shp-60p-red: absolute difference surface flux of SO2 – arctic surface concentration of SO4 – arctic surface concentration surface concentration of SO2 – arctic 0.0e + 0.00nmrbc (kg kg-1) əmiso2 (kg m $^{-2}$ s $^{-}$ so2 (kg kg – 1) ķď -1.0e-12 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000.02002.52005.02007.5 2000.02002.52005.02007.5 Year Year Year Year upwelling shortwave flux at TOA – arctic incident shortwave flux at TOA – arctic upwelling clear-sky longwav flux at TOA - arctic net radiative flux at TOA – arctic 00+00 $rsut (W m^{-2})$ rlutcs (W m-2) 0e+00 (Wm-2)(Wm-2)4e-02 2e-06 -2e-01 sdt (± E -8e-02 -4e-01 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 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 3.4e - 15 m^{-2} 5.0e-02 2.5e-15 vetbc (kg m⁻² s^{-'} drybc (kg m⁻² s⁻ rsutcs (W -1e-01 rlutcs -1.5e-15 -2e-01 6.4e-16 rsut – -1.0e-01 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 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 -5e-14 0.0e + 0.07.5e-03 dryso2 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ vetso2 (kg m^{-2} s $^{-1}$ dryso4 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ wetso4 (kg m⁻² ; 5.0e-03 2.5e-03 0.0e+002000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year Year cloud cover Ice water path - arctic Dimethyl sulphide (DMS) mole fraction ambient aerosol optical percentage - arctic thickness at 550nm - arctic 1e-04 clivi (kg m⁻²) _lom lom) smp 5e-05 양 ession 0e+00 2e-01 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 Year Year Year Year SO4 lifetime SO₂ lifetime load load of so2 of bc - arctic arctic arctic - arctic wetso4) (days 0.0e+00 oadso2/emiso2 (days) loadso2 (kg m⁻²) oadbc (kg m⁻²) 4e-10 (dryso4 0e+00 -7.5e-08-4e-10

2000 2001 2002 2003 2004

Year

GFDI -FSM4

GISS modelE

F3SM

GEOS

2001

2002

Year

NorESM2

2004

2000

2001

2002

Year

2003

surface flux of BC – arctic

2000 2001 2002 2003 2004

Year

upwelling longwave flux at TOA – arctic

2000 2001 2002 2003 2004

Year

2002 2003 2004

Year

total deposition rate of BC – arctic

2000 2001 2002 2003 2004

Year

total deposition rate of S – arctic

20002001200220032004

Year

load

of so4 - arctic

2000 2001 2002 2003 2004

Year

2000 2001

2002 2003 2004

Year

CESM1

CAM-ATRAS

upwelling clear-sky shortway flux at TOA - arctic

2 26-19

9 16-20

5e-02

0e+00

-5e-02

0e+00

-5e-02

-1e-01

3 1e-15

2.2e-15

1.3e-15

3.5e-16

2000 2001

rlut (Wm-2)

rsutcs (W m-

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

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

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

0e+00

-2e-08

-4e-08

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

2e-03

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