## shp-ind-shift-1950: absolute difference surface flux of BC – arctic surface flux surface concentration surface concentration of SO4 – arctic surface concentration of SO2 – arctic 9.5e-20 5.0e-13 emibc $(kg m^{-2} s^{-1})$ nmrbc (kg kg-1) $^{-2}$ s $^{-2}$ s $^{-1}$ 6.36-20 -6 4e-16 0.0e + 0.0so2 (kg kg – 1) 0e+00(kg kg-0e+00 -5.0e-13 3.1e-20 -1.0e-12 -9.0e-23 -2 2e-15 \_2e\_12 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2000 2001 Year Year Year Year Year upwelling longwave flux at TOA – arctic upwelling shortwave flux at TOA – arctic upwelling clear-sky longwa flux at TOA - arctic net radiative flux incident shortwave flux at TOA – arctic at TOA – arctic 2e-02 2.5e-02 rlut + rsut $(W m^{-2})$ rlut (Wm-2)sdt (Wm-2)rsut (Wm-2)rlutcs (W m-1e-02 0e+00 2e-07 0e+00 0.0e+00 0e+00 -4e-02-1e-02 -1e-01 \_8e\_02 -5.0e-02 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year Year upwelling clear-sky shortwa clear-sky net radiative flux at TOA – arctic implied cloud response dry deposition rate wet deposition rate of BC – arctic flux at TOA – arctic rlutcs - rsutcs (W m<sup>-2</sup>) at TOA - arctic of BC - arctic 3 8e-16 m<sup>-2</sup> 1e-01 rsutcs (W m-2) 4e-02 wetbc (kg $m^{-2}$ s<sup>-1</sup>) 2.0e-16 drybc (kg m<sup>-2</sup> s<sup>-</sup> rlutcs + rsutcs (W 5.0e-02 5e-02 0.0e+00 0e+00 0e+00 -5.0e-02 -5e-02 -4e-02 rsut – -1.0e-0 -1e-01 -1.5e-0 rlut + 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2000 2001 Year Year Year Year Year total deposition rate of BC – arctic dry deposition rate of SO2 – arctic wet deposition rate of SO2 – arctic dry deposition rate of SO4 – arctic wet deposition rate of SO4 – arctic 4 0e-16 2 8e-15 1 2e-15 4 5e-15 $drybc + wetbc (kg m^{-2} s^{-1})$ $dryso2 (kg m^{-2} s^{-1})$ wetso2 (kg ${\sf m}^{-2}\,{\sf s}^{-1}$ dryso4 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ 2.0e-16 8.2e-16 $vetso4 (kg m^{-2}$ 2.5e-18 -2.0e-16 \_3 2e\_15 -3 5e-15 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 dyso2 + wetso2)/2 + (dyso4 + wetso4)/3total deposition rate cloud cover Ice water path - arctic Dimethyl sulphide (DMS) mole fraction ambient aerosol optical of S - arctic percentage - arctic thickness at 550nm - arct 1e-04 0.0e+00 2e-13 5e-05 dms (mol mol<sup>-</sup> clivi (kg m<sup>-2</sup>) 4e-01 $(kg m^{-2} s^{-1})$ 양 2e-01 -5e-05 0e+002002 2003 2004 2000 2001 2002 2003 2004 20002001200220032004 2000 2001 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year Year SO4 lifetime SO<sub>2</sub> lifetime load load load of so2 of so4 - arctic of bc - arctic arctic - arctic arctic wetso4) (days 0.0e+00 oadso2/emiso2 (days) loadso4 (kg m<sup>-2</sup>) oadso2 (kg m<sup>-2</sup>) oadbc (kg m<sup>-2</sup>) -2.5e-092.5e-10 -1.0e-08-5.0e-09 (dryso4 0.0e + 00-1.5e-08 -2.0e-08 -1.0e-08 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2001 2002 2003 2004 2000 2001 2002 2003 Year Year Year Year Year CAM-ATRAS F3SM GISS modelE

CESM1

**GEOS** 

NorESM2