## Reference – absolute arctic averages surface flux of SO2 – arctic surface concentration of BC – arctic surface concentration of SO2 – arctic surface flux of BC surface concentration of SO4 – arctic arctic $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$ emiso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ mmrbc (kg kg<sup>-1</sup>) mmrso4 (kg kg<sup>\_1</sup> so2 (kg kg<sup>-1</sup>) 4e\_14 5.0e-10 2003 2001 2003 2001 2002 2003 2001 2002 2003 2001 2002 2003 2001 2002 Year Year Year Year Year incident shortwave flux at TOA – arctic clear-sky longwave flux at TOA - arctic longwave flux at TOA shortwave flux at TOA net radiative flux at arctic TOA -arctic arctic 191 rlut + rsut $(W m^{-2})$ rlutcs (W $m^{-2}$ ) rlut $(W m^{-2})$ $rsut (W m^{-2})$ $rsdt (W m^{-2})$ 190 -95 -300 189 -100 -214 -205 188 -216 -305 -105 2001 2003 2003 2001 2003 2001 2003 2001 2002 2003 Year Year Year Year Year dry deposition rate of BC – arctic clear-sky shortwave clear-sky net radiative implied cloud response wet deposition rate flux at TOA - arctic flux at TOA - arctic at TOA - arctic of BC - arctic rlut + rsut - rlutcs - rsutcs (W m-2) 1.75e-13 -280 rlutcs + rsutcs (W m<sup>-2</sup>) $drybc (kg m^{-2} s^{-1})$ wetbc $(kg m^{-2} s^{-1})$ rsutcs (W m<sup>-2</sup>) -70 -285 1.25e-13 1.00e-13 -290 -295 -80 5.00e-14 2003 2003 2001 2003 2001 2003 2001 2003 2001 2002 2001 2002 Year Year Year Year Year wet deposition rate of SO4 – arctic total deposition rate dry deposition rate wet deposition rate dry deposition rate of BC - arctic of SO2 - arctic of SO2 - arctic of SO4 - arctic 1.50e-12 $drybc + wetbc (kg m^{-2} s^{-1})$ 1.25e-12 wetso2 $(kg m^{-2} s^{-1})$ wetso4 $(kg m^{-2} s^{-1})$ $dryso4 (kg m^{-2} s^{-1})$ $dryso2 (kg m^{-2} s^{-1})$ 1.00e-12 7.50e-13 2e-12 0.0e+00 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2001 2002 2003 2004 2001 2002 2003 Year Year total deposition rate of S – arctic ambient aerosol optical convective cloud cover total cloud cover (dryso2 + wetso2)/2 + (dryso4 + wetso4)/3thickness at 550nm - arctic percentage - arctic percentage - arctic 0.10 90 3.5e-12 0.08 $(kg m^{-2} s^{-1})$ 80 od550aer % clt (%) 10 cltc 2.5e-12 0.06 70 2001 2002 2003 2004 2003 2004 2002 2003 2004 2002 2003 2001 2002 2001 2001 2004 Year Year Year Year

CFSM1

CESM2

F3SM

**GEOS** 

**GFDI** 

**GISS** 

MIROC

NorESM2

OsloCTM3

**UKESM**