land: absolute difference surface flux of BC – bc–no–season surface flux of SO2 – bc–no–season surface concentration surface concentration of SO4 – bc–no–season surface concentration of SO2 – bc–no–season 2.5e-12 0e+00 1.2e-10 mmrso4 (kg kg – 1) mmrbc (kg kg – 1) emiso2 (kg m⁻² s⁻ 0.0e + 00so2 (kg kg-1) -2 5e-12 -1e-09 0.00+00 2003 2003 2002 2003 2002 2003 2001 2002 2001 2002 2001 2001 Year Year Year Year upwelling longwave flux at TOA – bc–no–season upwelling shortwave flux at TOA – bc–no–season upwelling clear-sky longway flux at TOA - bc-no-seaso net radiative flux incident shortwave flux at TOA - bc-no-season at TOA - bc-no-season 7.5e-01 1.0e-07 rlut + rsut $(W m^{-2})$ 4e-01 rlutcs (W m-2) rsut(Wm-2)rsdt(Wm-2)5.0e-01 5.0e-08 -1e-01 2e-01 2.5e-01 0.0e+00 -2 5e-01 2003 2003 2003 2004 2001 2002 2001 2002 2001 2002 2001 2002 2003 Year Year Year Year upwelling clear-sky shortwav clear-sky net radiative implied cloud response dry deposition rate wet deposition rate flux at TOA - bc-no-seasor flux at TOA - bc-no-season at TOA - bc-no-season of BC - bc-no-season of BC - bc-no-season m^{-2} rsutcs (W 0.0e+00 rlutcs + rsutcs (W m^{-2} 2.7e-16 wetbc (kg $\mathrm{m}^{-2}\,\mathrm{s}^{-1}$) 6e-01 drybc (kg m $^{-2}$ s $^{-1}$) -5.0e-02 4e-01 4e-14 rlut + rsut - rlutcs 2e-01 0e+00 2004 2001 2002 2003 2001 2002 2003 2004 2002 2003 2002 2003 Year Year Year Year dry deposition rate of SO4 – bc–no–season wet deposition rate of SO4 – bc–no–season dry deposition rate wet deposition rate of BC - bc-no-season of SO2 - bc-no-season of SO2 - bc-no-season wetso2 $(kg m^{-2} s^{-1})$ $dryso2 (kg m^{-2} s^{-1})$ wetso4 (kg m $^{-2}$ s $^{-1}$) dryso4 (kg m^{-2} s⁻¹ 0e+00 1e-14 0e+00 -1e-14 2001 2003 2001 2003 2001 2002 2003 2003 Year Year convective cloud cover percentage – bc-no-season total deposition rate ambient aerosol optical total cloud cover of S - bc-no-seasor thickness at 550nm - bc-no-se percentage - bc-no-seaso 0.0e+00 0.0e + 0.0expression(clt~(%) 0e+00

-2.0e-01

GFDI

OsloCTM3

Year

MIROC

NorESM2

2003

Year

UKESM

GEOS

3.0e-15

3.4e-16

-9.9e-16

0e+00

-1e-01

8e-01

4e-01

0e+00

8e-14

4e-14

2e-14

0e+00

 $drybc + wetbc (kg m^{-2} s^{-1})$

(dryso2 + wetso2)/2 + (dryso4 + wetso4)/3

 $(kg m^{-2} s^{-1})$

0.0e+00

2001

2002

Year

total deposition rate

2003

2003

2001 2002 2003 2004

Year

-1.2e-01

2002

CESM1

E3SM

Year

2003

GISS

rsutcs (W m-2)

2001

2002

Year

2003

rlut (Wm-2)

2001 2002 2003

Year

 $\mathrm{emibc}\,(\mathrm{kg}\,\mathrm{m}^{-2}\,\mathrm{s}^{-1})$