## global: absolute difference surface flux of SO2 – no–so4 surface flux of BC – no-so4 surface concentration surface concentration of SO4 – no–so4 surface concentration of SO2 – no–so4 7.2e-20 1.5e-11 2.0e-13 $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$ emiso2 $(kg m^{-2} s^{-1})$ mmrso4 (kg kg – 1) mmrbc (kg kg – 1) so2 (kg kg-1) 0.0e+00 1.5e-20 1.0e-13 1.0e-11 -1.3e-20 5.0e-14 7.5e-12 -5.0e-13 2002 2003 2002 2003 2003 2002 2003 2002 2003 2001 2001 2001 2002 2001 2001 Year Year Year Year Year upwelling longwave flux at TOA – no-so4 upwelling shortwave flux at TOA – no–so4 upwelling clear-sky longway flux at TOA - no-so4 net radiative flux incident shortwave flux at TOA - no-so4 at TOA - no-so4 1.5e-01 16\_02 rlut + rsut $(W m^{-2})$ 1.5e-01 1.0e-01 rlutcs (W m-2) rlut (Wm-2)rsut(Wm-2)rsdt(Wm-2)0e+00 1.0e-01 5 0e-02 -1e-020.0e+00 0.0e+00 -5.0e-02 -2e-02 2003 2003 2003 2002 2003 2002 2003 2001 2002 2001 2002 2001 2002 2001 2001 Year Year Year upwelling clear-sky shortwav clear-sky net radiative implied cloud response dry deposition rate wet deposition rate flux at TOA - no-so4 flux at TOA - no-so4 at TOA - no-so4 of BC - no-so4 of BC - no-so4 $m^{-2}$ rlut + rsut - rlutcs - rsutcs (W 2e-02 lutcs + rsutcs (W $m^{-2}$ 7.0e-16 1.0e-01 $drybc (kg m^{-2} s^{-1})$ wetbc $(kg m^{-2} s^{-1})$ rsutcs (W m-2) 0.0e+00 5.0e-02 0e+00 0.0e+00 -2.5e-02 -2e-02 -5 0e-02 2001 2002 2003 2004 2001 2002 2003 2001 2002 2003 2001 2002 2003 2001 2002 2003 Year Year Year Year Year total deposition rate of BC – no–so4 dry deposition rate of SO2 – no–so4 wet deposition rate of SO2 – no–so4 dry deposition rate of SO4 – no-so4 wet deposition rate of SO4 – no-so4 1.3e-15 1.2e-13 $drybc + wetbc (kg m^{-2} s^{-1})$ 8.6e-16 wetso2 $(kg m^{-2} s^{-1})$ dryso2 (kg m $^{-2}$ s $^{-1}$ ) $dryso4 (kg m^{-2} s^{-1})$ wetso4 $(kg m^{-2} s^{-1})$ 1.0e-13 4.0e-16 -1.2e-13 6 0e-14 0e+00 2001 2002 2003 2001 2002 2003 2002 2003 2002 2003 2002 2003 Year Year Year total deposition rate of S – no–so4 ambient aerosol optical total cloud cover convective cloud cover (dryso2 + wetso2)/2 + (dryso4 + wetso4)/3thickness at 550nm - no-se percentage - no-so4 percentage - no-so4 0.0e+00 0e+00 0e+00expression(clt~(%) $(kg m^{-2} s^{-1})$ 5.0e-15 -5e-02 -5.0e-02 -4e-02 -5.0e-15 -7.5e-02 -6e-02 -1.0e-14 2001 2002 2003 2004 2002 2003 2002 2003 2003 Year Year Year Year **UKESM** CESM1 GISS MIROC **GFDI** E3SM CESM2 NorESM2 OsloCTM3 **GEOS**