## shp-ind-shift: absolute difference surface concentration of BC – arctic surface flux surface flux surface concentration surface concentration of BC - arctic of SO2 - arctic of SO4 - arctic of SO2 - arctic 2e-12 $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$ emiso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ (kg kg - 1)2.1e-20 6.5e-16 so2 (kg kg – 1) 0e+00 mmrso4 (kg kg 1.0e-20 4.0e-16 mmrbc ( -5.5e-22 1.4e-16 -2.0e-12 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year Year upwelling shortwave flux at TOA – arctic upwelling clear-sky longwa flux at TOA - arctic upwelling longwave flux at TOA – arctic net radiative flux incident shortwave flux at TOA – arctic at TOA – arctic 5.0e-02 5.0e-02 1e-01 rlut + rsut $(W m^{-2})$ 5.0e-02 rsut (Wm-2)rlut (Wm-2)rsdt (Wm-2)lutcs (W m-0e+002.5e-02 0.0e + 0.00.0e+00 -1e-01 -1e-010.0e + 0.0-2 5e-02 -2e-01 -2e-01 \_2 5e\_02 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 shortway implied cloud response dry deposition rate wet deposition rate clear-sky net radiative flux at TOA - arctic flux at TOA - arctic at TOA - arctic of BC - arctic of BC - arctic rsutcs $(W m^{-2})$ 7.5e-02 1e-01 lutcs + rsutcs (W m $^{-2}$ ) 5.0e-02 rsutcs (W m-2) 5.8e-17 drybc (kg $m^{-2} s^{-1}$ vetbc (kg m<sup>-2</sup> s<sup>-</sup> 0e+00 0e+00 2.5e-02 rlutcs 0.0e+00 -5e-02 -1e-0 rsut -1e-01 \_1 6e\_16 -5.0e-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 Year Year dry deposition rate of SO2 – arctic total deposition rate of BC – arctic wet deposition rate of SO2 – arctic dry deposition rate of SO4 – arctic wet deposition rate of SO4 – arctic 3.1e-16 -3.1e-15 4.3e-16 -9.6e-15 $\mathrm{drybc} + \mathrm{wetbc} \, (\mathrm{kg} \, \mathrm{m}^{-2} \, \mathrm{s}^{-1})$ dryso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ 7.3ewetso2 (kg m<sup>-2</sup> s<sup>-</sup> dryso4 (kg m<sup>-2</sup> s<sup>-</sup> wetso4 (kg m<sup>-2</sup> -1.7e-16 -5.4e-15 -3.1e-18 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)/3Dimethyl sulphide (DMS) mole fractic total deposition rate cloud cover Ice water path - arctic ambient aerosol optical thickness at 550nm 1e-01 1e-04 8 \_lom lom) smb clivi (kg $m^{-2}$ ) 2e-13 $(kg m^{-2} s^{-1})$ expression cltc 0e+00 -1e-04 1e-04 -2e-04 20002001200220032004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2000 2001 2000 2001 Year Year Year Year Year load load of so2 - arctic of bc - arctic 5.0e-11 3e-08 $\log dso4~(kg~m^{-2})$ 2e-08 oadbc (kg m<sup>-2</sup>) 1e-08 0.0e+00 0e+00 -1e-08 -2e-08 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year