land: percent difference surface flux surface flux surface concentration surface concentration surface concentration of BC - no-so4 of SO2 - no-so4 of BC - no-so4 of SO4 - no-so4 of SO2 - no-so4 5.0e-01 5.0e-05 2e+00 3.0e+00 ∆ mmrbc 2.5e-05 0.0e+00 1e+00 -2.5e-05 -1.2e+01 2.0e+00 _5 0e_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 upwelling longwave flux at TOA – no-so4 upwelling shortwave flux at TOA – no–so4 upwelling clear-sky longwa flux at TOA - no-so4 net radiative flux incident shortwave flux at TOA - no-so4 at TOA - no-so4 4e-01 1e-01 2e-01 5e-08 5.0e-02 -02 2e-01 0e+00 ∆ rsut ∆ rlut + 0e+00 0e+00 00+00 -5e-080.0e+00 -5e-02 -2e-01 -1e-01 -2e-01 -2.5e-02 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year clear-sky net radiative flux at TOA - no-so4 dry deposition rate of BC – no–so4 upwelling clear-sky shortway implied cloud response wet deposition rate flux at TOA - no-so4 at TOA - no-so4 of BC - no-so4 rsutcs) 4e-01 rsutcs rlutcs -4e - 013e-01 ∆ wetbc 2e-01 0e+00 ∆ rlutcs + 2e-01 -1e-01 rsut – 1e-01 _5e_0° -4e-01 0e+00 0e+00 -2e-01 -1e+00 -1e-01 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 total deposition rate of BC – no–so4 dry deposition rate of SO4 – no–so4 wet deposition rate of SO4 – no-so4 dry deposition rate wet deposition rate of SO2 - no-so4 of SO2 - no-so4 -1e+00 2.6e+00 -5.0e+00 2.5e+00wetso2 ∆ wetso4 0e+00 2 0e+00 2 4e+00 _5e_01 -1.5e+011.5e+00 2.3e+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 Year Year Year $\frac{1}{3} dryso2 + wetso2)/2 + \frac{1}{3} dryso4 + wetso4)/3$ total deposition rate ambient aerosol optical total cloud cover - no-so4 convective cloud cover - nosurface cloud cover - no-so of S - no-so4 thickness at 550nm - no-so 0.0e+00 0.0e + 00-2e+01 ∆ od550aer -5.0e+00 -4e-01 0.0e + 00-2.5e-01 -4e+01 -1.0e+01 -5.0e-01 -8e-01 -2.5e-01 -6e+01 -1.5e+01 -7.5e-0120002001200220032004 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 ice water path - no-so4 surface concentration column mass burden column mass burden column mass burden of DMS - no-so4 of BC - no-so4 of SO2 - no-so4 of SO4 - no-so4 6e+00 5.0e-01 5e-01 4.0e+00 1e+00 ∆ loadso4 2e+00 0e+00 0e+000.0e+0.03.0e+00 -2.5e-0° 0e+00 2.5e+00 -5e-01 -5.0e-01 -2e+00 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 Year Year Year Year Year CAM5 E3SM **GISS** OsloCTM3 CESM1 **GEOS** MIROC **UKESM** CESM2 GFDL NorESM2