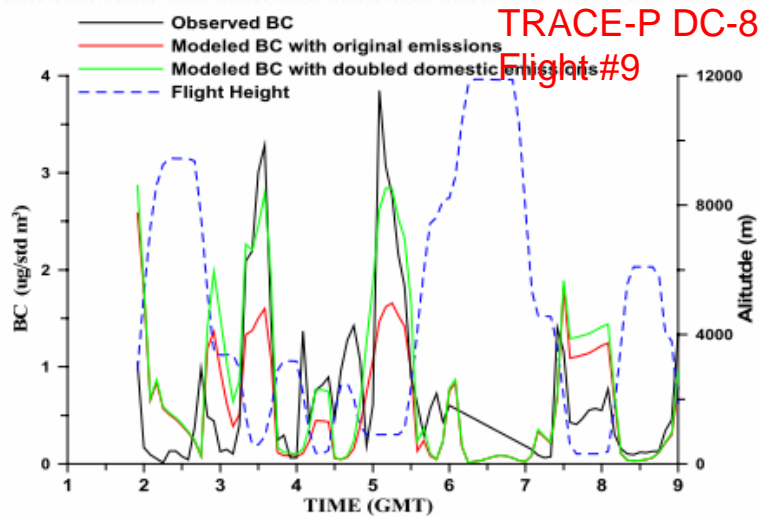# Emission inventory of BC in China: **Why we do it?**

Atmospheric BC in the area was underestimated!

Carmichael et al.,2003
Emission inventory: TRACE-P inventory (*Streets, 2001*)
Regional transport model: CFORS/STEM-2K1

Koch et al.,2008
Emission inventory: a global BC inventory (*Bond, 2004*)
Model: 17 AeroCom aerosol models

TRACE-P DC-8 Flight #9

Average model biases	N Am	Eur	Asia	S Am	Afr	Rest
Surface concentration	1.6	2.6	0.50	NA	NA	1.4
BC burden	0.42	0.58	0.64	0.42	0.64	0.40
AERONET AAOD	0.86	0.81	0.67	0.68	0.53	0.55
OMI AAOD	0.52	1.6	0.71	0.35	0.47	0.26

Ratio of modeled BC to observed BC

Similar results for the underestimation in the region were reported in other studies (*Uno,2003; Hakami,2003; Chung,2010; Kondo,2011*).

A high spatial resolution inventory was called for!

Emission inventory should be allocated to grids before input to the model.

Only nation/province –level emission inventory was available, **So** simple population proxy was used for gridding.

But population-based approach was discovered for the inherent biases,

Since assumption that the emission correlates with population was not justified (*Gurney,2009*).

Our estimated BC emission (2007): 2202 Gg (1382~3877 Gg as R_{50})

Vs
- ✓ 1342 Gg (1995) by Streets et al. (*Streets,2001*);
- ✓ 1489 Gg (1996) by Bond et al. (*Bond,2004*);
- ✓ 1499 Gg (2000) by Cao et al. (*Cao,2006*);
- ✓ 1811 Gg (2006) by Zhang et al. (*Zhang,2009*)

Reasons

- Update of the Emission Factors : mass of BC emitted per fuel consumed
  residential crop residues, motor vehicles, beehive coke production, et al.

Implications

- Underestimation of BC in the air will be reduced (*Hakami,2005*);
- Radiative forcing of BC in the region will be larger, warming more than 0.6 ℃ (*Ramanathan,2008*).

Shen,2010

High-resolution BC emission inventory in 2007 (also available for **2002, 2008**)

Stepwise spatial allocation process:

Using the method by Zhang et al. (*Zhang,2007*);

Province data=>county data=> 0.1°×0.1° gridded data

emission map by county in 2007

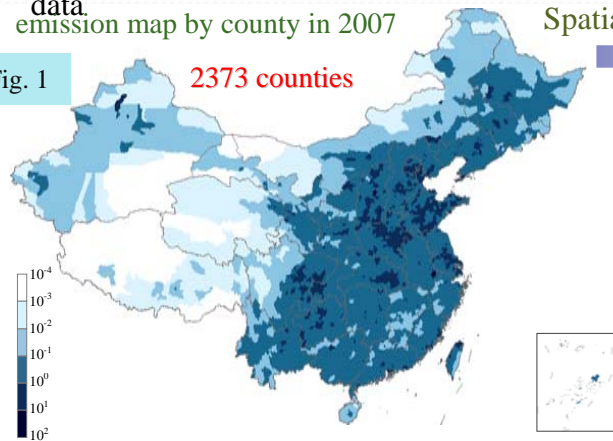Spatial allocation to 0.1°×0.1° grids

Fig. 1   2373 counties

using various proxies

- nation-level
- province-level
- county-level

Fig. 3

Fig. 4

Comparison

10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}

Unit: Mg/km² yr
10^2 10^1 10^0 10^{-1} 10^{-2} 10^{-3} 10^{-4}
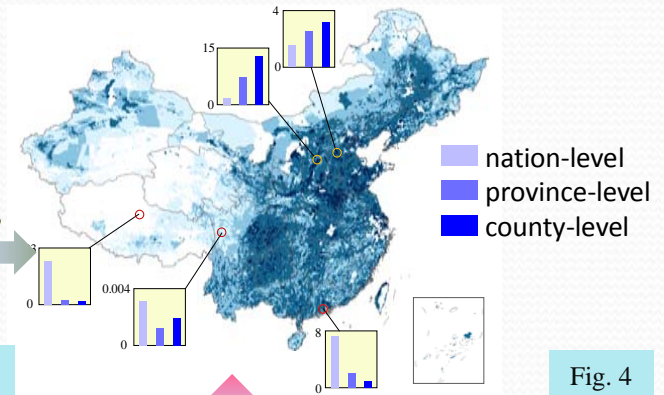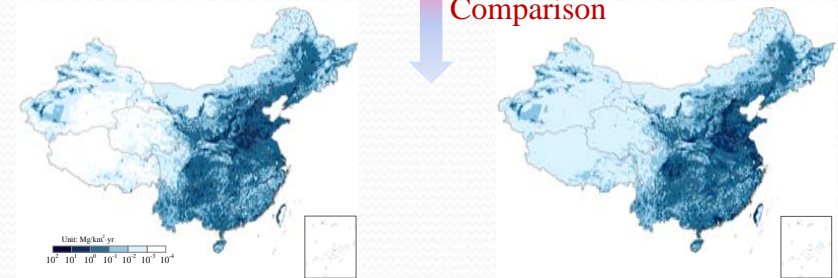
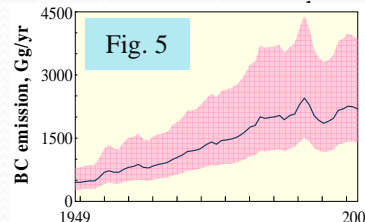Provincial data=>0.1°×0.1° gridded data

National data=>0.1°×0.1° gridded data

Time series of China BC emission from 1949 to 2007

Change of fuel consumptions.:

Variation of technologies:

Industrial boilers/control devices
Beehive coking/recovery battery coking
Residential chunk coal/briquette
Motor vehicles

Fig. 5

BC emission, Gg/yr
4500
3000
1500
0
1949   2007

A Question:

Which one first for climate mitigation in China, BC or CO_2?