-01 1.5e-15 Ĕ 0e+00 $\Delta \operatorname{rsutcs} (W m - 2)$ wetbc $(kg m^{-2} s^{-1}$ drybc (kg $m^{-2} s^{-1}$ rsutcs (W 0e+00 -1e-01 rlutcs --3e-0 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 wet deposition rate of SO2 – high–so4 total deposition rate of BC – high–so4 dry deposition rate dry deposition rate wet deposition rate of SO4 – high–so4 of SO2 - high-so4 of SO4 - high-so4 Δ drybc + wetbc (kg m⁻² s⁻¹ 4.2e-16 wetso2 (kg m $^{-2}$ s $^{-}$ ∆ dryso4 (kg m⁻² s¯ ∆ dryso2 (kg m⁻² s⁻ 2.0e-16 wetso4 (kg m⁻² 2.0e-13 -1.9e-1 -2 0e-13 -4.6e-16 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 dryso2 + wetso2)/2 + (dryso4 + wetso4)/3Year Year total deposition rate ambient aerosol optical total cloud cover - high-soconvective cloud cover - highsurface cloud cover - highof S - high-so4 thickness at 550nm - high-s 5.0e-02 Δ cltc (percent) ∆ clt (percent) ∆ cl (percent) $(kg m^{-2} s^{-1})$ od550ae 0e+002.5e-02 1e-02 0e+00 0.0e+00-1e-01 -7.5e-02 0e+00 -2 5e-02 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 - high-sosurface concentration column mass burden column mass burden column mass burden of DMS - high-so4 of SO2 - high-so4 of BC - high-so4 of SO4 - high-so4 1e-09 1.0e-04 Δ loadso2 (kg m $^{-2}$) Δ clivi (kg m $^{-2}$) Δ loadbc (kg m⁻²) Δ loadso4 (kg m⁻²) ∆ dms (kg kg-0.0e+00 0e+00 5.0e-13 2e-07 -5.0e-05 -6e-08 -8e-082000 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 CAM5 E3SM **GISS** OsloCTM3 CESM1 GEOS MIROC **UKESM** CESM2 **GFDL** NorESM2