so2-at-height: percent difference surface flux of BC – arctic surface flux of SO2 – arctic surface concentration surface concentration of SO4 – arctic surface concentration of SO2 – arctic 1e-04% 0% 20% 5e-05% 0% -20% -5% 15% ∆ emiso2 ∆ mmrbc ∆ mmrso4 ∆ emibc 0% $\Delta so2$ 10% -10% -60% -0.00015% 2001 2002 2003 2001 2002 2003 2001 2002 2003 2001 2002 2003 2004 2001 2002 2003 Year Year Year Year Year net radiative flux at TOA – arctic clear–sky longwave flux at TOA – arctic longwave flux at TOA shortwave flux at TOA incident shortwave flux at TOA - arctic arctic arctic 0.6% 0.6% 2e-08% 0% Δ (rlut + rsut) 0.4% 0% ∆ rsdt ∆ rsut -0.02% 0.2% -2e-08% -0.04% -0.04% 0% -0.06% -4e-08% 2001 2003 2001 2003 2003 2001 2002 2003 2004 2002 2003 Year Year Year Year Year clear-sky shortwaveflux clear-sky net radiative implied cloud response dry deposition rate wet deposition rate at TOA - arctic flux at TOA - arctic at TOA - arctic of BC - arctic of BC - arctic 0.6% 0.5% 0.2% Δ (rlut + rsut - rlutcs - rsutcs) 0.6% 0.4% 0.5% Δ (rlutcs + rsutcs) 0% 0.2% ∆ rsutcs 0.4% △ wetbc △ drybc 0% 0.2% -0.2% -1.5% 0% -0.4% 2003 2001 2003 2001 2003 2001 2002 2001 2003 2001 2003 Year Year Year Year Year wet deposition rate of SO4 – arctic total deposition rate dry deposition rate wet deposition rate dry deposition rate of BC - arctic of SO2 - arctic of SO2 - arctic of SO4 - arctic 80% 25% 0.5% 30% ∆ (drybc + wetbc) 60% 20% 0% ∆ wetso2 ∆ dryso4 ∆ wetso4 -0.5% 40% 20% -20% -1% 10% 15% -30% 20% -1.5%-40% 0% 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2004 Year total deposition rate of S – arctic ambient aerosol optical $\Delta \left(\text{dryso2} + \text{wetso2} \right) / 2 + \left(\text{dryso4} + \text{wetso4} \right) / 3$ total cloud cover convective cloud cover percentage - arctic percentage - arctic 20% 2e+36% 0% 1.5e+36% ∆ od550aer 1e+36% -20% 0% 10% 5e+35% -0.2%0% 2002 2003 2002 2003 2001 2003 2004 2001 2002 2004 2004 2001 2002 2003 2004 2001 Year Year Year Year

CFSM1

E3SM

GFOS

GISS

MIROC

NorESM2

OsloCTM3

UKESM