shp-atl-shift-1950: absolute difference surface flux of BC – arctic surface flux surface concentration surface concentration of SO2 – arctic surface concentration of SO4 – arctic 3.9e-15 mmrso4 (kg kg – 1) emibc $(kg m^{-2} s^{-1})$ nmrbc (kg kg-1) əmiso2 (kg m $^{-2}$ s $^{-1}$ 1 5e-19 2 90-15 (kg kg - 1)0e+00 0e+008.8e-20 1.9e-15 2.8e-20 8.6e-16 -1e-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 net radiative flux at TOA – arctic upwelling clear-sky longwa flux at TOA - arctic incident shortwave flux at TOA – arctic 5e-02 5.0e-02 $rsut (W m^{-2})$ rsdt (Wm-2)2.5e-02 rsut (Wm-2)2e-02 rlutcs (W m-2e-07 0.0e+00 0e+00 -5e-02 rlut + 0e+00 -1.0e-01 -2 5e-02 -2e-02 -1.5e-01 2000 2001 2002 2003 2004 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 clear-sky net radiative flux at TOA - arctic upwelling clear-sky shortway implied cloud response dry deposition rate of BC – arctic wet deposition rate of BC – arctic flux at TOA – arctic rsutcs (W m^{-2}) at TOA - arctic 9.5e-17 4 0e-16 5.0e-02 rlutcs + rsutcs (W m⁻²) vetbc (kg m^{-2} s⁻¹ drybc (kg m⁻² s⁻ 0.0e+0.00e+00 0e+00 rlutcs --5e-02 rsut -1e-01r H H 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 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 8e-16 6.8e-15 1.0e-04 4 0e-15 dryso2 (kg m $^{-2}$ s $^{-1}$) $dryso4 (kg m^{-2} s^{-1})$ wetso4 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ wetso2 (kg m^{-2} s⁻¹ 1.5e-16 7.5e-05 -1.7e-16 1.9e-15 -5.0e-16 -5 2e-16 -2 2e-15 0.0e + 0.0e +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 Dimethyl sulphide (DMS) mole fraction total deposition rate cloud cover Ice water path - arctic ambient aerosol optical of S – arctic thickness at 550nm – arctic percentage - arctic 1e-04 2e-04 4e-01 $^{-}$ m $^{-2}$) mol mol $(kg m^{-2} s^{-1})$ 양 clivi (kg ı 0e+00 2e-01 xpression 0e+00 2e-05 0e+00 20002001200220032004 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 SO4 lifetime SO₂ lifetime load load load of so2 of so4 - arctic of bc - arctic - arctic - arctic arctic wetso4) (days 5.0e-10 oadso2/emiso2 (days) loadso4 (kg m⁻²) loadso2 (kg m⁻²) oadbc (kg m⁻²) 2.5e-10 4e-09 (dryso4 + 0.0e+00 4e-09 2e-09 2000 2001 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2001 2002 2003 2004 2000 2001 2002 2003 Year Year Year Year Year

CAM-ATRAS

CESM1

F3SM

GEOS

GISS modelE

NorESM2

rlut (Wm-2)

rsutcs (W m-2)

drybc + wetbc (kg m⁻² s⁻¹)

dyso2 + wetso2)/2 + (dyso4 + wetso4)/3