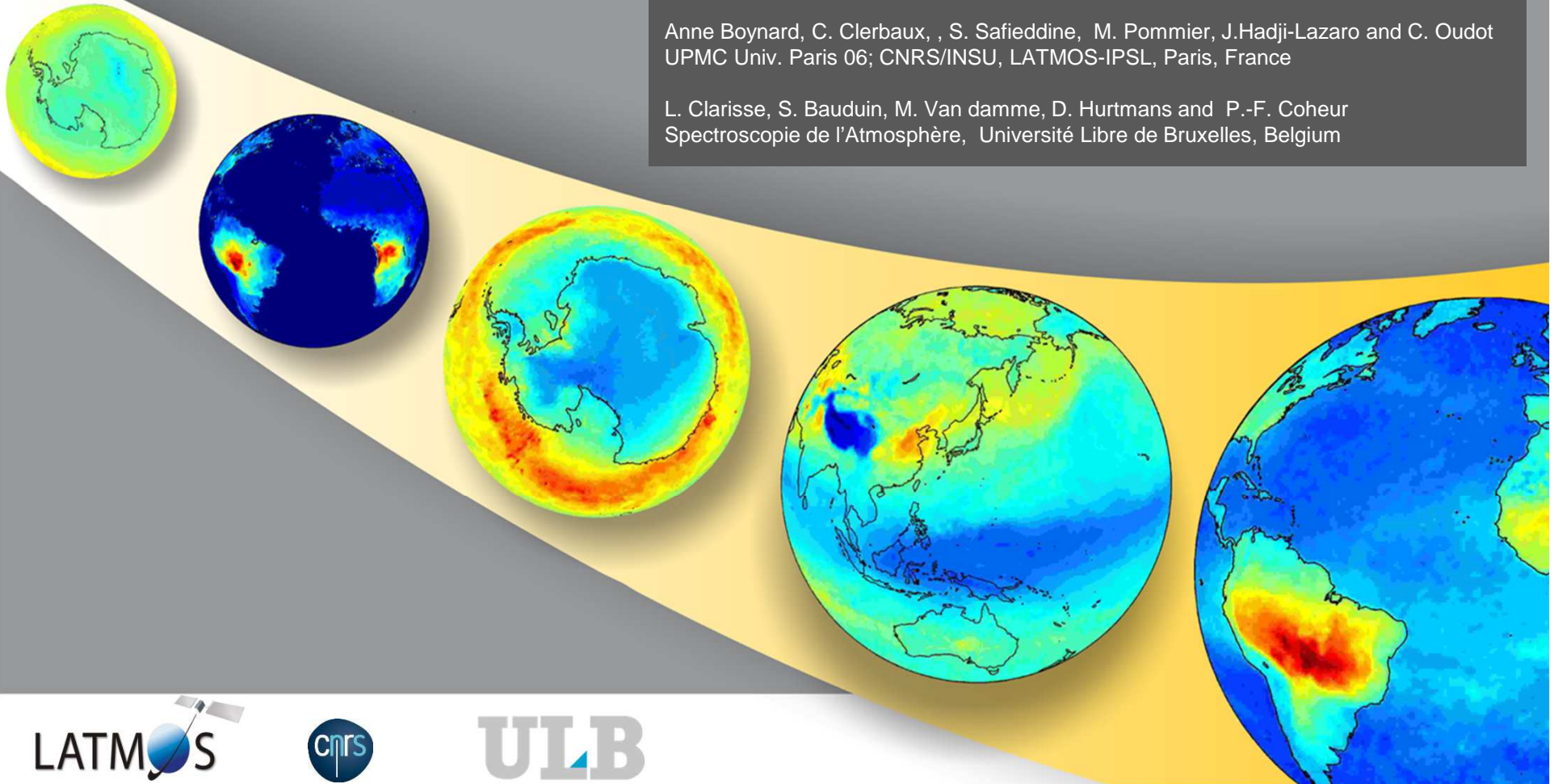


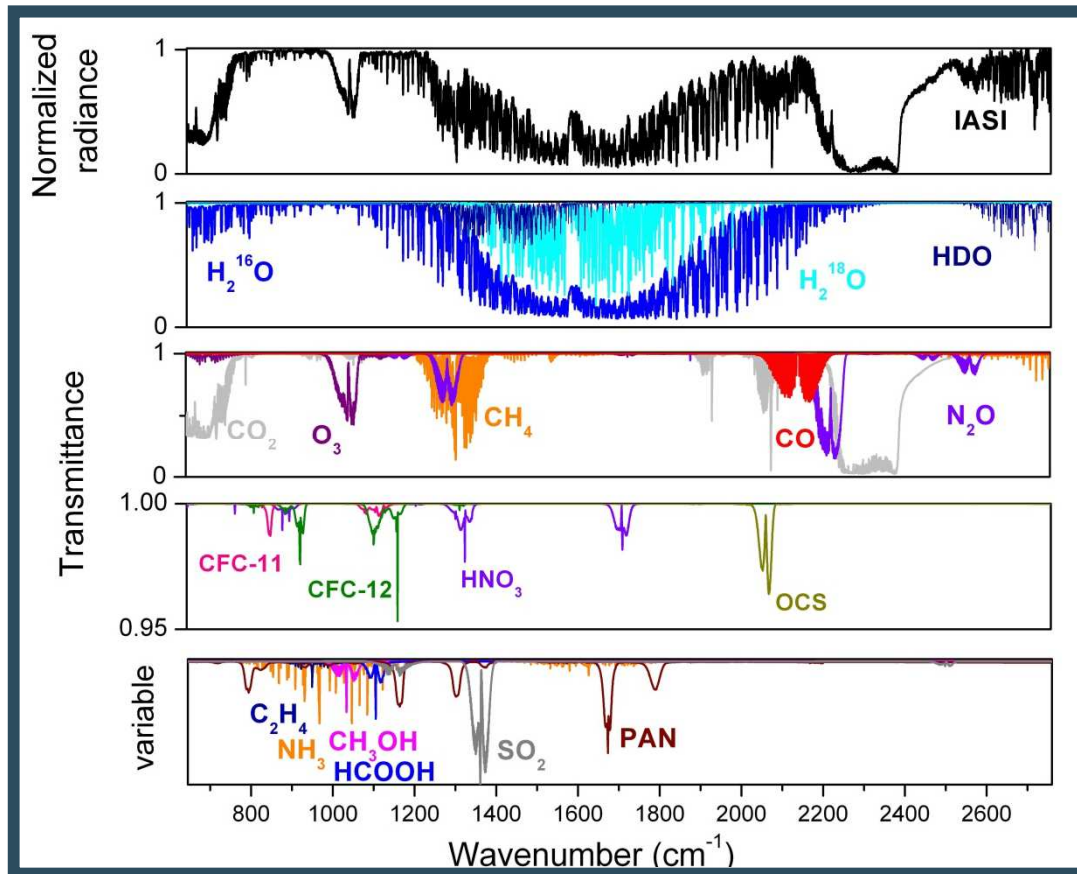
First simultaneous space measurements of atmospheric pollutants in the boundary layer from IASI: a case study in the North China Plain

Anne Boynard, C. Clerbaux, S. Safieddine, M. Pommier, J. Hadji-Lazaro and C. Oudot
UPMC Univ. Paris 06; CNRS/INSU, LATMOS-IPSL, Paris, France

L. Clarisse, S. Bauduin, M. Van damme, D. Hurtmans and P.-F. Coheur
Spectroscopie de l'Atmosphère, Université Libre de Bruxelles, Belgium



Aims of the IASI mission



Clerbaux et al., ACP, 2009

bonus

3/ Operational applications

Eg fire detection, volcanic plumes

T + 2.5 heures

1/ Meteorology

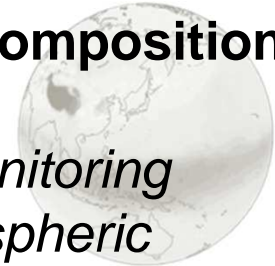
Weather forecast



2/ Atmospheric composition measurements

Climate gases monitoring

Understand atmospheric chemistry



List of species that are measured/detected by IASI:

H₂O O₃ CO HNO₃ HDO

NH₃ CO₂ PAN HONO

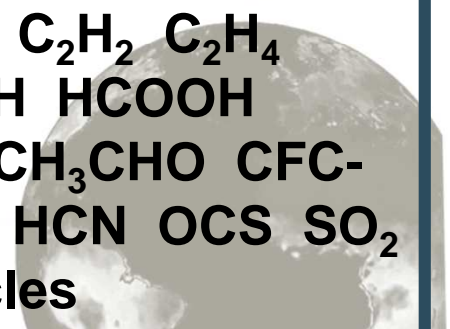
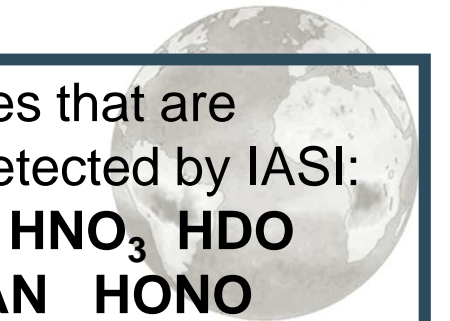
C₄H₄O CH₄ C₂H₂ C₂H₄

C₃H₆ CH₃OH HCOOH

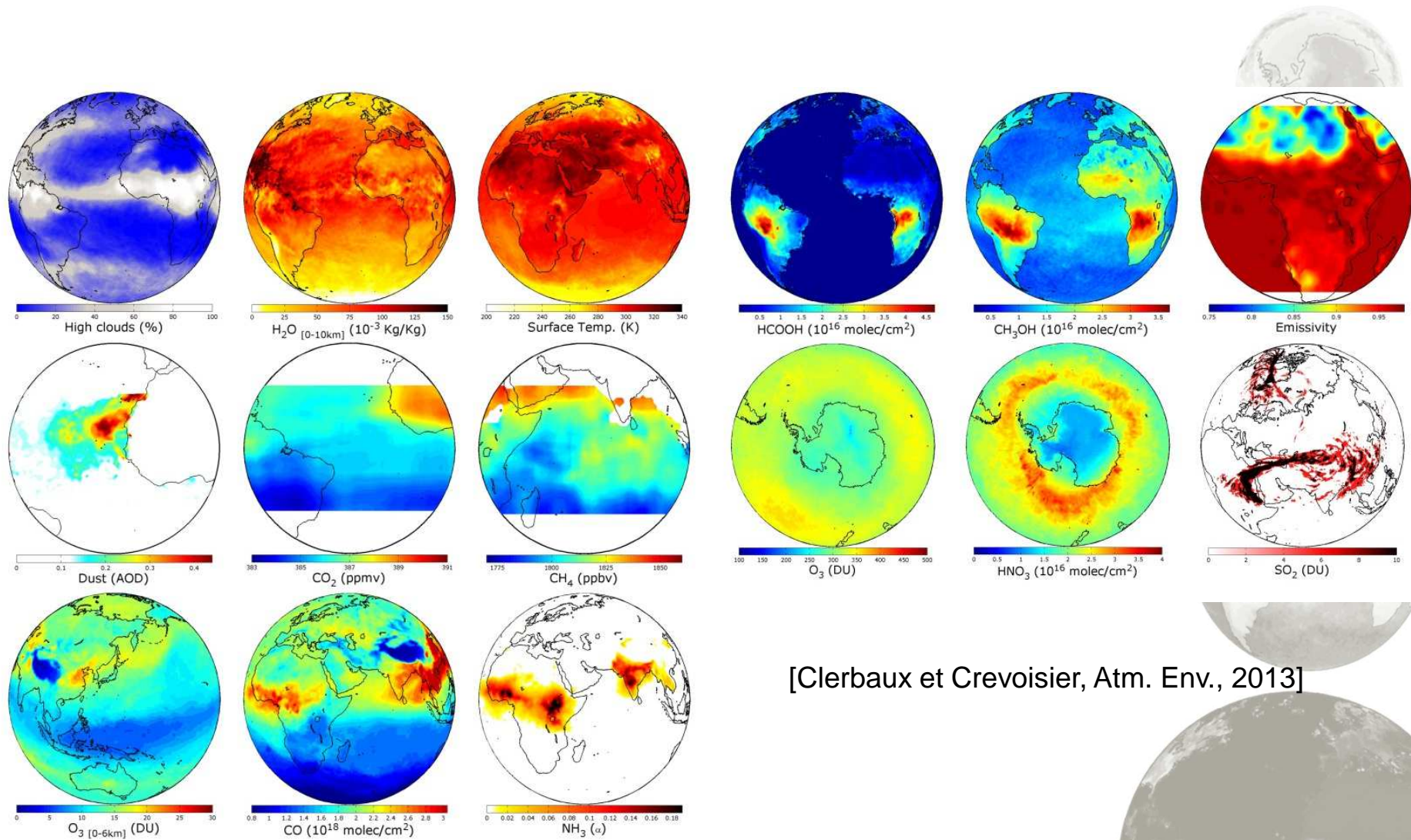
CH₃COOH CH₃CHO CFC-

11 CHC-12 HCN OCS SO₂

H₂S + particles



What do we measure with IASI?

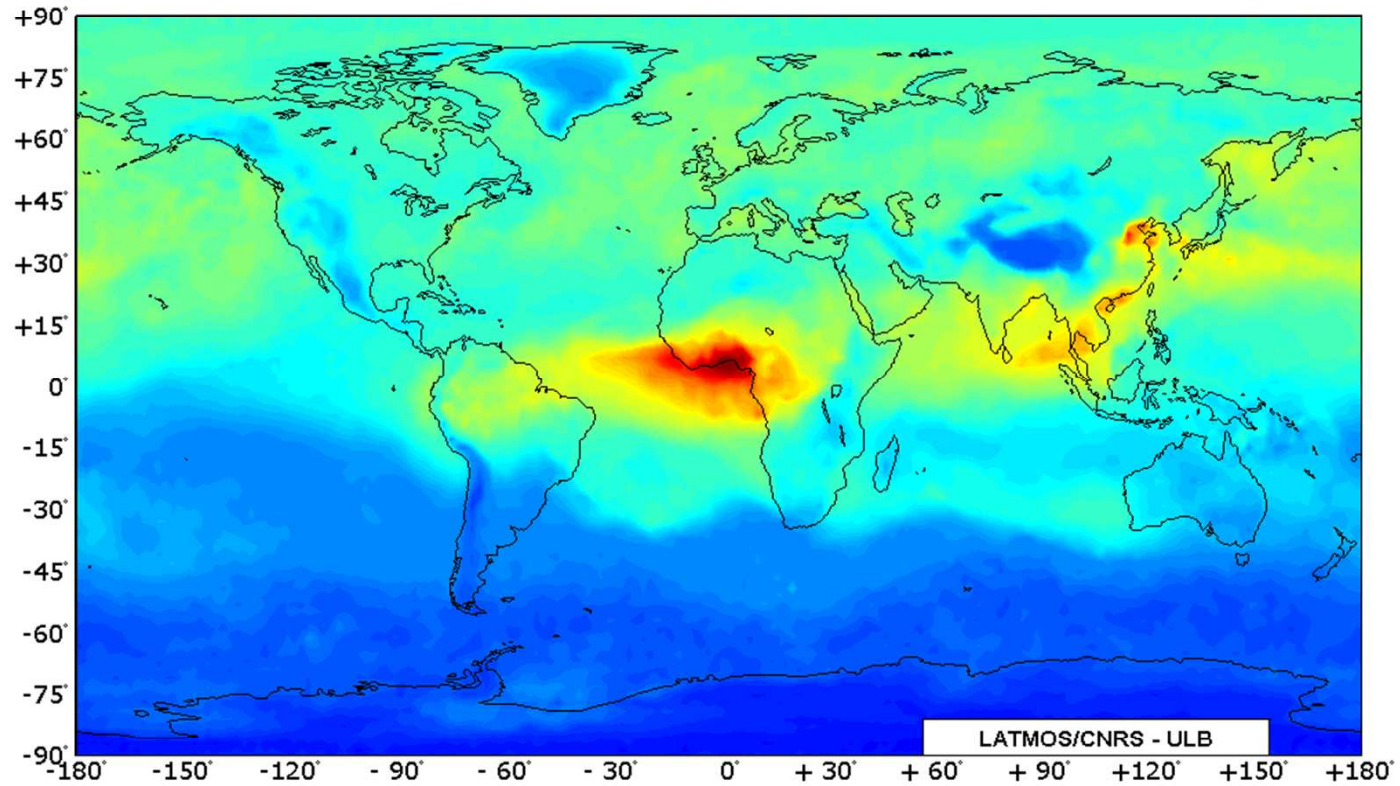


[Clerbaux et Crevoisier, *Atm. Env.*, 2013]

IASI CO Total Column on a global scale

2009

JAN **FEV** **MAR** **APR** **MAY** **JUN** **JUL** **AUG** **SEP** **OCT** **NOV** **DEC**



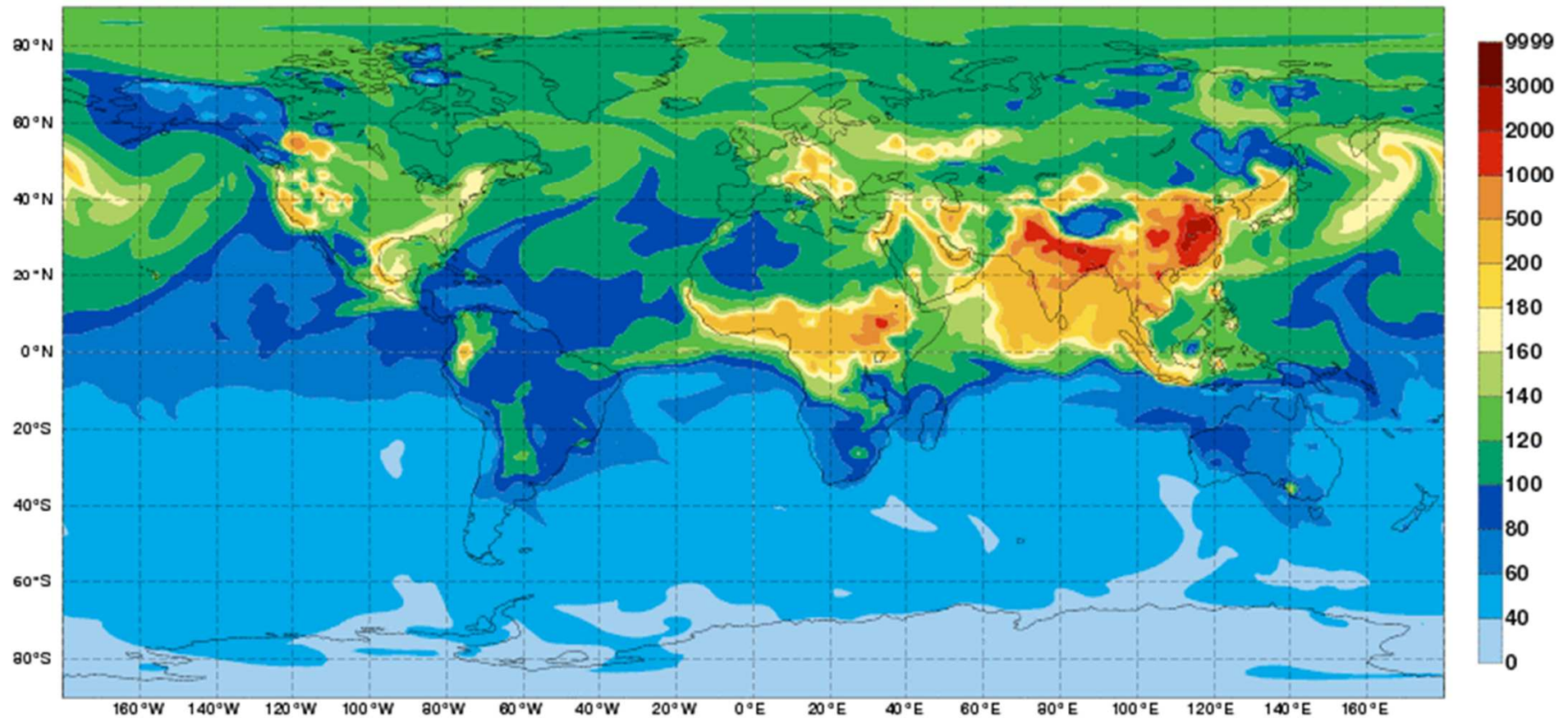
Total Column CO $\times 10^{18}$ molecules/cm²

Courtesy M. George

IASI CO Total Column on a global scale



Sunday 26 January 2014 00UTC MACC-II Forecast t+042 VT: Monday 27 January 2014 18UTC
Surface Carbon Monoxide [ppbv]



Air pollution in China

Air Pollution is a major issue in China:

- expansion of industrialization
- economic growth
- expansion of car ownership



Coal burning:

- major source of CO, SO₂ and PM
- main source of air pollution in China (>70% of its total energy consumption)



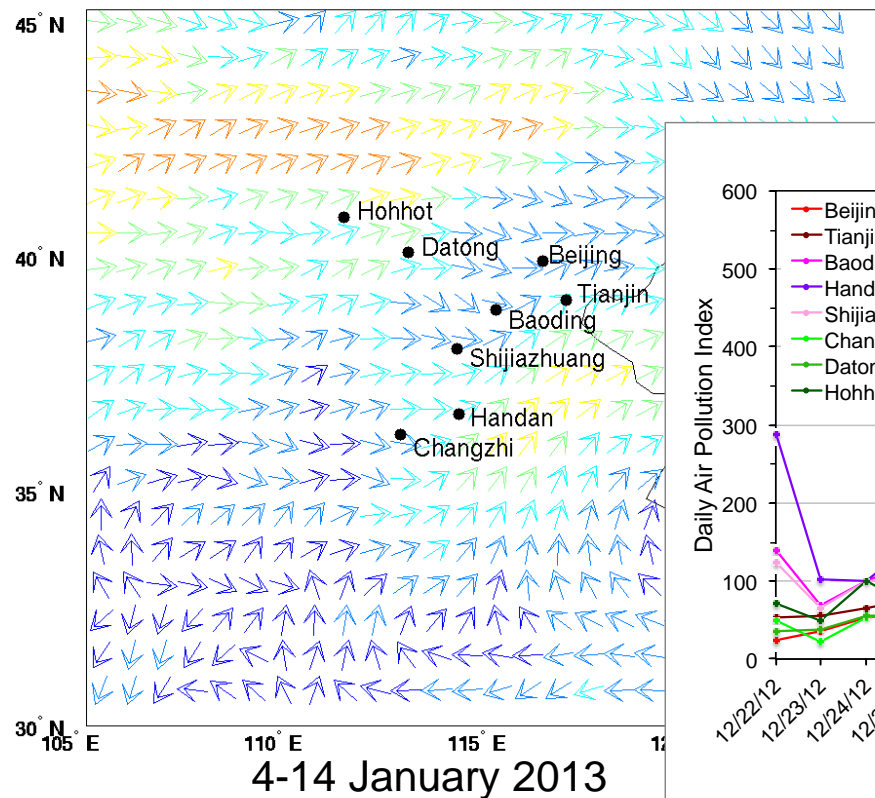
~500 000 premature deaths each year according to the former China's Health Minister (Chen Xhu)

=> Important public health issue impacting both environment and climate

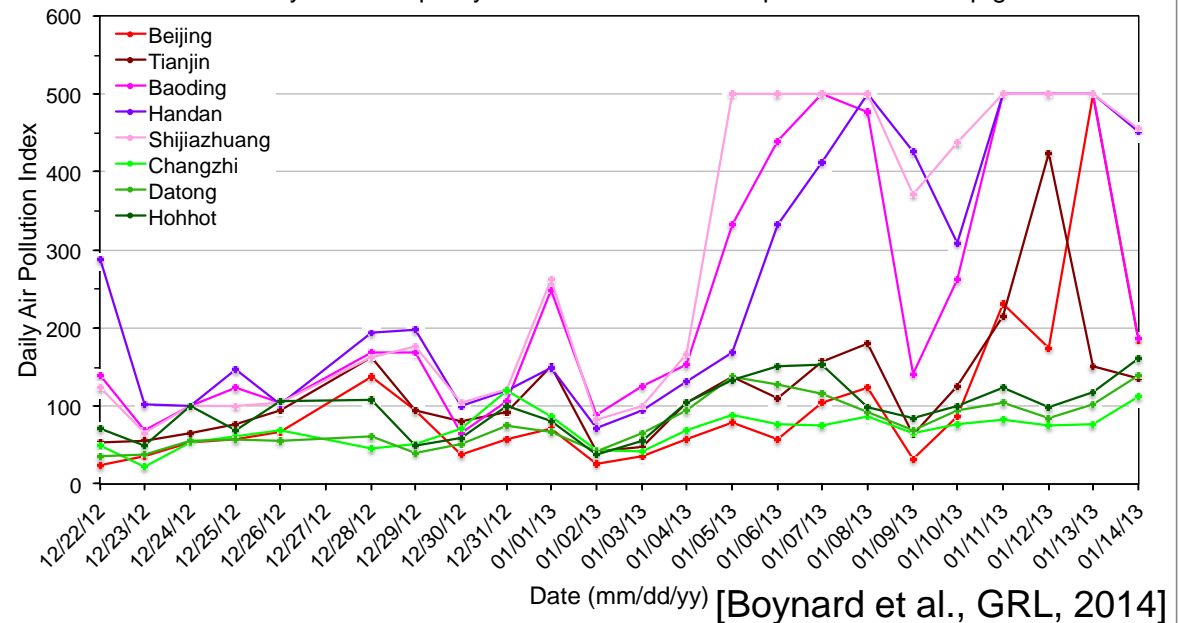
The January 2013 Air Pollution episode

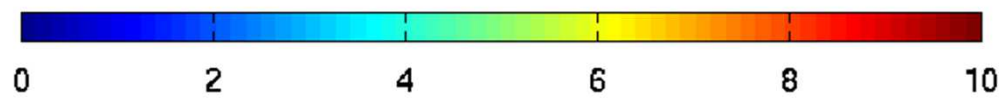
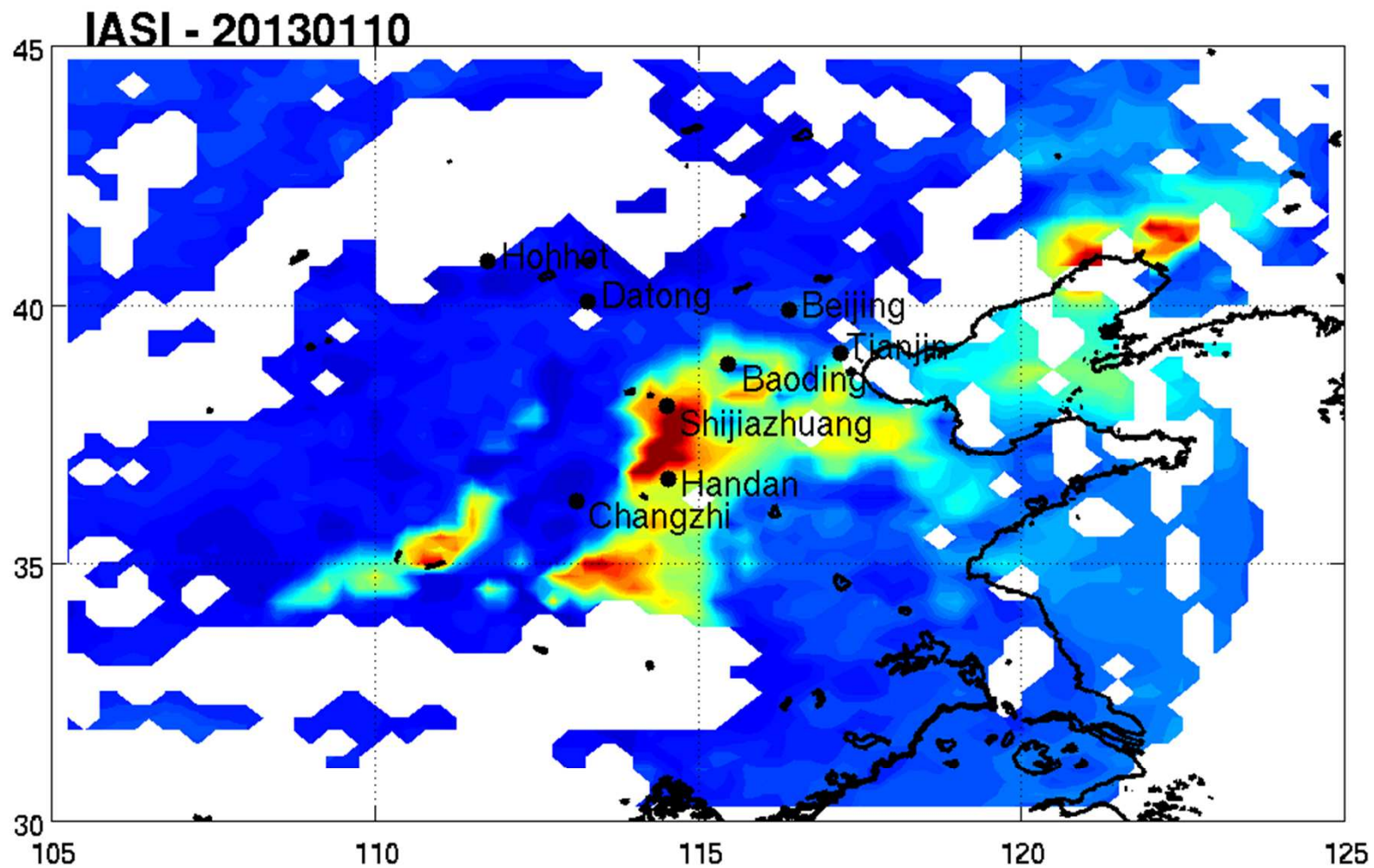
- In January 2013, China faced to an unprecedented pollution episode due to
 - seasonal coal consumption
 - unfavorable weather conditions (weak wind + temperature inversion)
- Air pollution levels reached values considered harmful to human health (exceeding the daily threshold recommended by the World Health Organization by a factor of nearly 40)

Surface-900 hPa Wind



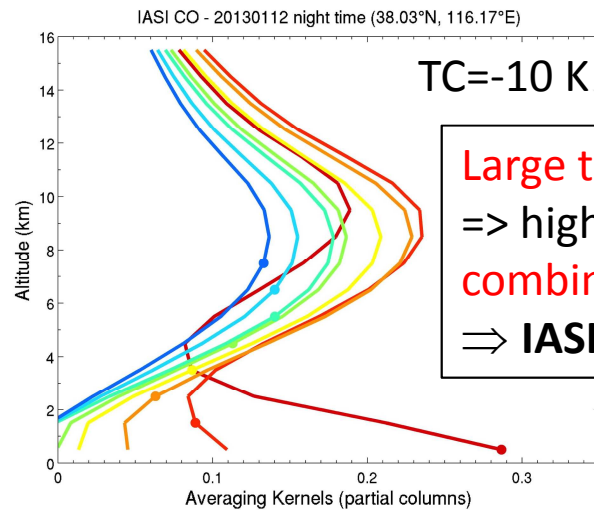
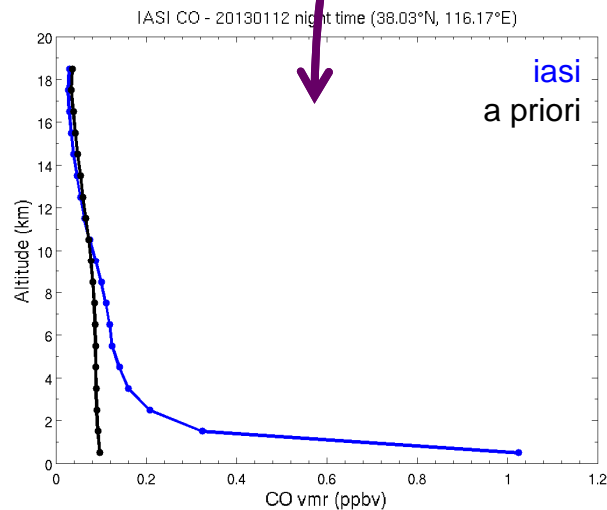
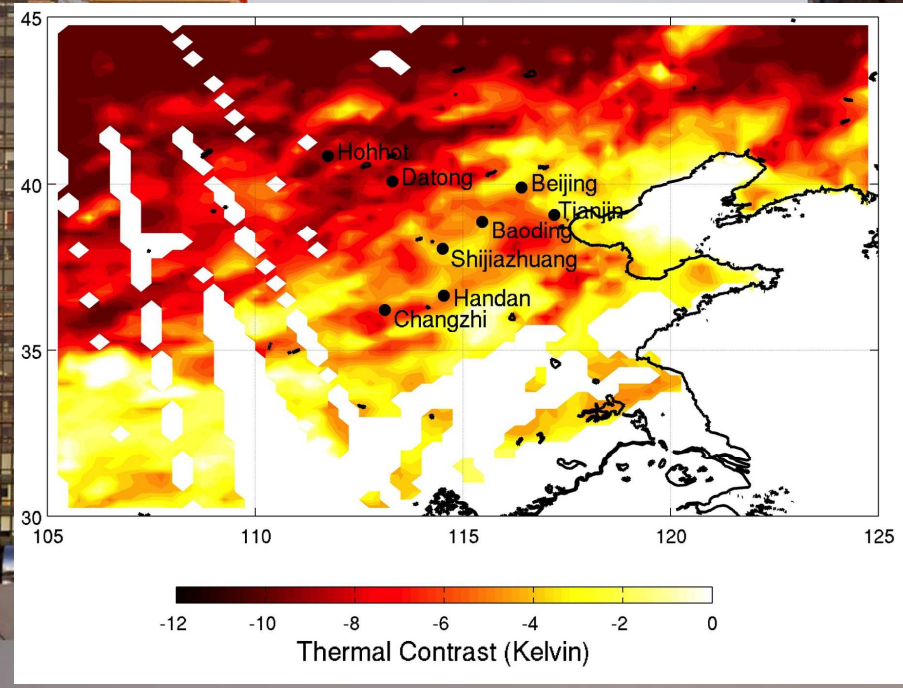
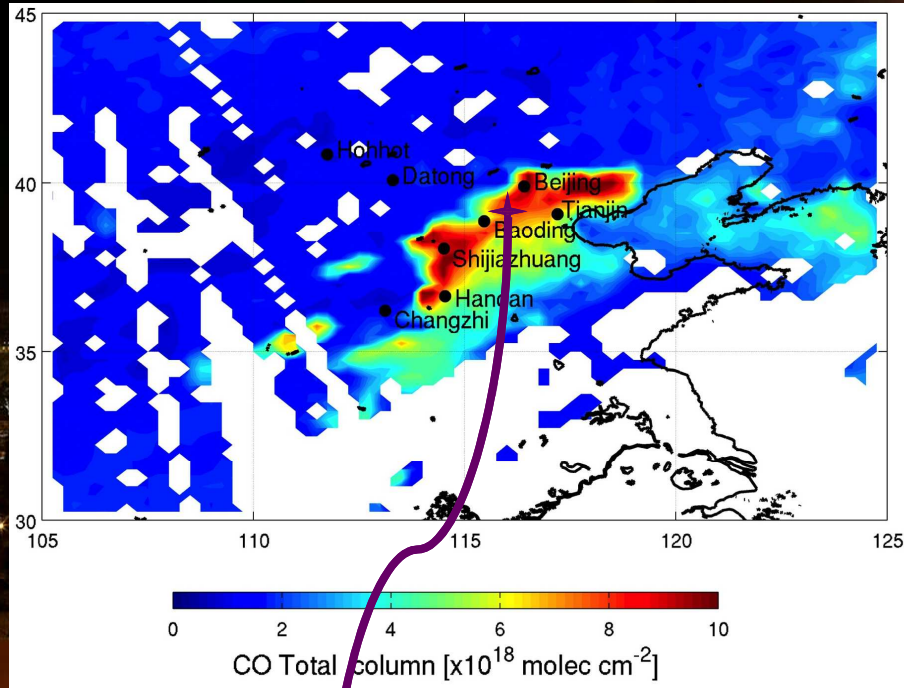
Daily local air quality index obtained from <http://datacenter.mep.gov.cn>





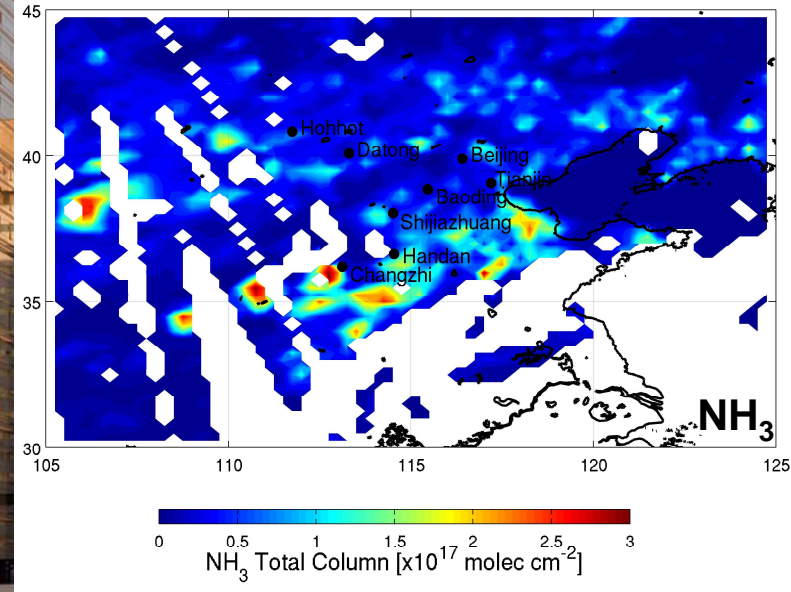
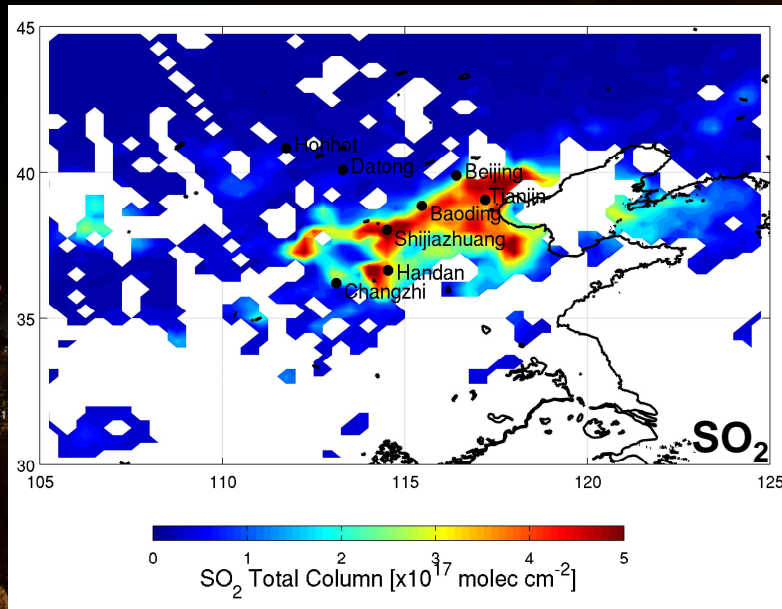
CO Total column [$\times 10^{18}$ molec cm^{-2}]

Detection of CO in the PBL (January 12)

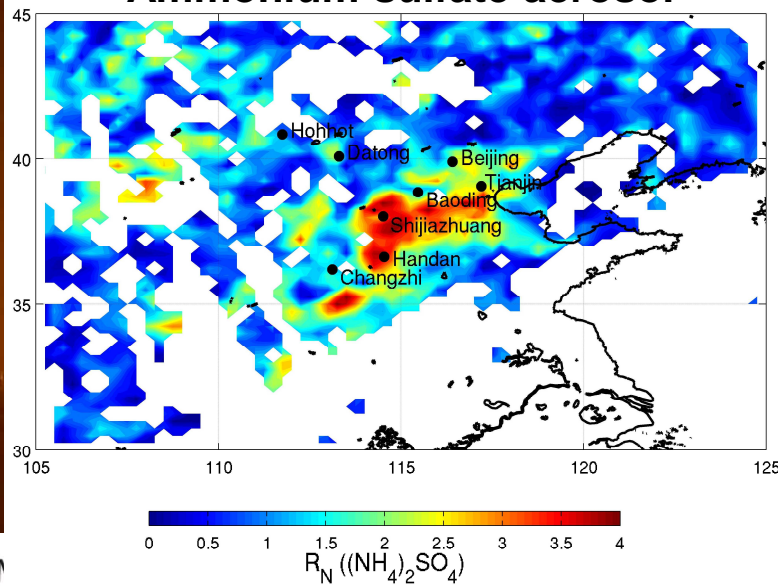


Large thermal contrast
 => high IASI sensitivity at the surface
 combined with high CO concentrations
 => IASI detects CO in the PBL

Can IASI see other pollutants?



Ammonium sulfate aerosol



- Detections of NH₃, SO₂, and ammonium sulfate (major component of anthropogenic aerosols).
- Emission signatures in the spectra
=> enhanced loadings in the PBL

=> First time that plumes of several anthropogenic pollutants located near the surface over China have been detected from IASI

[Boynard et al., GRL, 2014]

LATMOS / IPSL - ULB


METOP-A
METOP-B

IXION



Summary

- IASI is suitable to monitor high anthropogenic pollution over China
- Stable meteorological conditions and large thermal contrast favor detection of boundary layer pollutants
- High CO, SO₂, NH₃ and ammonium sulfate aerosol are measured in January 2013
- IASI-B on MetOp-B is now operational => twice as much information available
 - ⇒ Monitoring pollution episodes associated with stable weather conditions more accurately and regularly
- PANDA project (Europe/China)

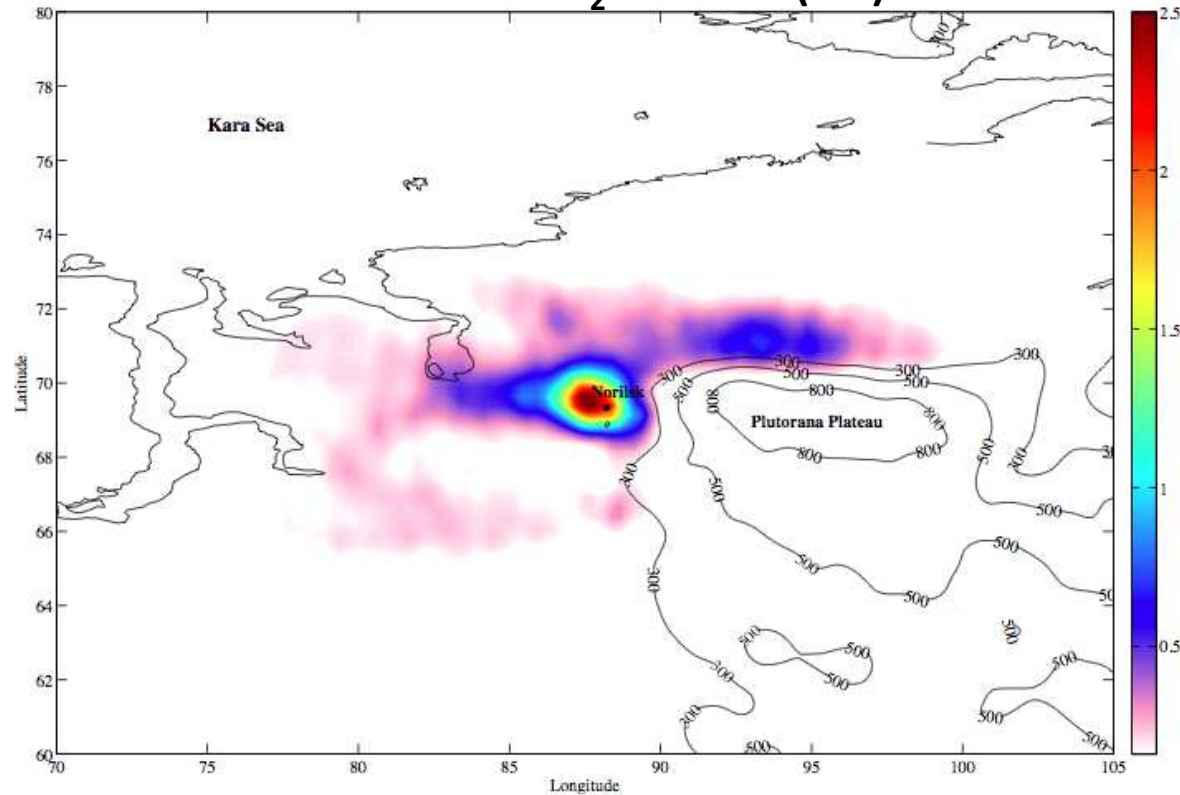


Thank you!



IASI boundary layer SO₂ in Norilsk

0-2 km SO₂ columns (DU)



Norilsk: one of the most polluted cities in the world largely because of intense mining and heavy metals

=> Capability of IASI to measure near-surface anthropogenic SO₂ in winter (large temperature inversion + low humidity)