



A comparison of the AeroCom hindcast emission inventory and the IPCC AR5 emission inventory for 1980-2000

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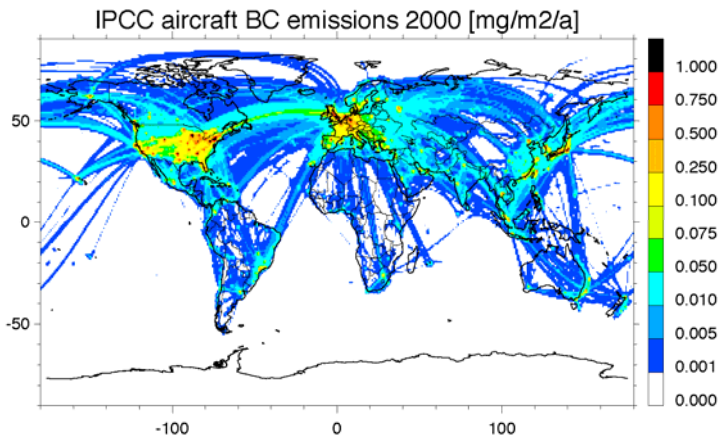
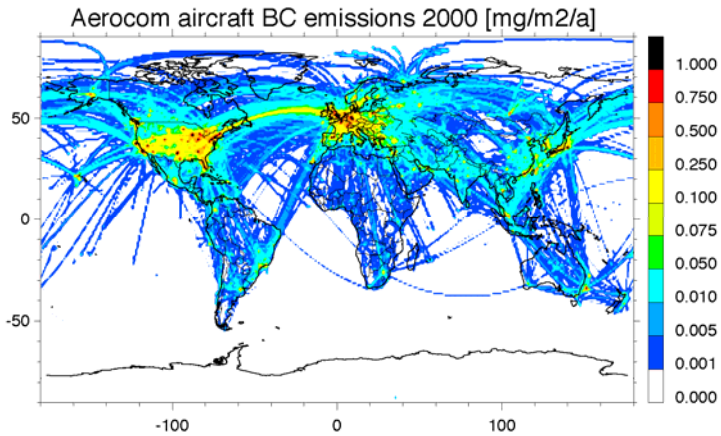
Background

- A number of hindcast experiments have been proposed by the AeroCom community (HCA-0, HCA-FIX, ...) for 1980-2007
- We compiled an emission inventory of black carbon (BC), organic carbon (OC), and SO₂ for these experiments and made it available via the AeroCom website (based on the input of many colleagues ...)
- Several groups have compiled hindcast emissions for the IPCC AR5, covering 1850 to 2000
- This presentation: comparing some of the features of these two datasets, specifically differences of the source strengths and trends

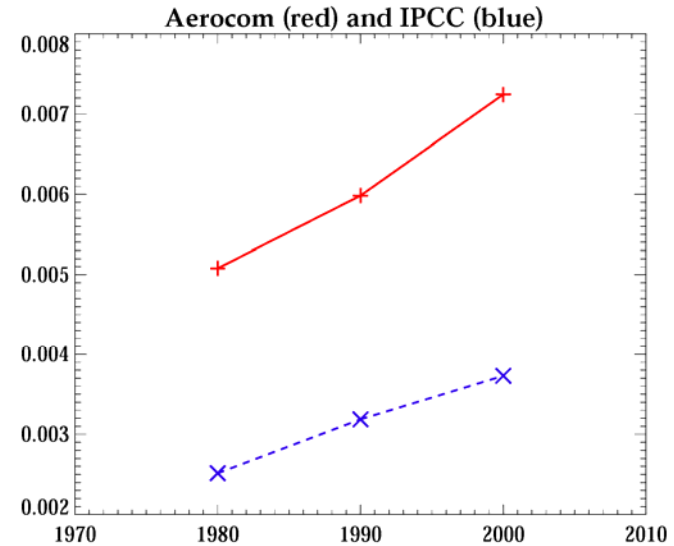
Overview of some general features

	IPCC AR5	AeroCom
Species	BC, OC, SO ₂ , NH ₃ , NMVOC, CO ₂ , + other trace gases	BC, OC, SO ₂
Spatial resolution	0.5x0.5 degrees	1.0x1.0 degrees
Temporal resolution	Decadal	Yearly (daily for volcanoes)
Seasonal Variation	Biomass burning (BB)	BB/Aircraft
Emission sectors	Anthrop., BB, ships, aviation [planned: biogenic, volcanic, oceanic, dust]	Anthrop., BB, ships, aviation, volcanic

Aircraft emissions



Global Emission of Aircraft BC [Tg/a]

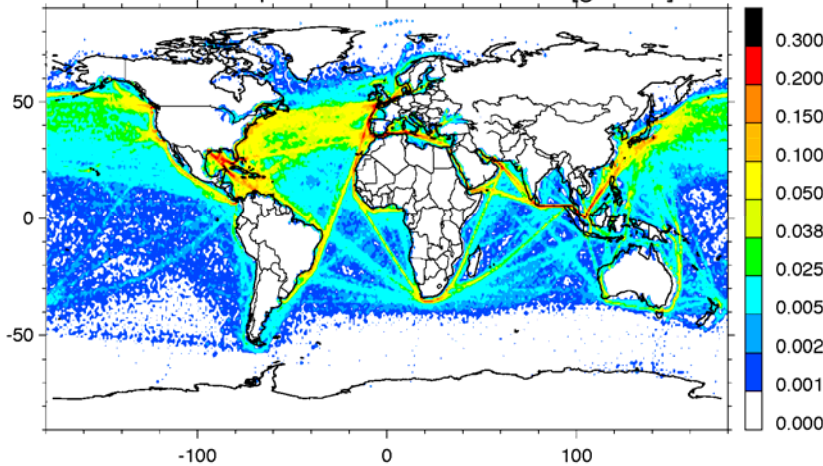


- AeroCom: based on NASA AEAP project
- IPCC: based on D. Lee et al. (2009)
- Impact of different emission factors
- No SO₂ provided by IPCC
- AeroCom: also non-scheduled air traffic

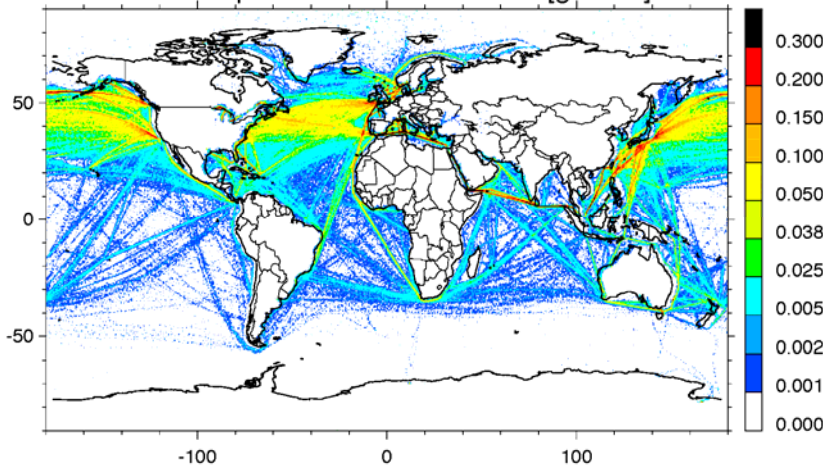
Emissions from international ship traffic



Aerocom ship sulfur emissions 2000 [g/m²/a]

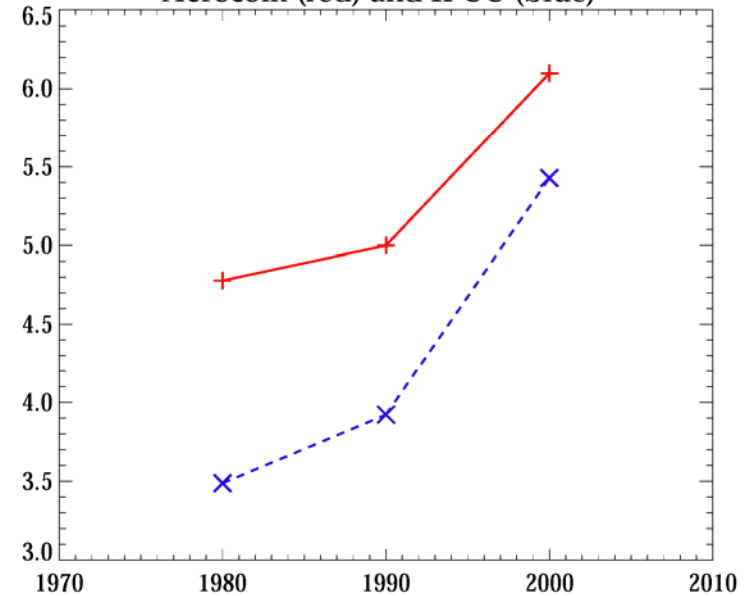


IPCC ship sulfur emissions 2000 [g/m²/a]



Global Emission of Ship S [Tg/a]

Aerocom (red) and IPCC (blue)

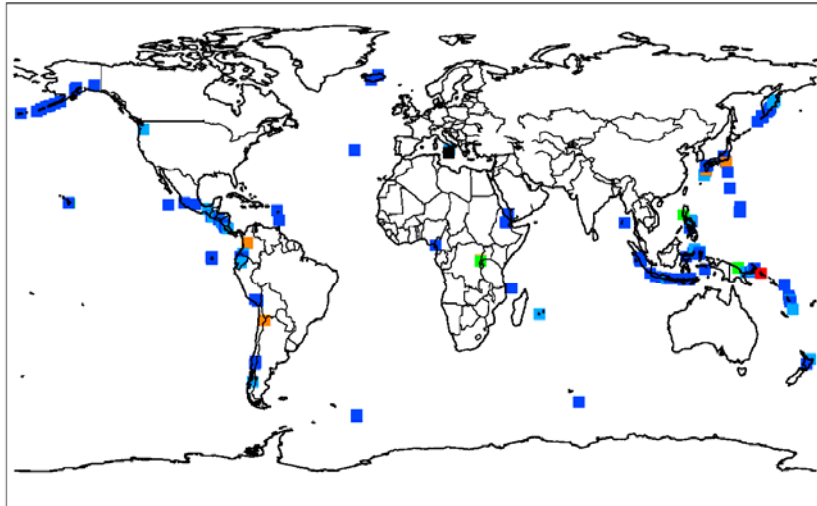


- Aerocom: based on Eyring (2005)
- IPCC: based on Eyring (2005, 2009), Endresen (2003), Wang (2007)

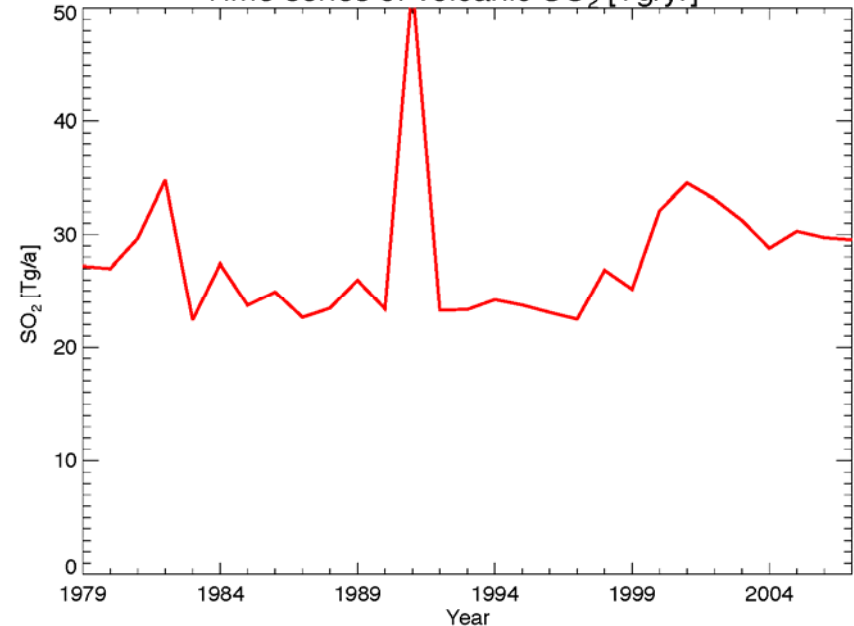
Volcanic emissions – only AeroCom



Emitted SO₂ during 1979-2007 [Tg]



Time series of volcanic SO₂ [Tg/yr]



- Base on the Smithsonian Institution's Global Volcanism Program, GEIA, TOMS, OMI, and COSPEC measurements
- Cloud column height is derived from the VEI or from measurements

Anthropogenic emissions

- AeroCom: BC and OC based on Streets (annual trend for 17 regions) and Bond (gridded emissions for 1996); SO₂ based on Streets and gridded emissions from the EDGAR 32FT2000 database
- IPCC: BC and OC from Bond/Liousse; SO₂ from Steve Smith; tables with regional emissions also available (for 24 IMAGE regions)
- Similar subsectors: Energy, Transport, Industry, Residential (incl. waste burning)

World regions used for anthropogenic emissions

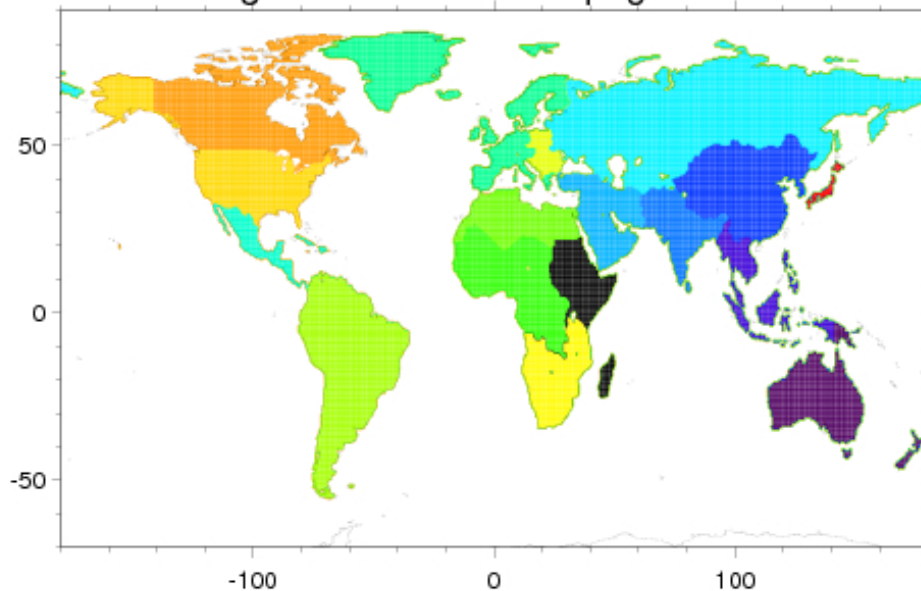
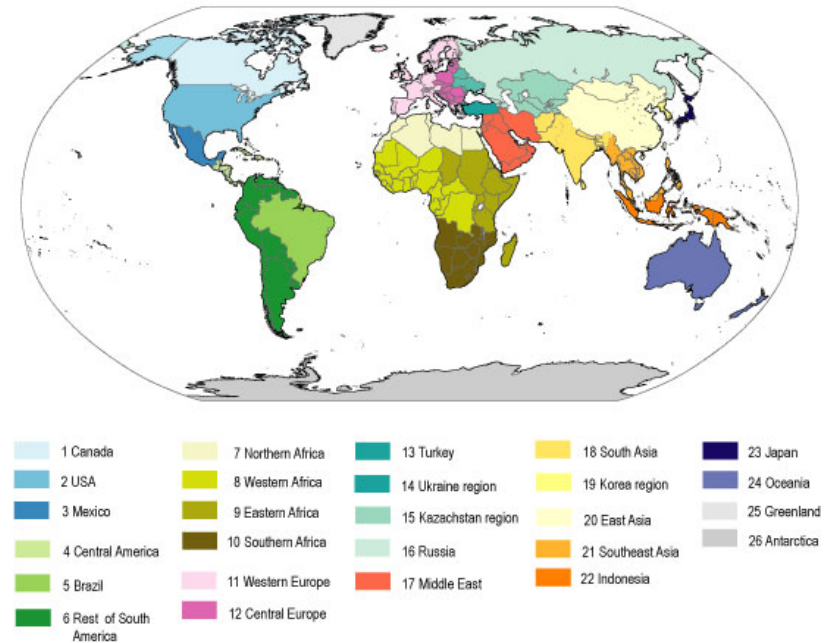
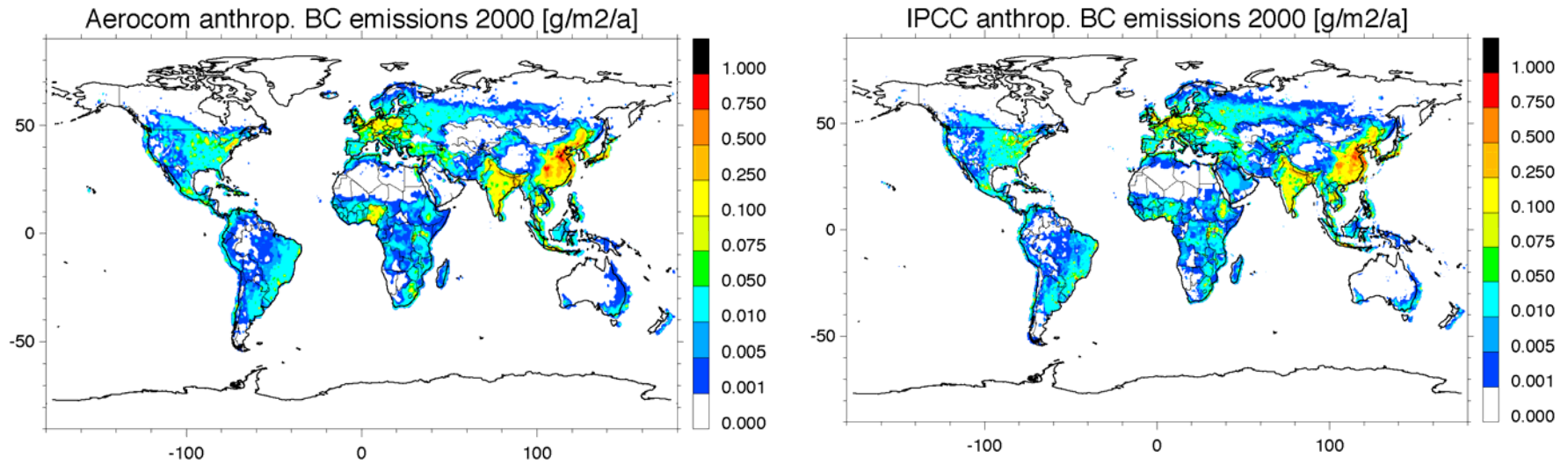


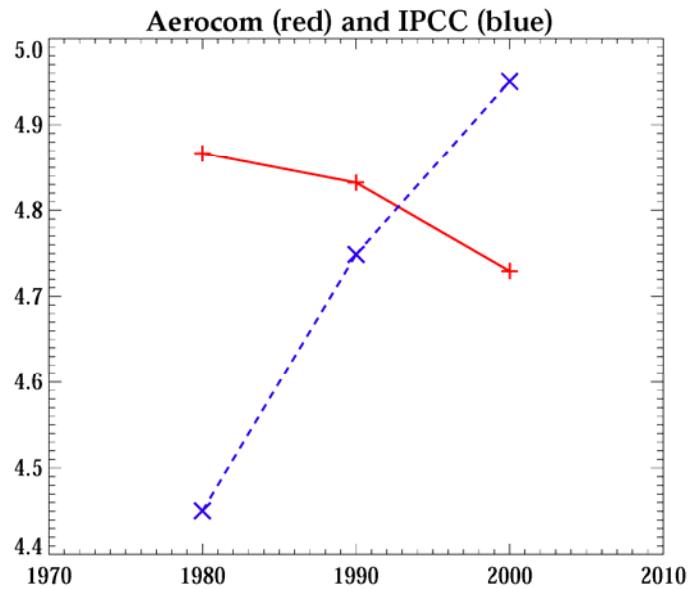
IMAGE regional breakdown



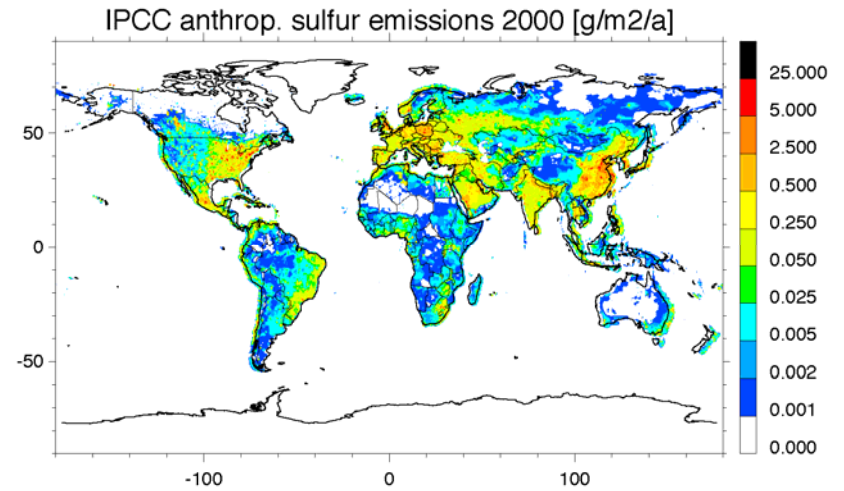
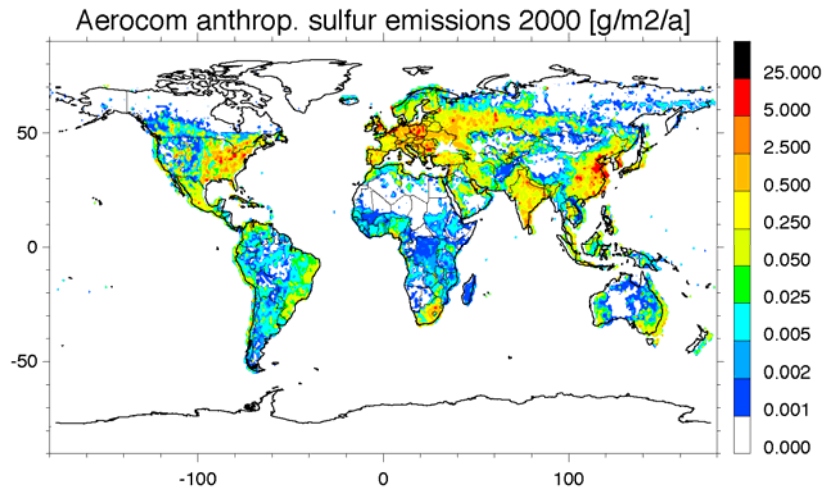
Anthropogenic BC emissions



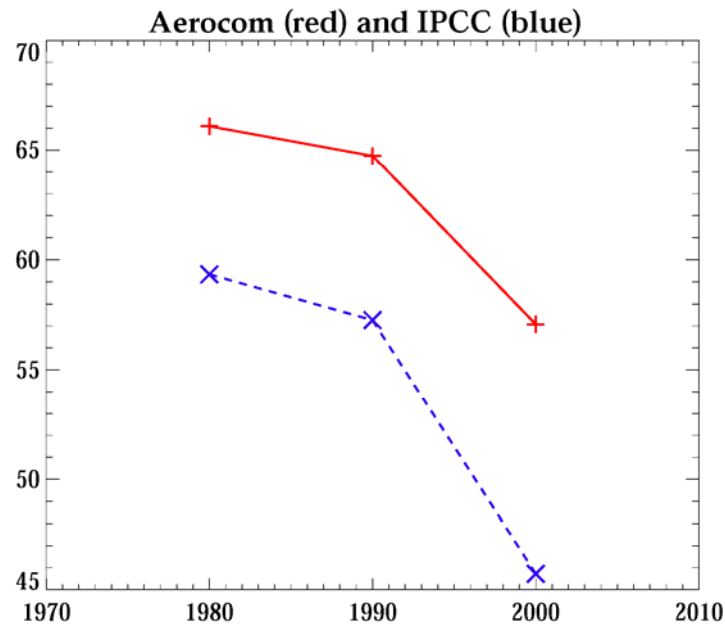
Global Emission of Anthropogenic BC [Tg/a]



Anthropogenic SO₂ emissions

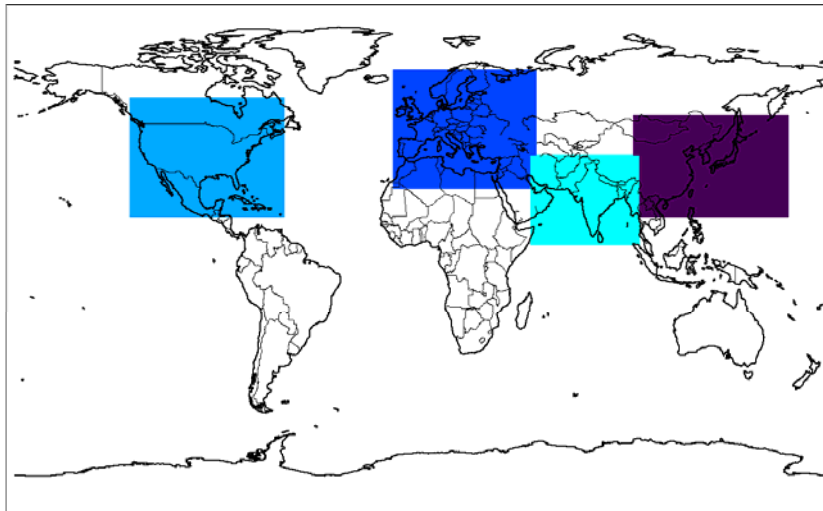


Global Emission of Anthropogenic S [Tg/a]

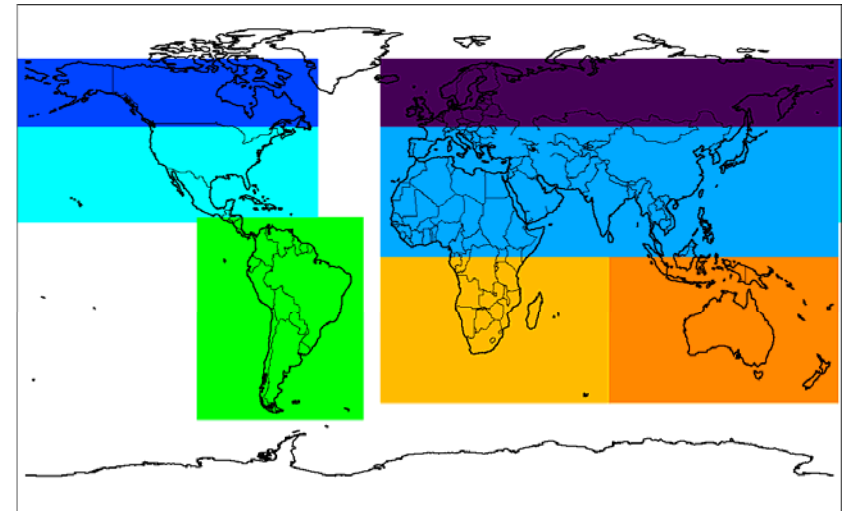


Regional emissions

Anthrop. emissions regions
Based on HTAP definitions

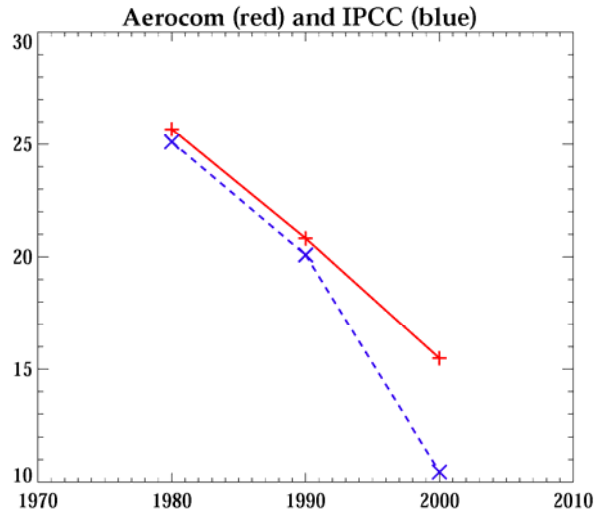


Biomass burning regions

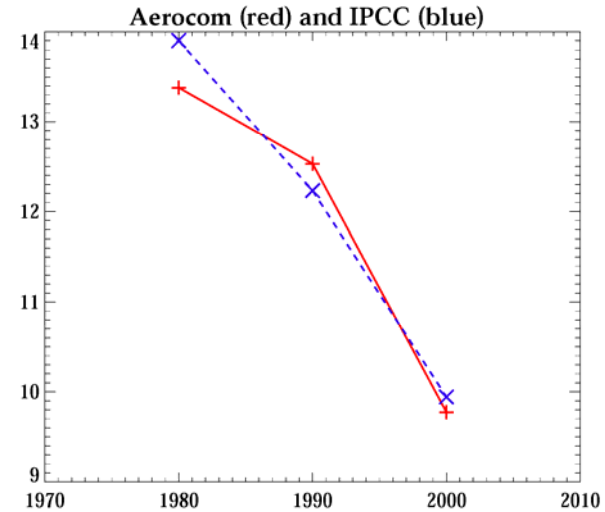


Regional anthropogenic emissions of SO₂

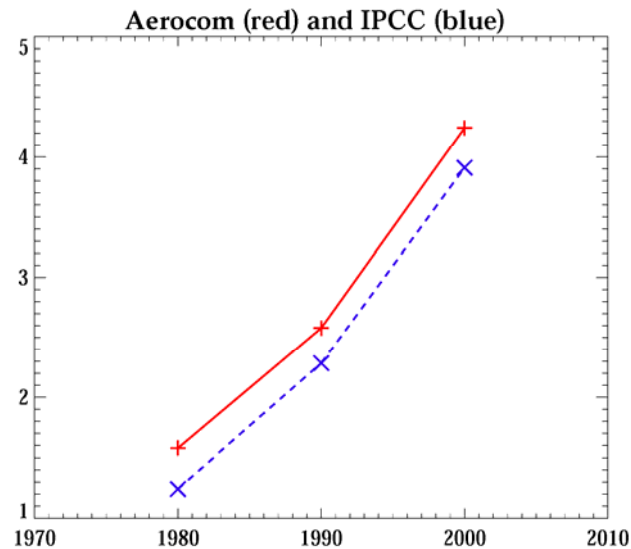
Emission of Anthropogenic S [Tg/a], Region: EU



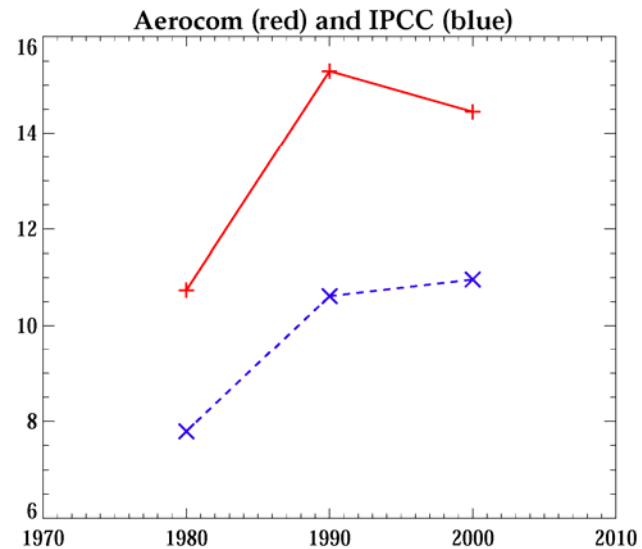
Emission of Anthropogenic S [Tg/a], Region: NA



Emission of Anthropogenic S [Tg/a], Region: SA

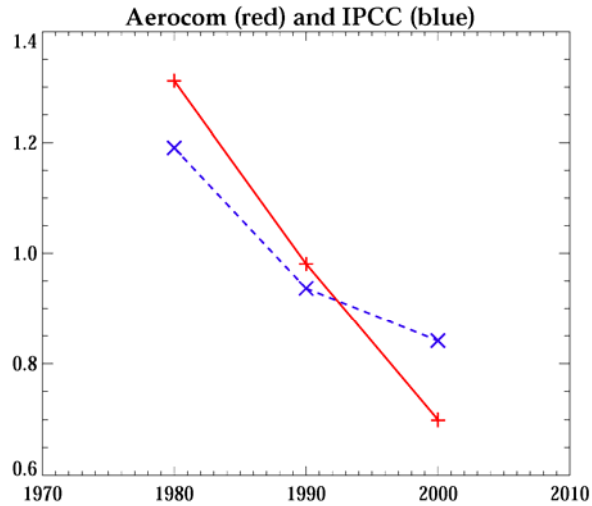


Emission of Anthropogenic S [Tg/a], Region: EA

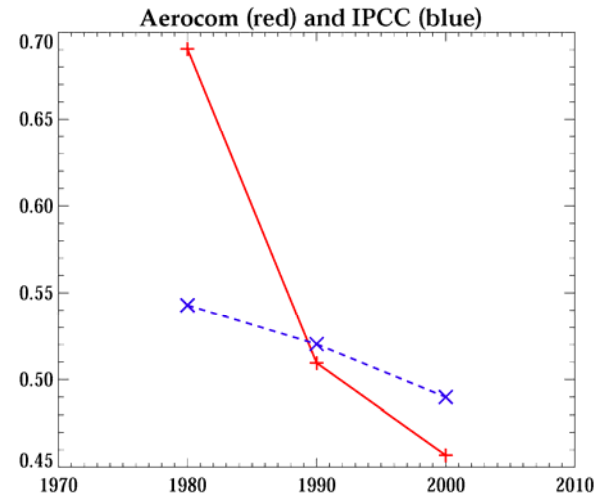


Regional anthropogenic emissions of BC

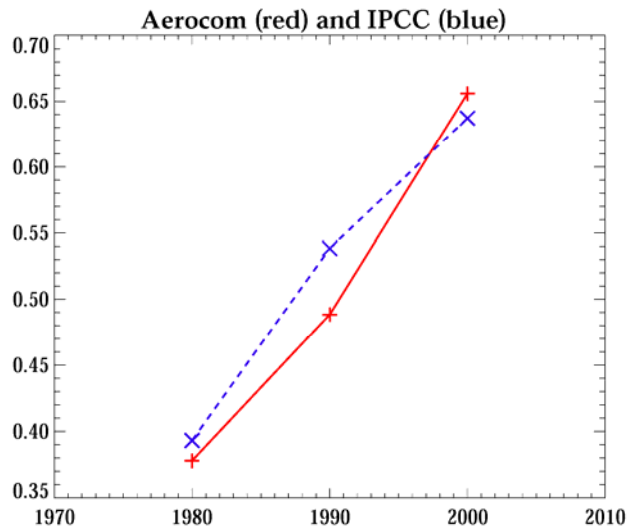
Emission of Anthropogenic BC [Tg/a], Region: EU



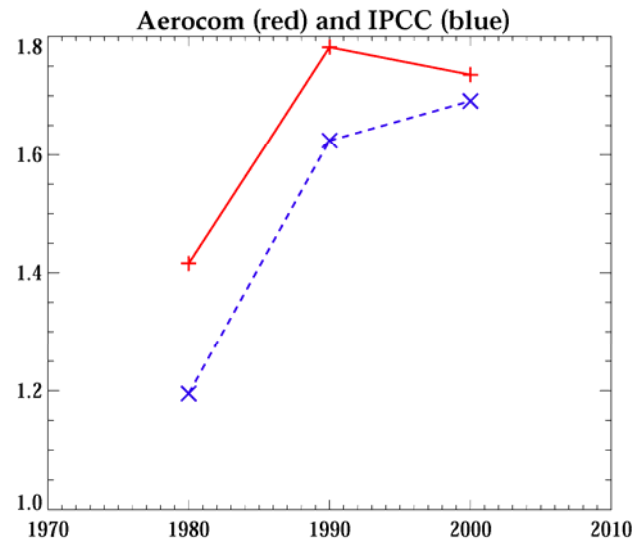
Emission of Anthropogenic BC [Tg/a], Region: NA



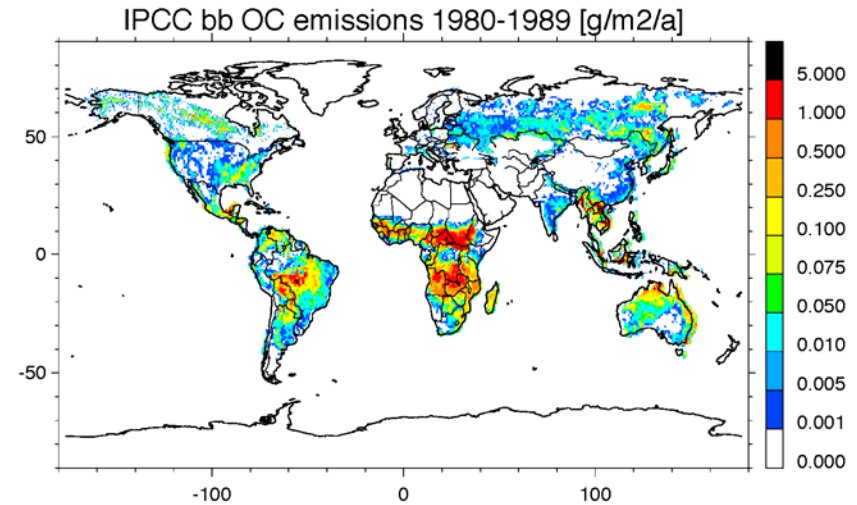
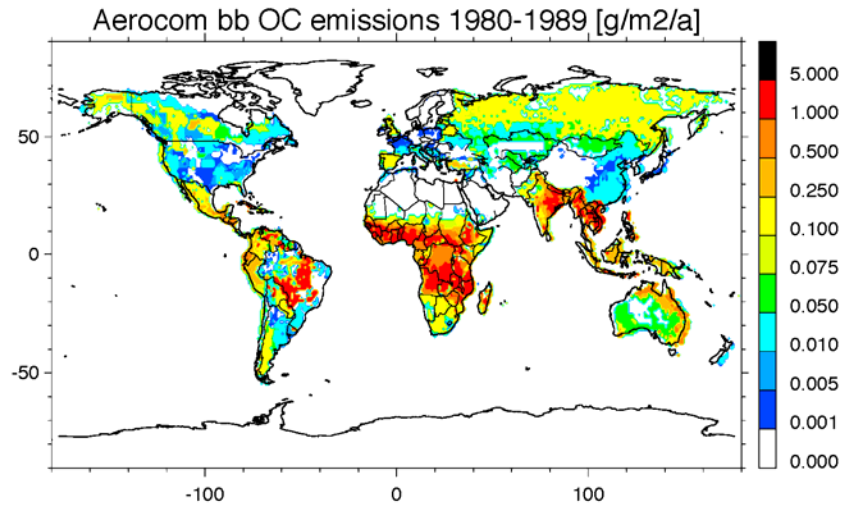
Emission of Anthropogenic BC [Tg/a], Region: SA



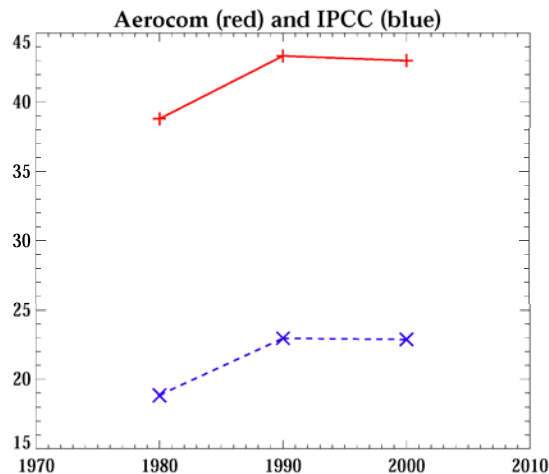
Emission of Anthropogenic BC [Tg/a], Region: EA



Biomass Burning Emissions



Global Emission of Biomass Burning OC [Tg/a]

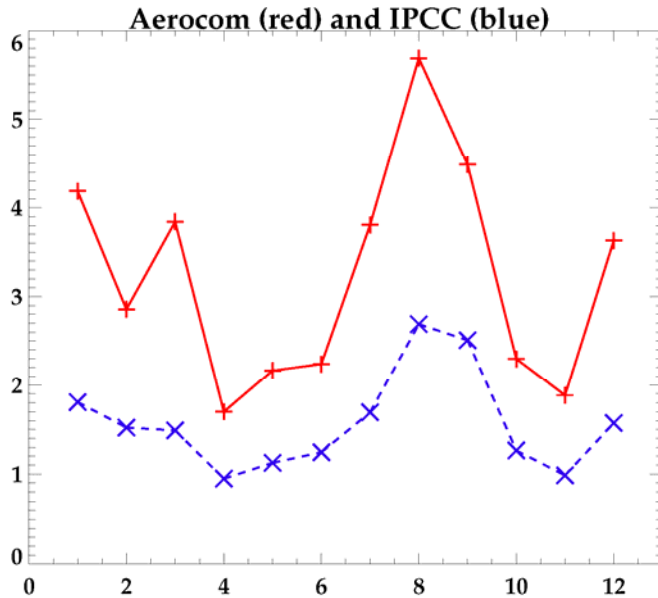


- Aerocom: based on Duncan (2003) for 1980-1996 and GFEDv2 for 1997-2007
- IPCC: based on RETRO for "1980" and "1990" and on GFEDv2 for "2000" (decadal averages)
- Different emission factors

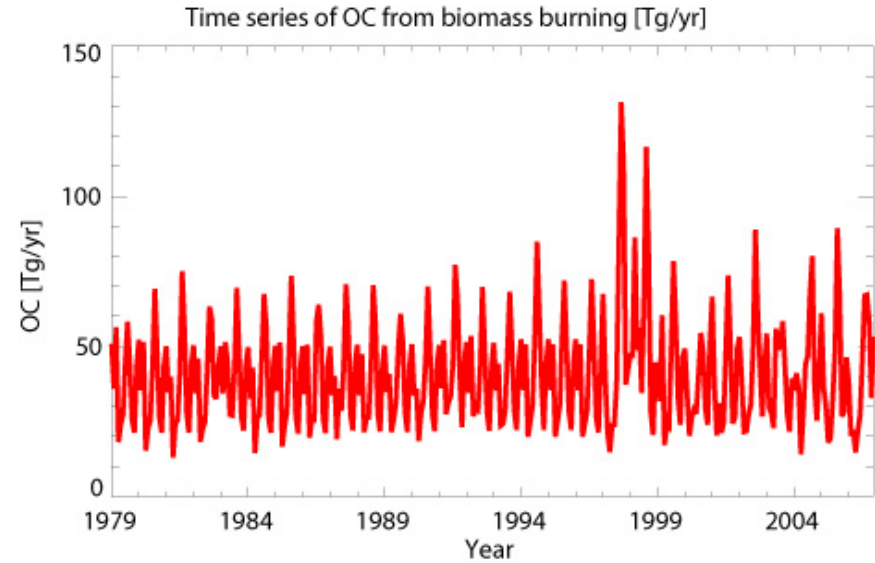
Biomass Burning Emissions (2)



Global Emission of OC from BB (1980-1989 mon. avg.) [Tg/a]



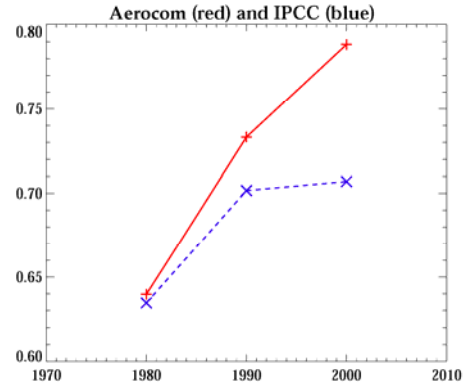
AeroCom time series



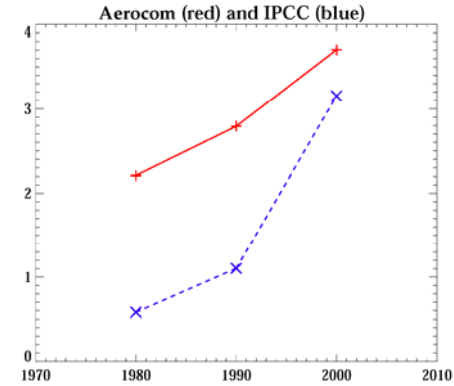
- Similar seasonal dependence
- Large individual events not captured in IPCC

Regional biomass burning emissions of OC

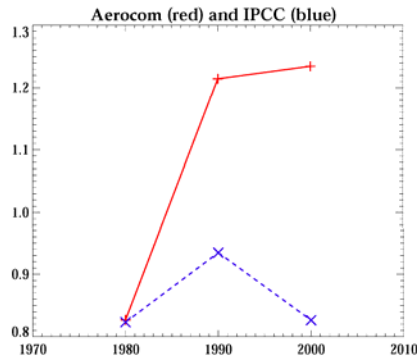
Emission of Biomass Burning OC [Tg/a], Region: BW



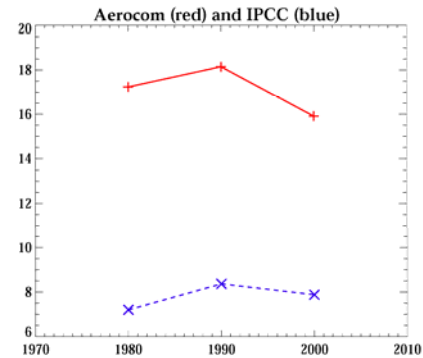
Emission of Biomass Burning OC [Tg/a], Region: BE



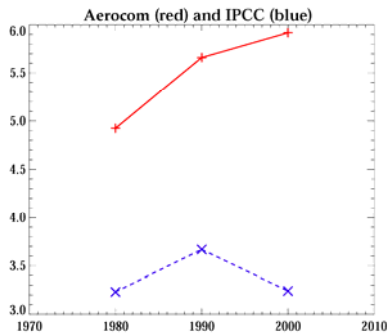
Emission of Biomass Burning OC [Tg/a], Region: NW



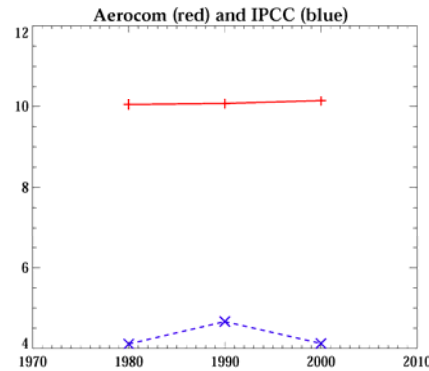
Emission of Biomass Burning OC [Tg/a], Region: NE



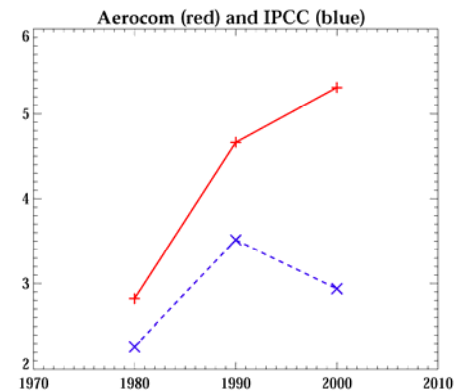
Emission of Biomass Burning OC [Tg/a], Region: SW



Emission of Biomass Burning OC [Tg/a], Region: SC



Emission of Biomass Burning OC [Tg/a], Region: SE



Summary

- Distribution patterns generally similar
- Global anthropogenic emissions similar for SO₂
- Relative large discrepancies for BB emissions

IPCC vs. AeroCom emissions:

- Lower temporal resolution
- Additional species available
- No volcanoes and no BB events resolved