shp-atl-shift-1950: absolute difference surface flux of SO2 – arctic surface concentration surface concentration of SO2 – arctic surface concentration of SO4 – arctic 3.9e-15 mmrso4 (kg kg-1) mmrbc (kg kg - 1) əmiso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ 2 90-15 so2 (kg kg – 1) 0e+00 0e+00 0e+001.9e-15 8.6e-16 -1e-12 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year upwelling shortwave flux at TOA – arctic net radiative flux at TOA – arctic incident shortwave flux at TOA – arctic upwelling clear-sky longwa flux at TOA - arctic 5e-02 $rsut(W m^{-2})$ rsdt (Wm-2)2.5e-02 0.0e+00 rlutcs (W mrsut (W m-2e-07 -5e-02 rlut + 1 0e+00 -2.5e-02 -1.5e-01 Year Year Year Year clear-sky net radiative flux at TOA - arctic implied cloud response dry deposition rate of BC – arctic wet deposition rate of BC – arctic rsutcs $(W m^{-2})$ at TOA - arctic 9.5e-17 4 0e-16 5.0e-02 rlutcs + rsutcs (W m⁻²) vetbc (kg ${\sf m}^{-2}\,{\sf s}^{-1}$ drybc (kg m⁻² s⁻ 0.0e+0.00e+00 rlutcs --9.6e-17 rsnt rlut + 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year dry deposition rate of SO2 – arctic wet deposition rate of SO2 – arctic dry deposition rate of SO4 – arctic wet deposition rate of SO4 – arctic 6.8e-15 1.0e-04 4 0e-15 dryso2 (kg m $^{-2}$ s $^{-1}$) wetso4 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ $dryso4 (kg m^{-2} s^{-1}$ wetso2 (kg m⁻² s⁻' 5.0e-05 1.9e-15 2.5e-05 -5.2e-16 0.0e + 00-3.0e-15 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 Year Year Year Year Dimethyl sulphide (DMS) mole fraction cloud cover Ice water path - arctic ambient aerosol optical thickness at 550nm – arctic percentage - arctic 1e-04 2e-04 4e-01 clivi (kg m^{-2}) mol mol_ 0e+00 2e-01 expression 0e+00 0e+00 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year load load of so2 of bc - arctic arctic 5.0e-10 oadso2 $(kg m^{-2})$ loadbc (kg m $^{-2}$) 2.5e-10 0.0e+00 4e-09

2002 2003 2004

GISS modelE

NorESM2

Year

F3SM

GEOS

surface flux of BC – arctic

2000 2001 2002 2003 2004

Year

upwelling longwave flux at TOA – arctic

2000 2001 2002 2003 2004 Year

upwelling clear-sky shortway flux at TOA - arctic

2000 2001 2002 2003 2004

Year

total deposition rate of BC – arctic

2000 2001 2002 2003 2004

Year

total deposition rate of S – arctic

20002001200220032004

Year

2000 2001 2002 2003 2004

Year

CAM-ATRAS

CESM1

load

of so4 - arctic

Year

 $\mathrm{emibc}\left(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1}\right)$

rlut (Wm-2)

rsutcs (W m-2)

 $drybc + wetbc (kg \ m^{-2} \ s^{-1})$

4ryso2 + wetso2)/2 + (dryso4 + wetso4)/3

 $loadso4 (kg m^{-2})$

4e-09

2e-09 0e+00

 $(kg m^{-2} s^{-1})$

2e-05

1.5e-19

8.8e-20

2.8e-20

2e-02

0e+00

5e-02

0e+00

4 8e-16

1.5e-16

-1.7e-16

-5.0e-16