NH-sea: percent difference upwelling longwave flux at TOA – so2–no–season surface flux surface flux surface concentration surface concentration surface concentration of BC - so2-no-season of SO2 - so2-no-season of BC - so2-no-season of SO4 - so2-no-season of SO2 - so2-no-season 0.00+00 0e+00 4e-02 -1e+00 0e+00 1.0e+00 -2e+00 0e+00 0e+00 -5.0e-03 5.0e-01 -3e+00-5e-01 0.0e+00 -4e+00 -4e-02 -7.5e-03 -6e-02 -5.0e-01 2003 2002 2003 2000 2001 2002 2004 2000 2001 2003 2004 2000 2001 2002 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 2000 2001 2002 2003 2004 Year Year Year upwelling shortwave flux at TOA – so2–no–season incident shortwave flux at TOA – so2–no–season upwelling clear-sky longwave flux at TOA - so2-no-season upwelling clear–sky shortwave flux at TOA – so2–no–season clear–sky net radiative flux at TOA – so2–no–season net radiative flux at TOA - so2-no-season 6e-01 5e-08 4e-0 ths 4e-01 √ 2e-01 4e-01 4e-01 0e+00 2.5e-01 2e-01 0e+00 0.0e + 0.02003 2001 2000 2001 2003 2002 2003 2002 2003 Year Year Year Year Year Year dry deposition rate of SO2 – so2–no–season implied cloud response dry deposition rate wet deposition rate total deposition rate wet deposition rate of BC - so2-no-season at TOA - so2-no-season of BC - so2-no-season of BC - so2-no-season of SO2 - so2-no-season rlutcs - rsutcs) 1e+00 5.0e-01 5e-02 56_01 _1e+00 ∆ dryso2 0e+00 0.0e+0.0drybc+ ∆ (rlut + rsut – _5e_02 _2e+00 -3e+00 2002 2002 2003 2002 2003 2004 2003 2004 2003 2004 2001 2004 2000 2001 2004 2000 2001 2000 2001 2002 2000 2001 2002 2003 2004 2000 2001 2000 2002 2003 Year Year Year Year ambient aerosol optical dry deposition rate wet deposition rate total deposition rate total cloud cover - so2-no-seasor convective cloud cover - so2-no-sea of SO4 – so2–no–season thickness at 550nm - so2-no-seas of SO4 - so2-no-season of S - so2-no-season dryso2 + wetso2)/2 + (dryso4)1e-0 -1e+00-2e+011e-01 Δ cltc 0e+00 -4e+01 -3e+00 0e+00 -1e-01 -3e-0 -4e+00 -6e+0 -1e-01 -2e-0 -1e+00-5e+00 -6e-0 -8e+01 2000 2001 2002 2003 2000 2002 2000 2001 2002 2003 2004 2000 2001 2002 2003 2000 2001 2002 2003 2000 2001 2002 2003 Year Year Year Year Year Year surface cloud cover - so2-no-seaso ice water path - so2-no-season surface concentration column mass burden column mass burden column mass burden of DMS - so2-no-season of BC - so2-no-season of SO2 - so2-no-season of SO4 - so2-no-season 1e+00 5.0e-0.05e-0 1.0e+01 5e-01 2.5e-0 1e-01 dms 7.5e + 000.0e+00 0e+00 0e+00 5.0e+00 -1e-01 -2 5e-0 -2e-01 -5e-0 -2.5e+00-5.0e-01 0.0e+00 -1e+00 2000 2001 2002 2003 2000 2002 2003 2004 2000 2001 2002 2003 2002 2003 2001 2002 2003 2000 2001 2002 2003 2004 2004 2001 2004 2000 2001 2000 2004 2004 Year Year Year Year SO4 lifetime - so2-no-season SO2 timescale - so2-no-season ∆ loadso4/(dryso4 + wetso4) 0.0e+00 loadso2/emiso2 -2.5e+02 -1e+02 -5.0e+02 -2e+02 -1.0e+032000 2001 2002 2003 2000 2001 2002 2003 Year Year CAM5 E3SM GISS OsloCTM3 - UKESM - CESM1 -GEOS - MIROC

CESM2

-GFDL

NorESM2