arctic: percent difference surface flux surface flux surface concentration surface concentration surface concentration of BC - high-so4 of SO2 - high-so4 of BC - high-so4 of SO4 - high-so4 of SO2 - high-so4 00+00 2e-04 -4e+00 2.0e+00 4e+01 -1e+00 1.5e + 0.0mmrs04 ∆ emibc \_2e+00 0e+00 1.0e+00 -6e+00 2e+0 5.0e-01 -2e-04 -4e+00 -7e+00 -5e+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 upwelling longwave flux at TOA – high–so4 upwelling shortwave flux at TOA – high–so4 upwelling clear–sky longwav flux at TOA – high–so4 net radiative flux incident shortwave flux at TOA - high-so4 at TOA - high-so4 4e-02 2e-07 7.5e-01 4e-02 1e-07 ∆ rlut 5.0e ∆ rlut + 2.56 0e+00 0e+00 0.0e+00 0.0e+00 \_1e\_07 -8e-02 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 Year Year Year upwelling clear–sky shortway flux at TOA – high–so4 clear-sky net radiative flux at TOA - high-so4 dry deposition rate of BC – high–so4 wet deposition rate of BC – high–so4 implied cloud response at TOA - high-so4 rsutcs) 4e+00 2e-01 1e+00 rsutce 3e+00 1e-01 ∆ rlutcs + 0e+00 0e+00 rsut 0e+00 0.0e+00 -1e-01 -1e-01 (rlut -5e-01 2002 2003 2004 2002 2003 2004 2000 2001 2002 2003 2004 2002 2003 2004 2002 2003 2004 2000 2001 2000 2001 2000 2001 2000 2001 total deposition rate of BC – high–so4 wet deposition rate of SO2 – high–so4 dry deposition rate dry deposition rate wet deposition rate of SO4 – high–so4 of SO2 - high-so4 of SO4 - high-so4 -3e+00 -3e+002.0e+0° 7.5e+00 ∆ drybc + wetbc 4e+00 -4e+00 3e+00 wetso2 1.0e+01 2 50+00 -60+00 0e+00 -7e+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  $\frac{1}{3} dryso2 + wetso2)/2 + \frac{1}{3} dryso4 + wetso4)/3$ total deposition rate ambient aerosol optical total cloud cover - high-soconvective cloud cover - highsurface cloud cover - high-so of S - high-so4 thickness at 550nm - high-s 4e+00 1.5e+00 0e+00 1e+01 1.0e+00 ∆ od550ae ㅎ ا کا کا -2e+01 2e-01 5e+00 5.0e-01 0e+00 0e+00 0e+00 -2e-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 ice water path - high-so4 column mass burden column mass burden column mass burden surface concentration of DMS - high-so4 of BC - high-so4 of SO2 - high-so4 of SO4 - high-so4 8e-01 4e+00 4e-01 1.0e+012e+01 ∆ clivi  $\Delta$  dms 2e+00 5 0e+00 0e+00 0.0e+00 0e+00 -4e-01 -5.0e+00 -2e+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 CAM5 E3SM **GISS** OsloCTM3 CESM1 **GEOS** MIROC **UKESM** 

CESM2

**GFDL** 

NorESM2