## so2-at-height: absolute difference surface flux surface flux surface concentration surface concentration of BC - NH-atlantic of SO2 - NH-atlantic of BC - NH-atlantic of SO4 - NH-atlantic of SO2 - NH-atlantic 3.7e-20 $\Delta$ emibc (kg m<sup>-2</sup> s<sup>-1</sup>) ∆ mmrso4 (kg kg −1) emiso2 (kg m $^{-2}$ s $^{-1}$ $\Delta \cos (kg kg - 1)$ △ mmrbc (kg kg – 0e+00 1.4e-20 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 upwelling longwave flux at TOA – NH–atlantic upwelling shortwave flux at TOA – NH–atlantic upwelling clear-sky longway flux at TOA - NH-atlantic net radiative flux incident shortwave flux at TOA – NH–atlantic at TOA - NH-atlantic 0e+00 $\Delta$ rlut + rsut (W m<sup>-2</sup>) $\Delta$ rlutcs (W m-2) $\Delta$ rlut (W m – 2) 1e-01 rsut (W mrsdt (W m-0e+00 0e+00 -1e-01 -6e-01 -2e-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 shortwa flux at TOA – NH–atlantic dry deposition rate of BC – NH–atlantic wet deposition rate of BC – NH–atlantic clear-sky net radiative $\rm rsutcs \ (W\ m^{-2})$ implied cloud response flux at TOA - NH-atlanti at TOA - NH-atlantic 2e-01 9.5e-16 Ĕ wetbc $(kg m^{-2} s^{-1})$ $\Delta \operatorname{rsutcs} (W m - 2)$ drybc (kg $m^{-2} s^{-1}$ rsutcs (W -2.5e-0° rlutcs --5 0e-01 -5.0e-01 rsut -4e-01 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 SO4 – NH–atlantic total deposition rate of BC – NH–atlantic dry deposition rate of SO2 – NH–atlantic wet deposition rate of SO2 – NH–atlantic dry deposition rate of SO4 – NH–atlantic $\Delta$ drybc + wetbc (kg m<sup>-2</sup> s<sup>-1</sup> 2.9e-15 wetso2 (kg m<sup>-2</sup> s<sup>-</sup> dryso2 (kg $m^{-2}$ s<sup>-</sup> $\Delta$ wetso4 (kg m $^{-2}$ s $^{-}$ $_{ m \Delta}$ dryso4 (kg m $^{-2}$ s $^{-}$ 0e+00 4.8e-16 2e-13 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 Year Yea Year Year dryso2 + wetso2)/2 + (dryso4 + wetso4)/3total deposition rate ambient aerosol optical total cloud cover - NH-atlan convective cloud cover - NH-atl surface cloud cover - NH-atl of S - NH-atlantic thickness at 550nm - NH-atla 2e-01 0.0e+00 ∆ cltc (percent) ∆ clt (percent) ∆ cl (percent ∆ od550ae \_2 5e\_02 -5.0e-02 1e+35 5.0e-13 -1e-01 -2e-01 0e+00 2002 2003 2004 20002001200220032004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2000 2001 Year Year Year Year Year ice water path - NH-atlant surface concentration column mass burden column mass burden column mass burden NH–atlantic of SO4 - NH-atlantic of BC - NH-atlantic 7.5e-04 $\Delta$ loadso2 (kg m $^{-2}$ ) $\Delta$ loadso4 (kg m<sup>-2</sup>) $\Delta\,\mathrm{clivi}\,\left(\mathrm{kg}\;\mathrm{m}^{-2}\right)$ $\Delta$ dms (kg kg – 1) $loadbc (kg m^{-2})$ 0e+00 5.0e-04 4e - 070e+00 2.5e-04 -1e-09 0.0e+00 0.0e+0.02000 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 E3SM **GISS** OsloCTM3

CESM1

CESM2

GEOS

**GFDL** 

MIROC

NorESM2

**UKESM**