## shp-atl-shift: absolute difference surface flux of BC – arctic surface flux of SO2 – arctic surface concentration of SO4 – arctic surface concentration surface concentration of SO2 – arctic 0.0e+00 emiso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ nmrbc (kg kg-1) (kg kgmmrso4 -1 0e-12 0e+00 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 longwave flux at TOA – arctic upwelling shortwave flux at TOA – arctic upwelling clear-sky longway flux at TOA - arctic net radiative flux incident shortwave flux at TOA – arctic at TOA – arctic 2e-01 $rlut + rsut (W m^{-2})$ rlutcs (W m-2) 00+00 sut (W m-2)rsdt (Wm-2)-2e-01 -2.5e-07 -1e-01 \_4e\_01 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year Year upwelling clear-sky shortway flux at TOA - arctic clear-sky net radiative flux at TOA - arctic implied cloud response at TOA – arctic dry deposition rate of BC – arctic wet deposition rate of BC – arctic rsutcs (W m<sup>-2</sup>) 7.5e-16 8 4e-15 rlutcs + rsutcs (W m<sup>-2</sup> vetbc (kg $m^{-2}$ s<sup>-1</sup>) 5.0e-16 drybc (kg m<sup>-2</sup> s<sup>-</sup> 1e-01 rlutcs --2e-01 2.5e-16 3.8e-15 0e+00 -4e-01 rsut-2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 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 0e+00 $dryso2 (kg m^{-2} s^{-1})$ $dryso4 (kg m^{-2} s^{-1})$ wetso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ wetso4 $(kg m^{-2} s^{-1}$ 6e-03 4e-03 0e+002000 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 cloud cover total deposition rate of S – arctic Ice water path - arctic Dimethyl sulphide (DMS) mole fractic ambient aerosol optical thickness at 550nm percentage - arctic 1e-01 expression cltc (%) clivi (kg ${\sf m}^{-2}$ ) \_lom lom) smp 5e-05 0e+00 0e+00 -1e-01 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 of so2 of so4 - arctic of bc - arctic - arctic arctic - arctic wetso4) (days oadso2/emiso2 (days) 0.0e+0.0loadso2 (kg m<sup>-2</sup>) loadbc (kg m<sup>-2</sup>) (dryso4 + 2e-10 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2001 2002 2004 2000 2001 2002 2003

Year

GFDI -FSM4

GISS modelE

F3SM

**GEOS** 

Year

NorESM2

Year

1.9e-19

1 36-19

7.5e-20

1.6e-20

1.2e-01

0.0e+00

-4.0e-02

1e-01

-1e-01

-2e-01 -3e-01

-4e-0 -5e-01

9 0e-15

6.5e-15

4.1e-15

1.6e-15

2000 2001

Year

rsutcs (W m-

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

dyso2 + wetso2)/2 + (dryso4 + wetso4)/3

loadso4 (kg m<sup>-2</sup>)

1e-08

0e+00

-1e-08

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

2e-03

0e+00

load

Year

Year

CESM1

CAM-ATRAS

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