shp-ind-shift: absolute difference surface flux of BC – arctic surface flux of SO2 – arctic surface concentration surface concentration of SO4 – arctic surface concentration of SO2 – arctic 4 20-19 1 20-15 0.0e+00 0e+00 əmiso2 (kg m $^{-2}$ s $^{-1}$ nmrbc (kg kg – 1) 3.0e-19 (kg kg – 1) \$ ķď 0e+00 1.8e-19 6.0e-20 -5 0e-15 -9.0e-11 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 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 incident shortwave flux at TOA – arctic upwelling clear-sky longwa flux at TOA - arctic 2e-01 5.0e-02 $rsut (W m^{-2})$ rlutcs (W m-2) sut (W m-2)rsdt (W m-2) 2.5e-02 2.5e-02 0e+00 0.0e+000.0e+00 -1e-01 rlut + 1 -1e-01 0e+00 -2e-01 -2e-01 _5 0e_02 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 dry deposition rate of BC – arctic wet deposition rate of BC – arctic rsutcs (W m⁻²) at TOA - arctic rlutcs + rsutcs (W m⁻²) 1e-01 vetbc (kg m^{-2} s⁻¹) 1.6e-16 drybc (kg m⁻² s⁻ 5e-02 5e-02 0e+00 rlutcs -0e+00 5.6e-17 -1e-01 -5e-02 -5e-02 rsut--1e-01 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 6 0e-16 5 4e-15 dryso4 (kg m⁻² s⁻¹. wetso4 (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$ wetso2 (kg ${\sf m}^{-2}\,{\sf s}^{-1}$ 2.3e-16 2.6e-15 5e-14 5.0e-03 -1.4e-16 2.5e-03 -5.1e-16 0.0e+00-6.0e 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 cloud cover total deposition rate of S – arctic Ice water path - arctic Dimethyl sulphide (DMS) mole fraction ambient aerosol optical thickness at 550nm – arctic percentage - arctic 3e-13 1e-01 8 clivi (kg m⁻²) mol mol expression cltc 1e-13 od550aeı 0e+00 0e+00 2e-03 -1e-13 -1e-0 0e+0020002001200220032004 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2000 2001 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 oadso2/emiso2 (days) loadso2 (kg m⁻²) 2e-08 oadbc $({\sf kg}\ {\sf m}^{-2})$ 1e-08 0e+00 0e+00 (dryso4 -1e-08 -6e-08 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2001 2002 2004 2000 2001 2002 2003 Year Year Year Year Year

CAM-ATRAS

CESM1

F3SM

GEOS

GFDI -FSM4

GISS modelE

NorESM2

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

rsutcs (W m-2)

drybc + wetbc (kg m⁻² s⁻¹)

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

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

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