so2-at-height: percent difference surface flux of BC – land surface flux of SO2 – land surface concentration of BC – land surface concentration of SO4 – land surface concentration of SO2 – land 2e-05% -20% -30% 3% 1e-05% 20% ∆ mmrso4 ∆ mmrbc $\Delta so2$ 2% -50% 10% 0% -60% 0% -70% 0% 2001 2002 2003 2001 2002 2003 2004 2001 2002 2003 2001 2002 2003 2001 2002 2003 Year Year Year Year Year net radiative flux at TOA – land clear-sky longwave flux at TOA - land longwave flux at TOA shortwave flux at TOA incident shortwave flux at TOA - land land land 0% 0.05% 0.4% 1e-08% 0.025% 0.3% -0.02% ∆ (rlut + rsut) ∆ rlut ∆ rsdt 0.2% 0.2% 0% -0.04% 0.1% -0.025% -1e-08% -0.069 0% 2003 2001 2002 2003 2003 2002 2003 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 - land flux at TOA - land at TOA - land of BC - land of BC - land 1% (rlut + rsut - rlutcs - rsutcs) 0% 0.5% 0.9% Δ (rlutcs + rsutcs) 0.75% -0.2% ∆ rsutcs △ wetbc 0.25% △ drybc 0.6% 0.5% -0.25% -0.4% 0.3% 0.25% -0.5% -0.25%0% 0% -0.75% 2003 2003 2003 2001 2001 2001 2001 2003 2001 2002 2003 Year Year Year Year Year total deposition rate dry deposition rate wet deposition rate dry deposition rate wet deposition rate of BC - land of SO2 - land of SO2 – land of SO4 - land of SO4 – land 0.2% 0.1% ∆ (drybc + wetbc) -30% 30% 20% ∆ dryso2 ∆ wetso2 ∆ dryso4 ∆ wetso4 0% 20% -40% 20% 10% -0.1%10% -50% -0.2%2001 2002 2003 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2004 2001 2002 2003 2004 Year Year total deposition rate of S – land convective cloud cover $\Delta \left(\text{dryso2} + \text{wetso2} \right) / 2 + \left(\text{dryso4} + \text{wetso4} \right) / 3$ ambient aerosol optical total cloud cover thickness at 550nm - land percentage - land percentage - land 2e+36% 20% 0.1% 1.5e+36% 0% 10% ∆ od550aer 1e+36% -0.1% 0% 5e+35% -50% -0.2% -10% 0% -0.3% 2002 2002 2003 2003 2001 2003 2004 2002 2003 2004 2004 2001 2002 2004 2001 2001 Year Year Year Year OsloCTM3 CFSM1 **GFOS** MIROC

E3SM

GISS

NorESM2

UKESM