



Recent perspectives on future SO₂, NO_x, and carbonaceous aerosols emissions in Asia

11th MICS meeting
IIASA, Laxenburg, 26 – 27th February 2009

Background – motivation

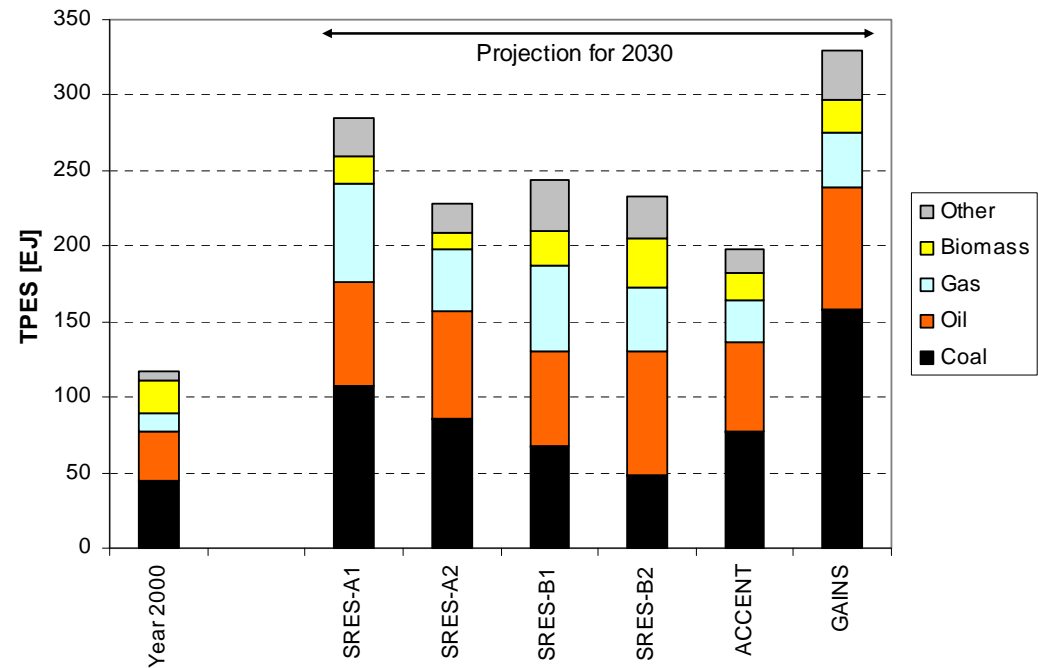
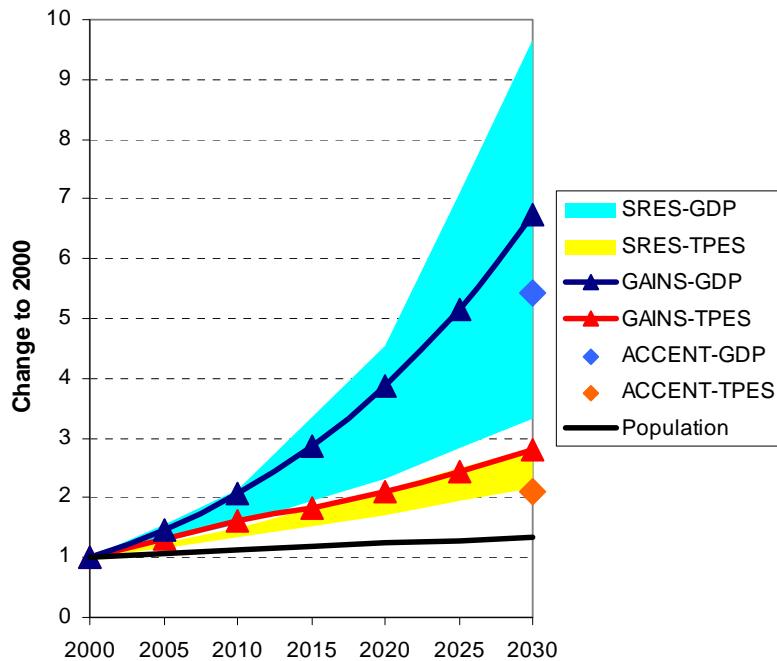


- **Following remote sensing work on NO₂, emission inventory community updated several inventories in the last years, also for other pollutants (SO₂, CO, BC, OC, CO₂, CH₄, NMVOC)**
- **IPCC SRES scenarios are still used in modelling work but contain dated projections**
- **Several new projections available, also for BC/OC**
- **Remote sensing community provides first assessments of SO₂ change over Asia**
- **GAINS-Asia project (collaboration between IIASA, ERI, Tsinghua, TERI, JRC) completed in 2008**

Comparison of macroeconomic assumptions

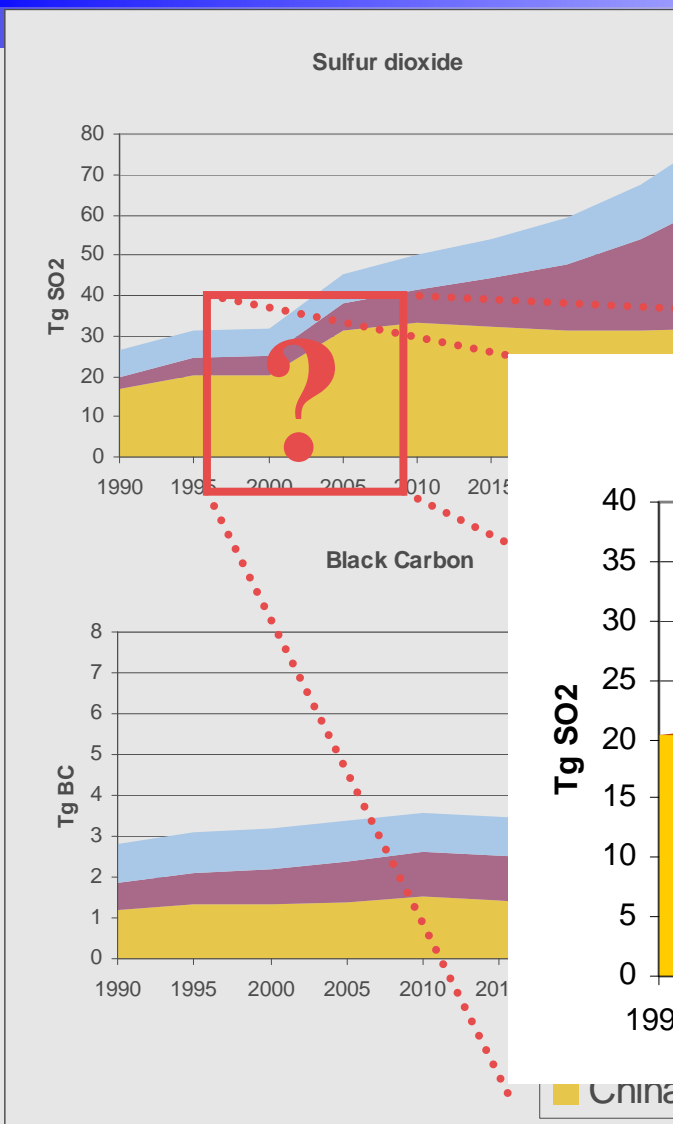


Assumptions on the growth of population, GDP, and total primary energy supply (TPES) in Asia (**LEFT**) and TPES in 2030 by fuel (**RIGHT**) for the compared scenarios

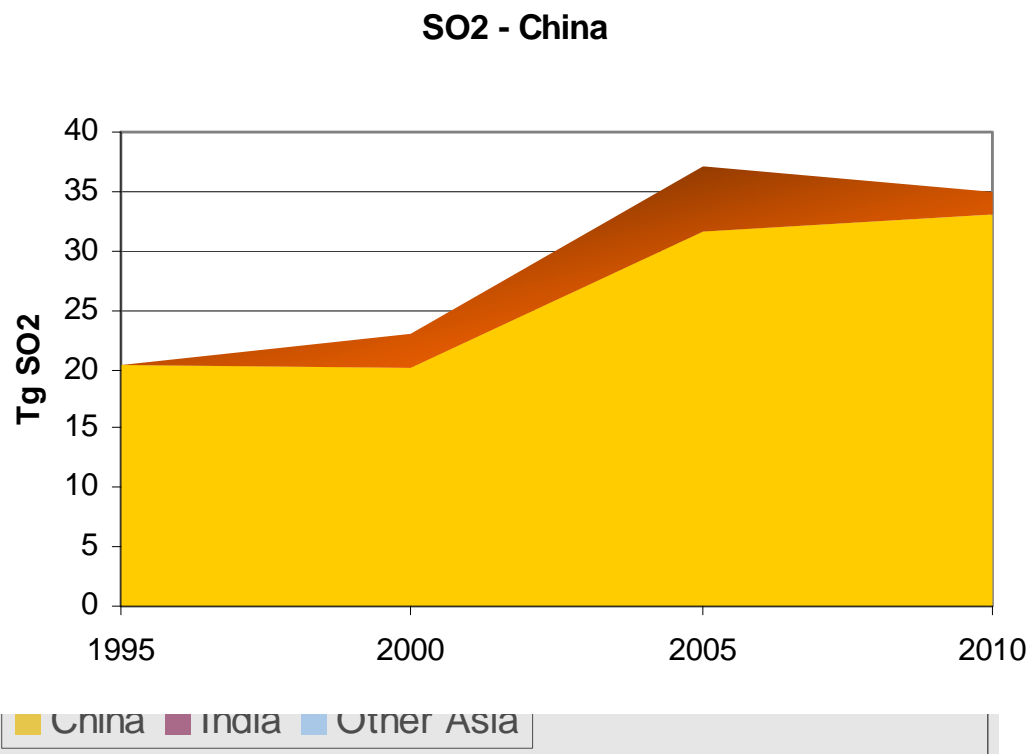


Emissions of air pollutants in Asia

GAINS-Asia baseline (2008)



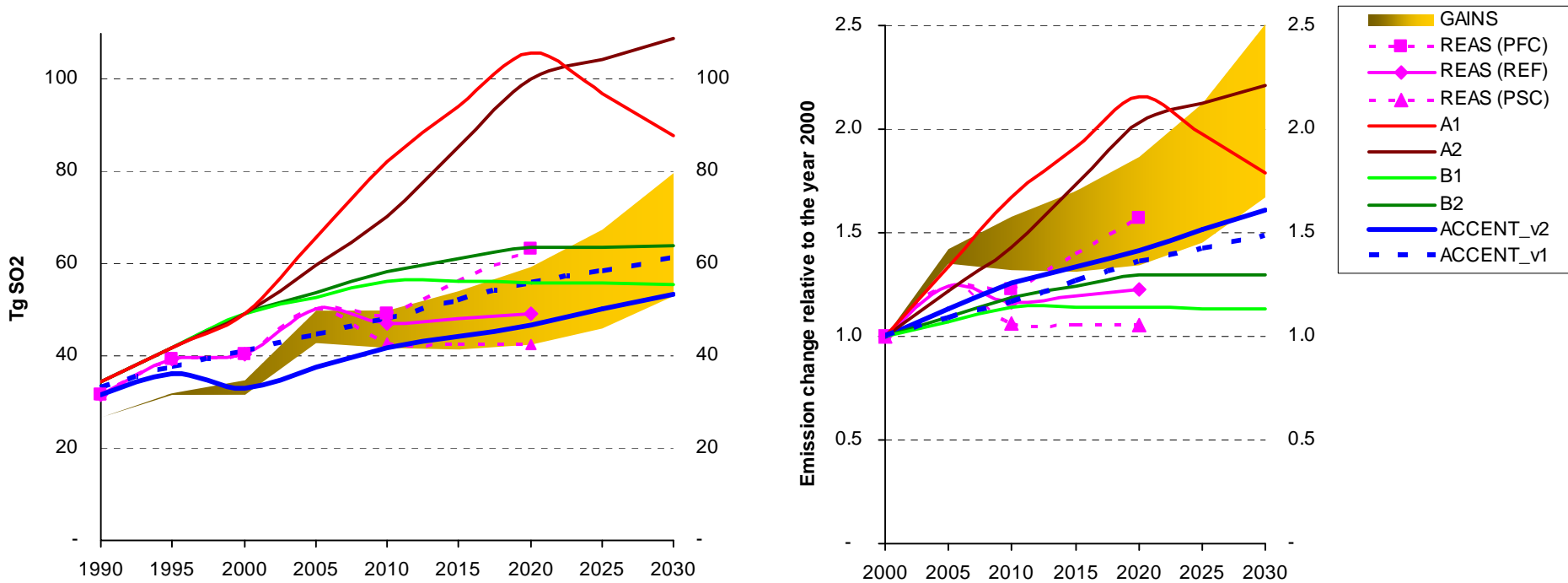
- Fuel consumption estimates for 2005 vary up to 10% between Chinese sources
- Strong increase in FGD penetration after 2000;
- By 2008 >60% of power plant capacity with FGD but unclear what is their operating time



Comparison of SO₂ emissions



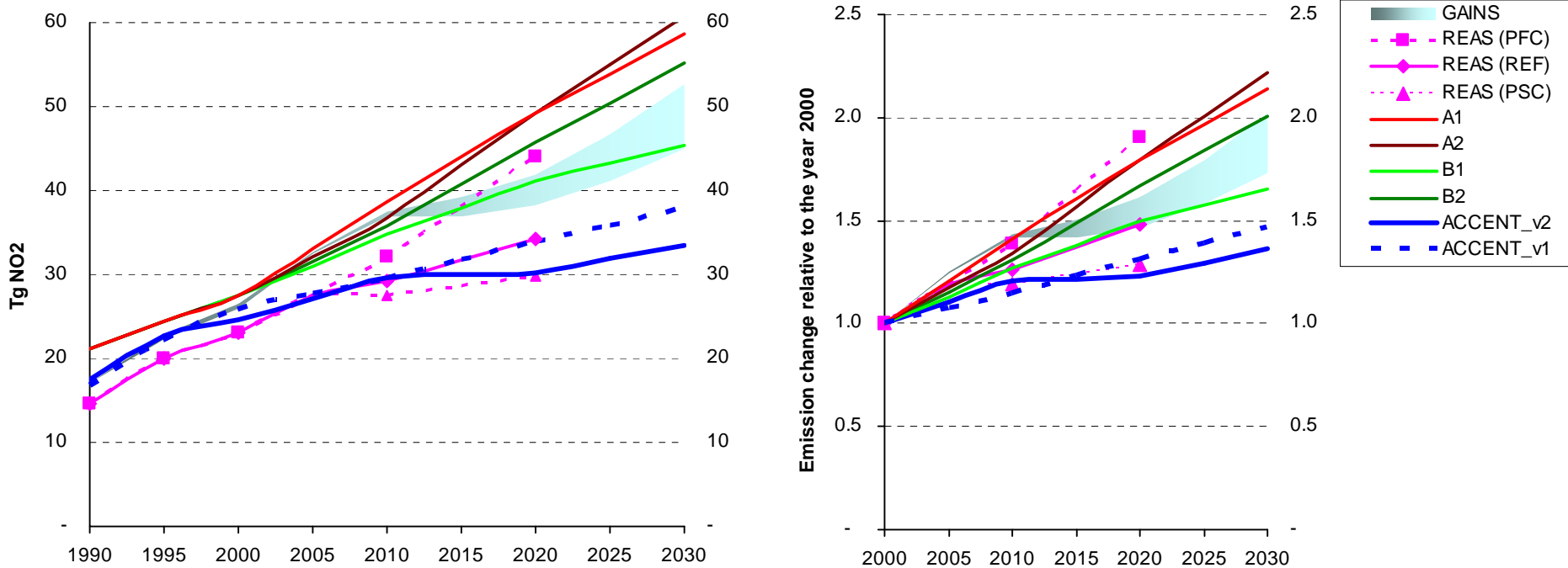
SO₂ emission estimates for Asia (**LEFT**) and their growth rates from the year 2000 (**RIGHT**) for the compared scenarios



Comparison of NO₂ emissions



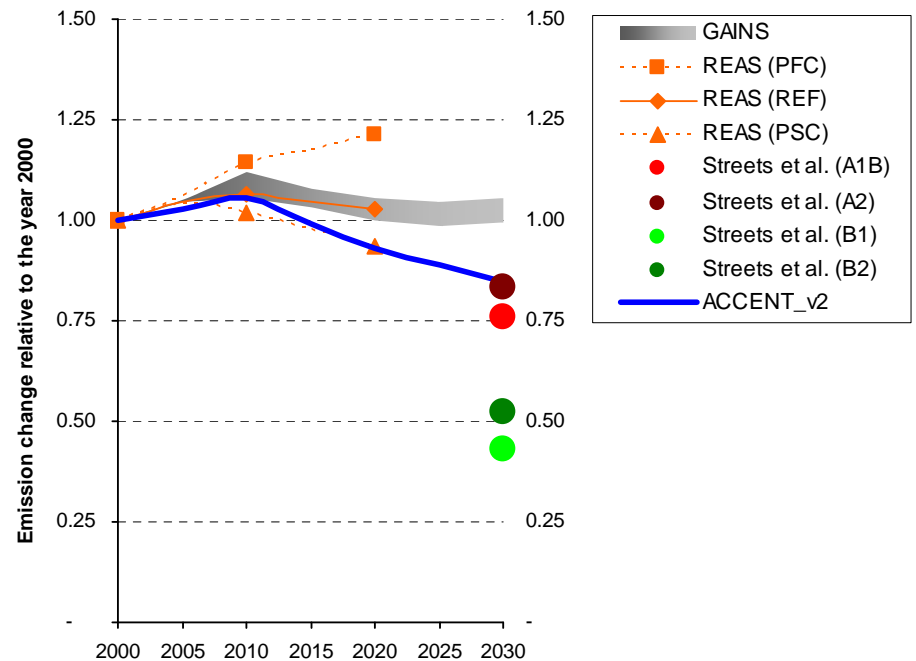
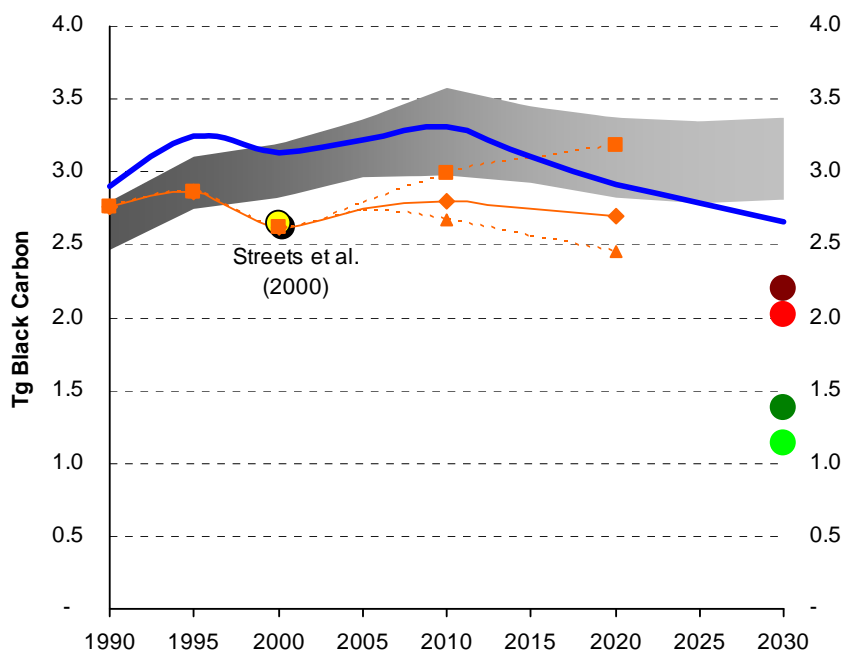
NO₂ emission estimates for Asia (**LEFT**)
and their growth rates from the year 2000 (**RIGHT**) for the compared scenarios



Comparison of BC emissions



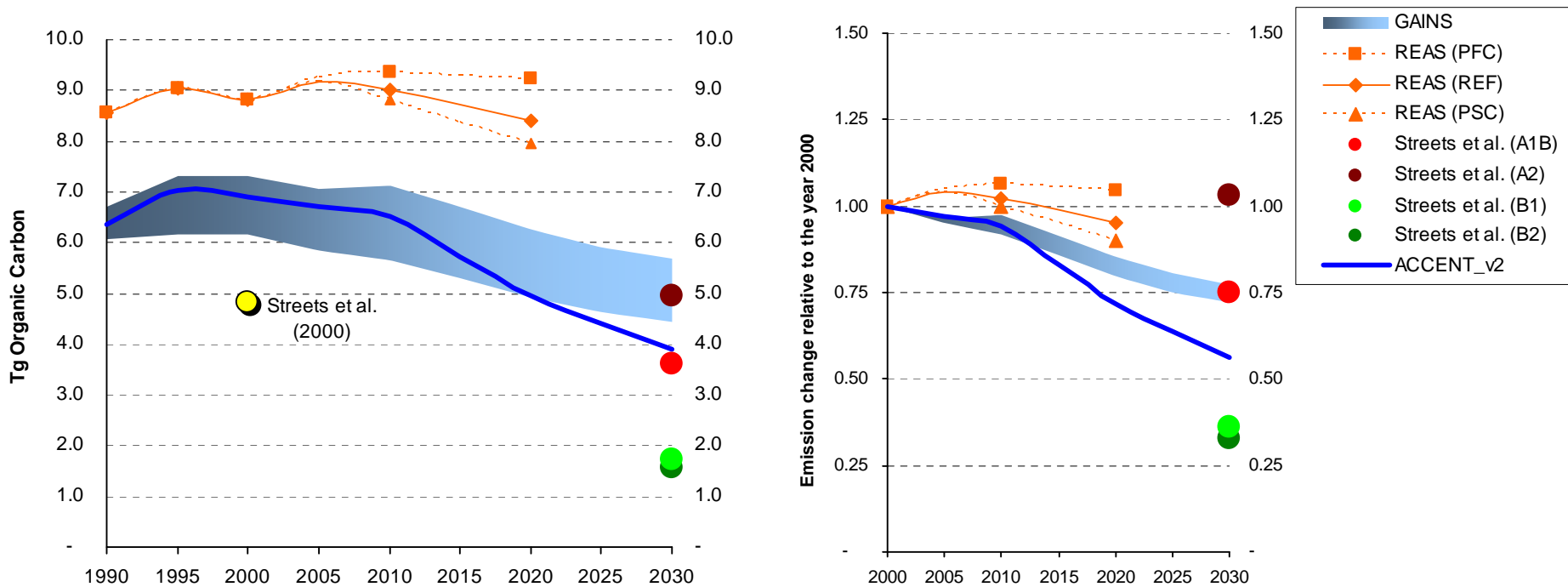
BC emission estimates for Asia (**LEFT**)
and their growth rates from the year 2000 (**RIGHT**) for the compared scenarios



Comparison of OC emissions



OC emission estimates for Asia (**LEFT**)
and their growth rates from the year 2000 (**RIGHT**) for the compared scenarios



Comparison of remote sensing data on NO₂ changes over China (Richter et al., 2007) with GAINS emission changes



Richter et al. (2007) Tropospheric composition change observed from space. 2nd ACCENT symposium. Urbino, Italy

▲ GAINS-China;
NO₂ emission change relative to 1995 for the selected area

NO₂ Increase above China

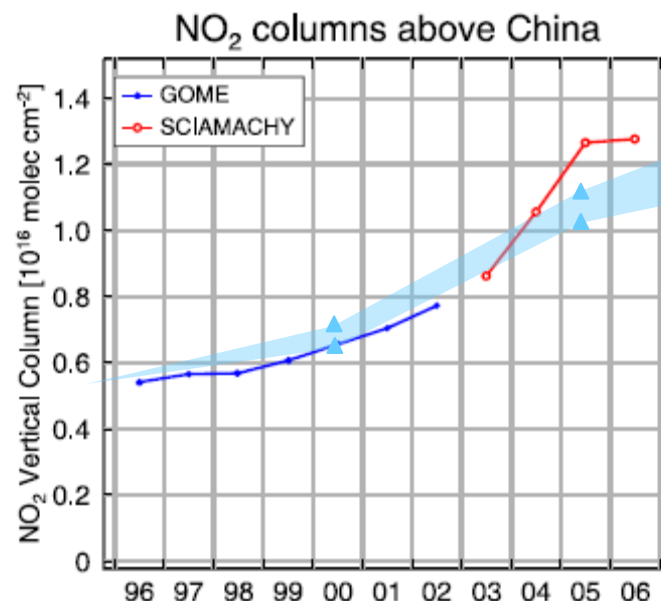
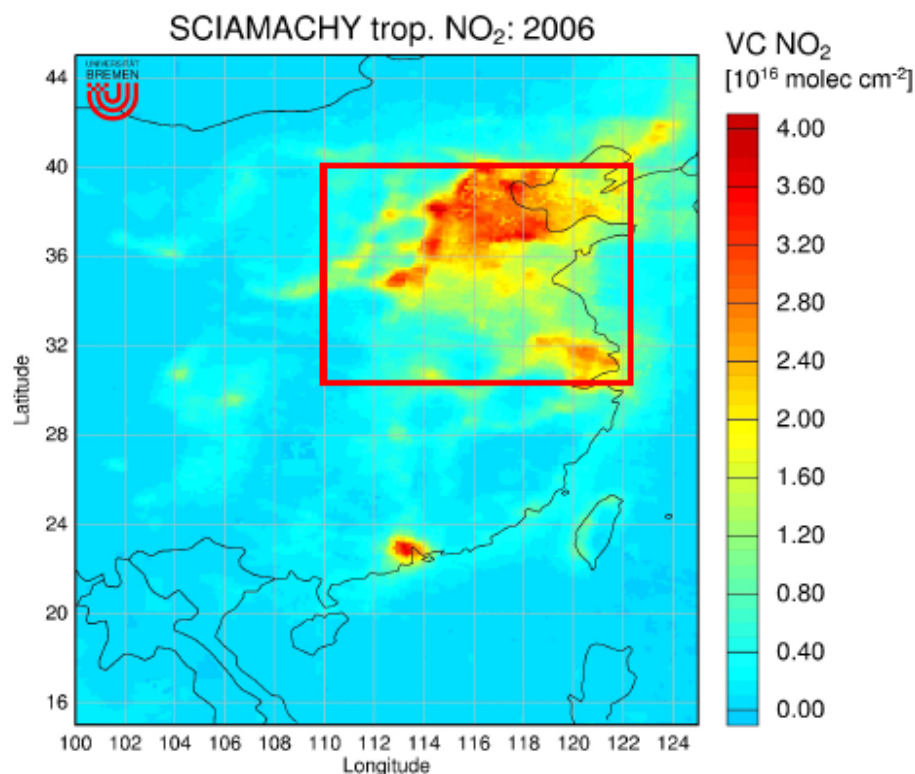
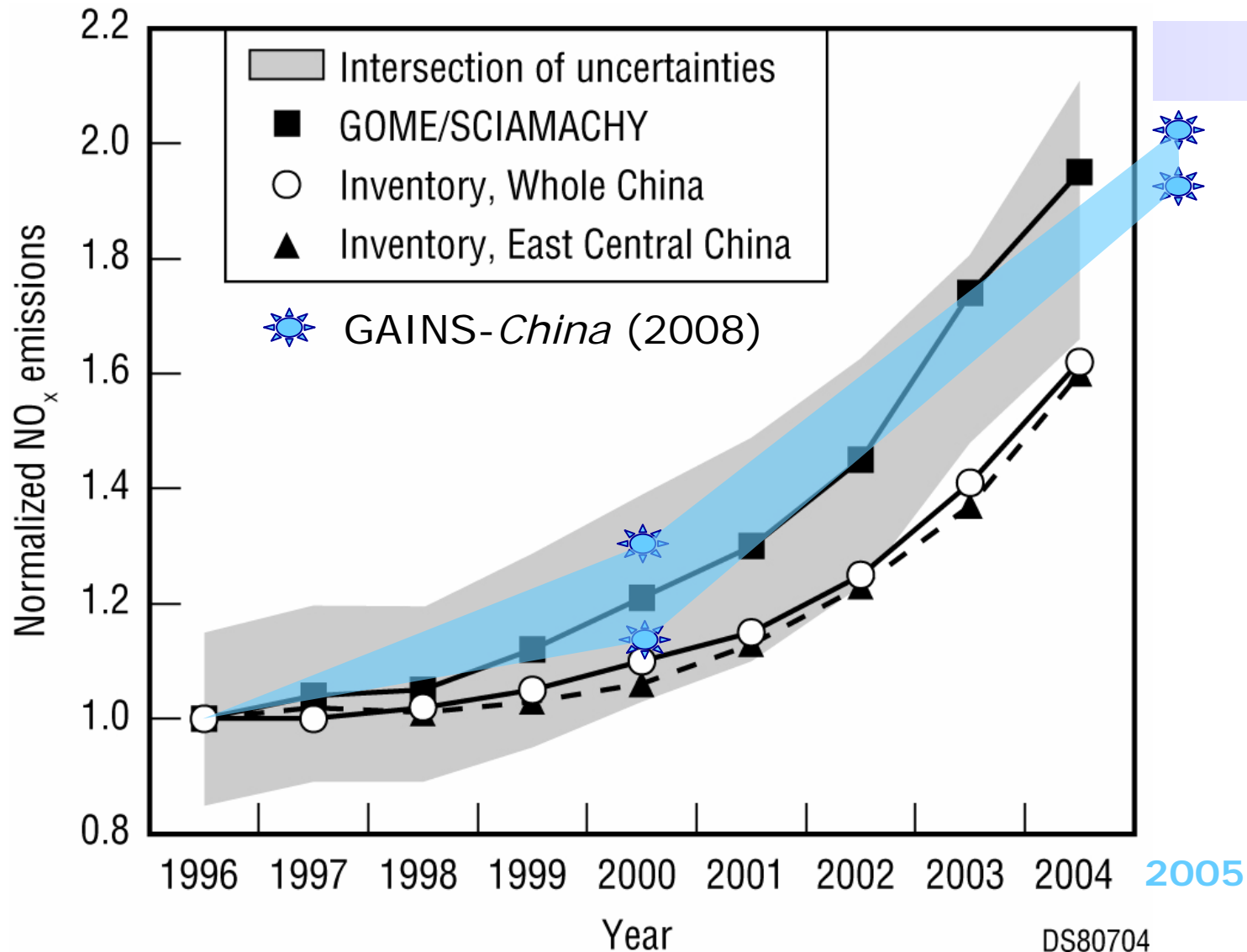


Fig. 2. Annual averages of tropospheric NO₂ above the indicated region in China as seen by GOME and SCIAMACHY. Data for 2006 are still preliminary.

We cannot replicate the exceptionally high growth rates reported by Richter et al. [Nature, 2005] (95%, 1996-2004), but we still get a 61% increase [Zhang et al.,2007]

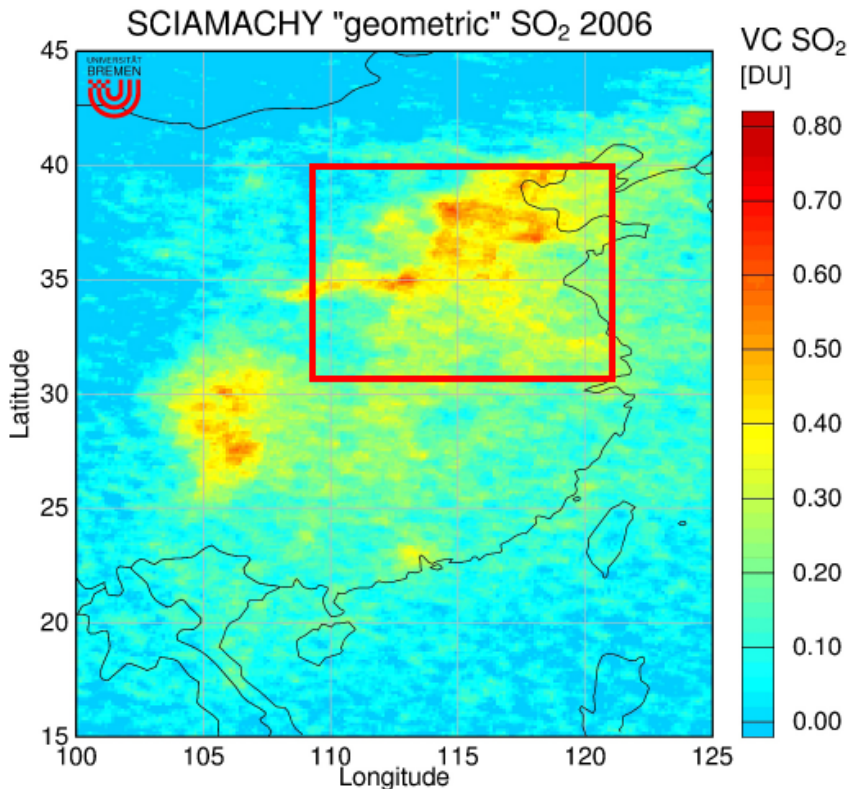


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Preliminary comparison of remote sensing data on SO₂ changes over China (Richter et al., 2007) with GAINS emission changes

Richter et al. (2007) Tropospheric composition change observed from space. 2nd ACCENT symposium, Urbino, Italy

SO₂ Increase above China



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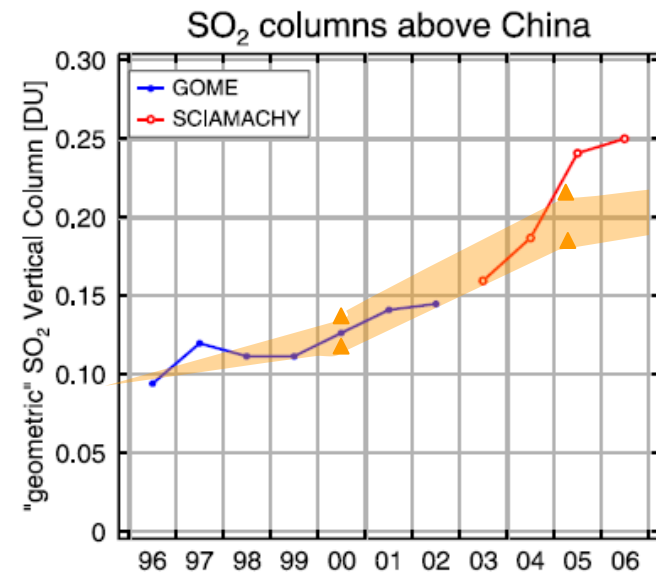


Fig. 3: Annual averages of tropospheric SO₂ above the indicated region in China as seen by GOME and SCIAMACHY. Data have not yet been fully corrected for light path effects. 2006 point is still preliminary.

Conclusions



- Recent inventories and modelling studies confirm the findings of the remote sensing community about high growth of NO_x and SO_2 over East Asia in the last decade, although estimating slightly smaller increases.
- There are still significant uncertainties in the historical estimates of air pollutants
- For the future, the recent studies show comparable trends of SO_2 , NO_x , BC, and OC emissions
- The impact of legislation has been underestimated in SRES scenarios; Compared to the recent projections, A1 and A2 scenarios estimate much higher future SO_2 and NO_x while B1 and B2 are more in line with them.
- The importance of better quantification of BC and OC emissions has been highlighted recently by various scientific communities; a lot more needs to be done to reduce uncertainty in historical estimates and assessment of reduction potential in Asia
- **This work did not consider any potential impact of the current global economic crisis**

References



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- **Thanks to Tsinghua University collaborators (Wang Long and Yu Chao) for their work in the last weeks on SO₂ strategies!...to be continued**