Reference - absolute NH-land averages surface concentration of BC – NH–land surface flux of BC – NH–land surface flux of SO2 – NH–land surface concentration of SO4 – NH–land surface concentration of SO2 – NH–land 1.9e-12 $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$ emiso2 $(kg m^{-2} s^{-1})$ 1.8e-12 mmrbc (kg kg⁻¹ mmrso4 (kg kg so2 (kg kg⁻¹ 2e-09 1 6e-12 2001 2002 2003 2001 2002 2003 2001 2003 2001 2002 2003 2001 2002 2003 Year Year Year Year Year longwave flux at TOA -NH-land shortwave flux at TOA -NH-land net radiative flux at TOA –NH–land incident shortwave flux at TOA – NH–land clear-sky longwave flux at TOA - NH-land 323.0 322.5 -342 rlut + rsut $(W m^{-2})$ -108 rlutcs $(W m^{-2})$ rlut $(W m^{-2})$ $rsut (W m^{-2})$ $rsdt (W m^{-2})$ 322.0 -346 -257 -236 -350 -259 2001 2003 2001 2003 2001 2003 2001 2003 2001 2002 2003 Year Year Year Year Year dry deposition rate of BC – NH–land wet deposition rate of BC - NH-land clear-sky shortwave clear-sky net radiative implied cloud response flux at TOA - NH-land flux at TÓA - NH-land at TOA - NH-land rlut + rsut - rlutcs - rsutcs (W m-2) -320 1.25e-12 rlutcs + rsutcs (W m^{-2}) $drybc (kg m^{-2} s^{-1})$ wetbc $(kg m^{-2} s^{-1})$ -325 $\rm rsutcs \, (W \, m^{-2})$ 1.00e-12 -20 -330 7.50e--25 -335 -30 -80 2003 2003 2003 2001 2003 2001 2001 2002 2003 2001 2001 2002 Year Year Year Year Year total deposition rate of BC – NH–land dry deposition rate of SO4 – NH–land wet deposition rate of SO4 – NH–land dry deposition rate wet deposition rate of SO2 - NH-land of SO2 - NH-land 1.6e-12 $drybc + wetbc (kg m^{-2} s^{-1})$ $dryso2 (kg m^{-2} s^{-1})$ wetso2 $(kg m^{-2} s^{-1})$ wetso4 $(kg m^{-2} s^{-1})$ $dryso4 (kg m^{-2} s^{-1})$ 3.0e-12 1.2e-12 1 0e-12 6.0e-12 2001 2002 2003 2004 2001 2002 2003 2001 2002 2003 2004 2001 2002 2003 2001 2002 2003 Year total deposition rate of S – NH–land ambient aerosol optical convective cloud cover total cloud cover (dryso2 + wetso2)/2 + (dryso4 + wetso4)/3thickness at 550nm - NH-land percentage - NH-land 60 0.25 $(kg m^{-2} s^{-1})$ od550aer clt (%) 8 cltc 1.00e-11 0 2001 2002 2003 2004 2003 2004 2002 2003 2002 2003 2001 2002 2004 2001 2004 2001 Year Year Year Year OsloCTM3 CFSM1 F3SM **GFDI** MIROC

CESM2

GEOS

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