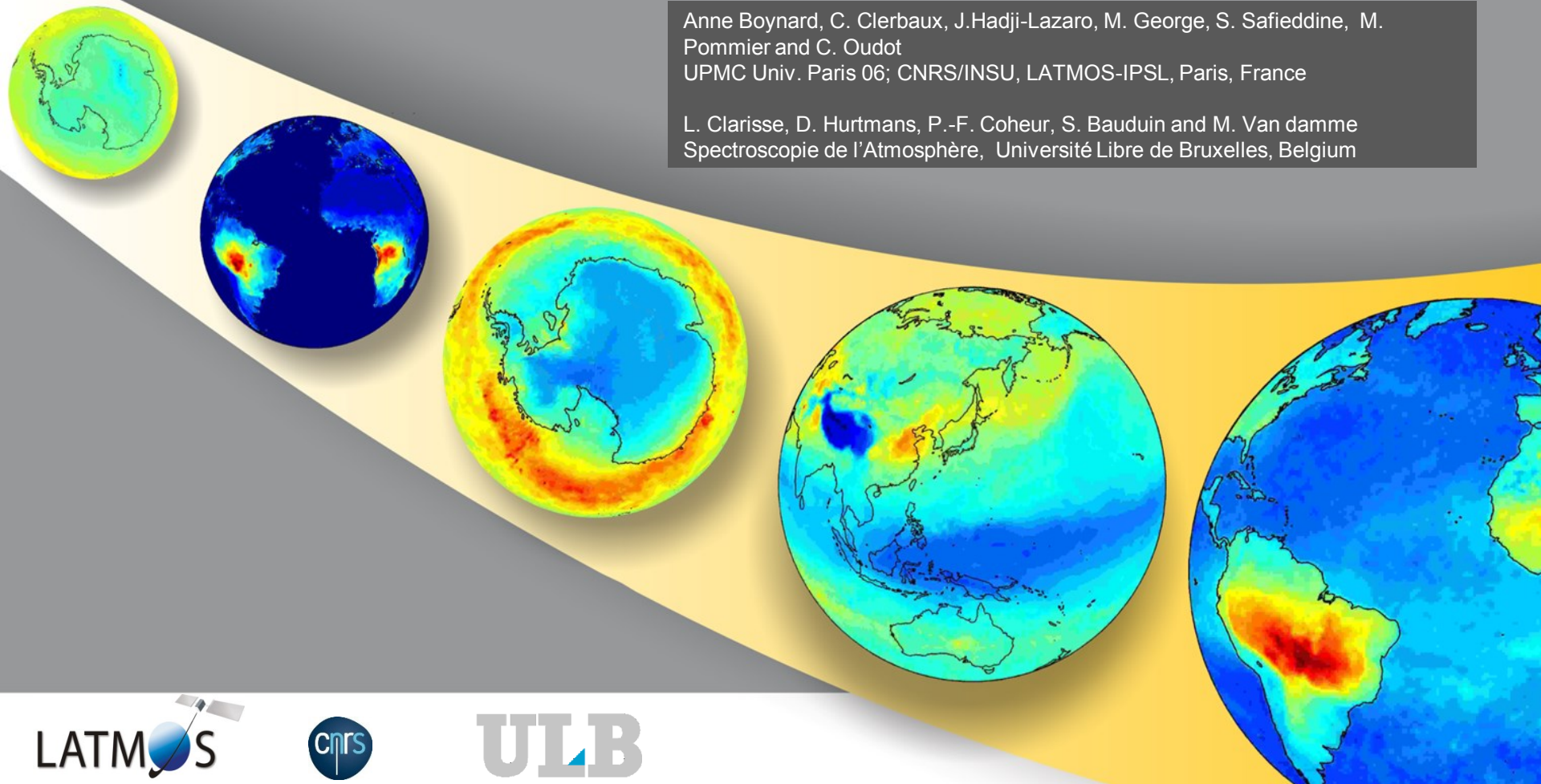
How able is IASI for tracking pollution?

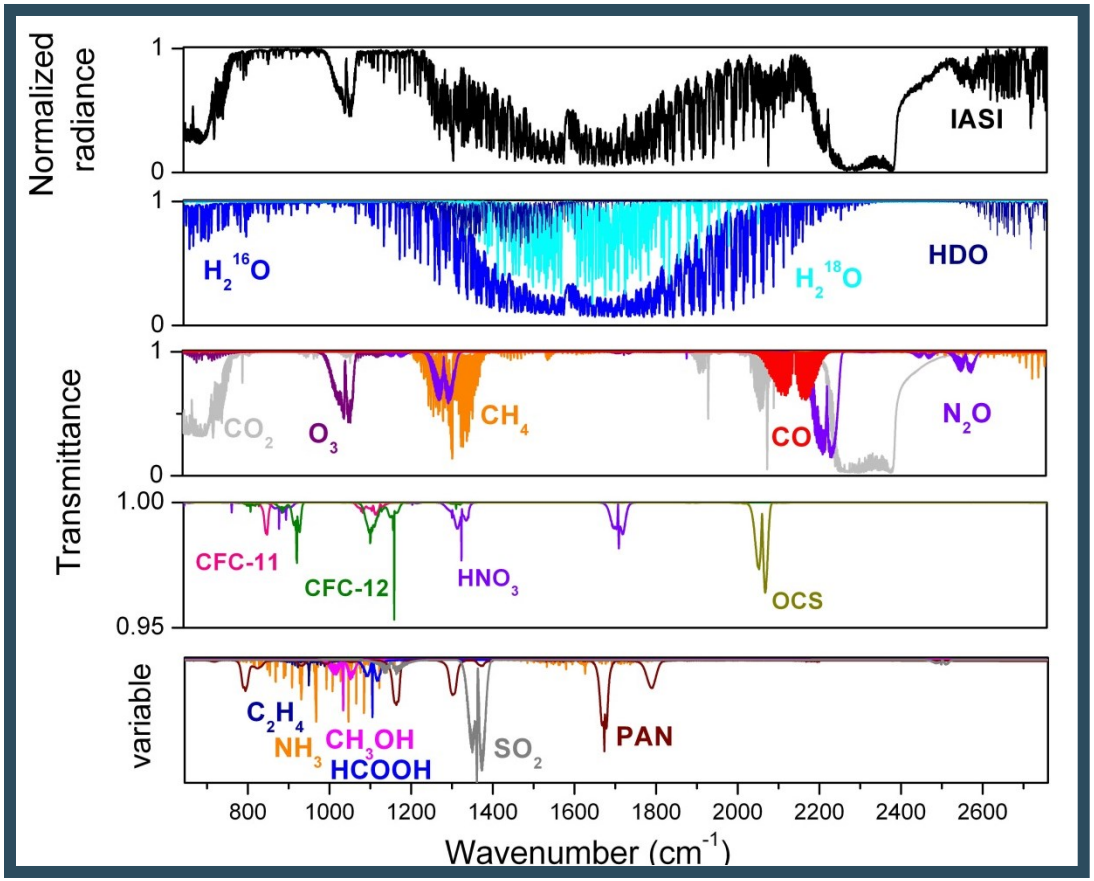
Anne Boynard, C. Clerbaux, J.Hadji-Lazaro, M. George, S. Safieddine, M. Pommier and C. Oudot
UPMC Univ. Paris 06; CNRS/INSU, LATMOS-IPSL, Paris, France

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



LATMOS cnrs ULB

Aims of the IASI mission



Clerbaux et al., ACP, 2009

1/ **Meteorology**
Weather forecast

2/ **Atmospheric composition measurements**
Climate gases monitoring
Understand atmospheric chemistry

List of species that are measured/detected by IASI:
H_2O O_3 CO HNO_3 HDO NH_3 CO_2 PAN HONO C_4H_4O CH_4 C_2H_2 C_2H_4 C_3H_6 CH_3OH HCOOH CH_3COOH CH_3CHO CFC-11 CHC-12 HCN OCS SO_2 H_2S + particles

Clarisse et al., GRL, 2011

bonus

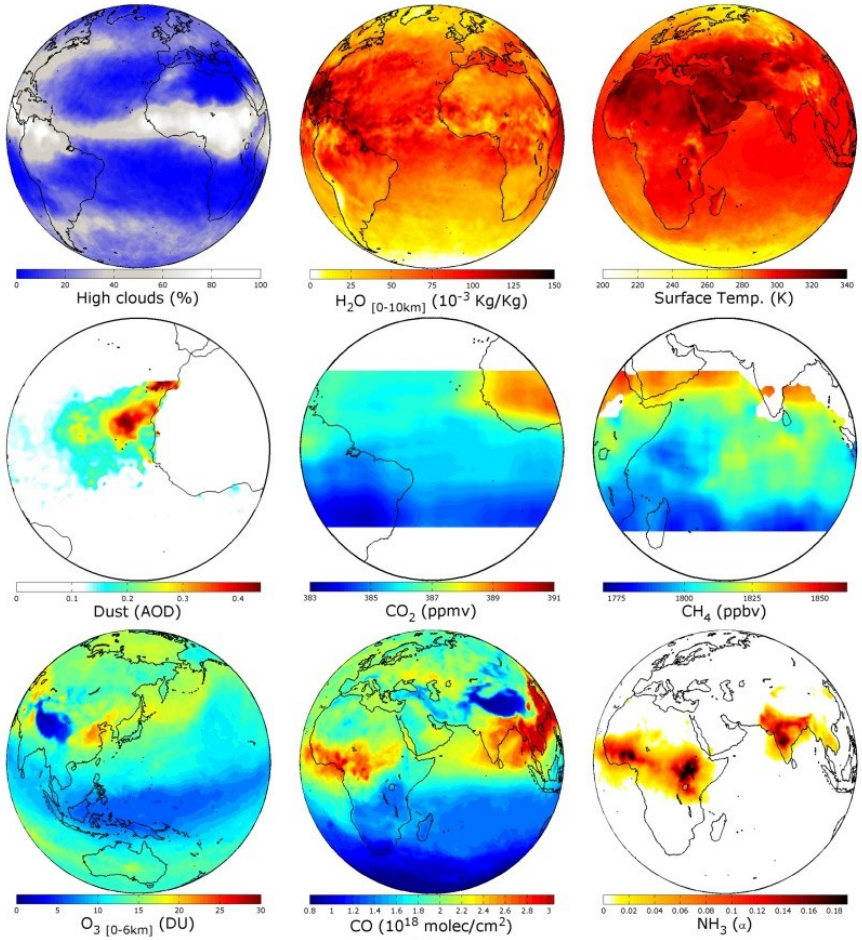
3/ Operational applications

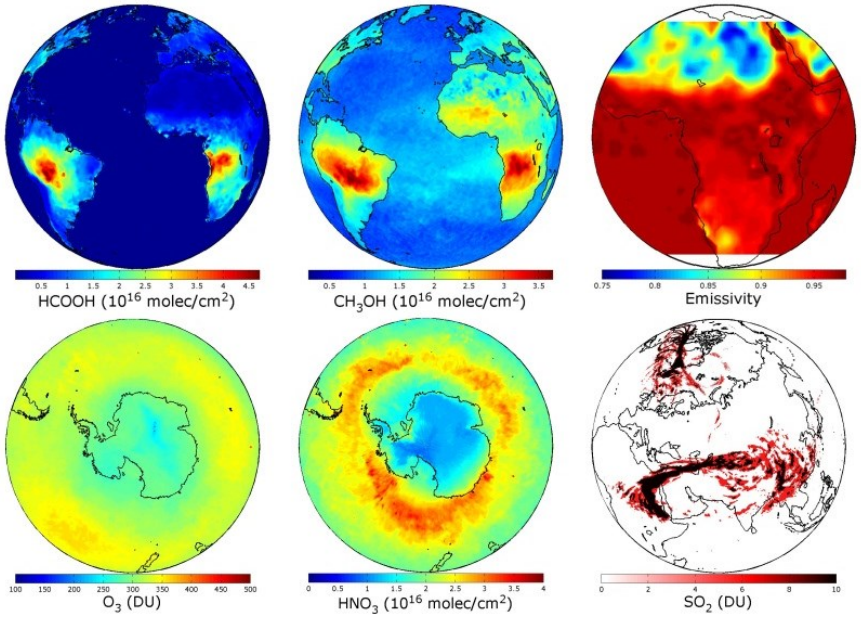
Eg fire detection, volcanic plumes

T + 2.5 heures

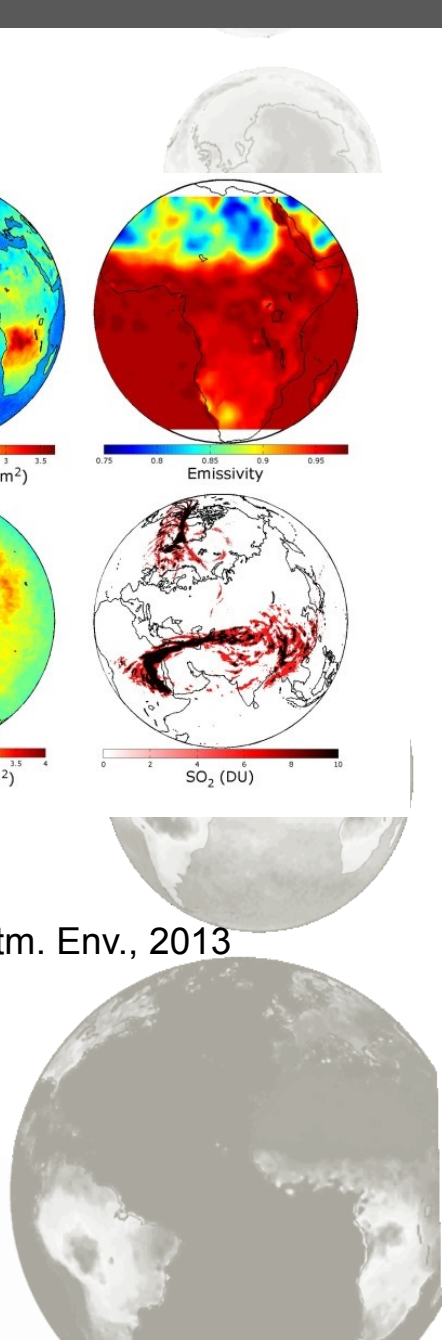
LATMOS ULB

What do we measure with IASI?



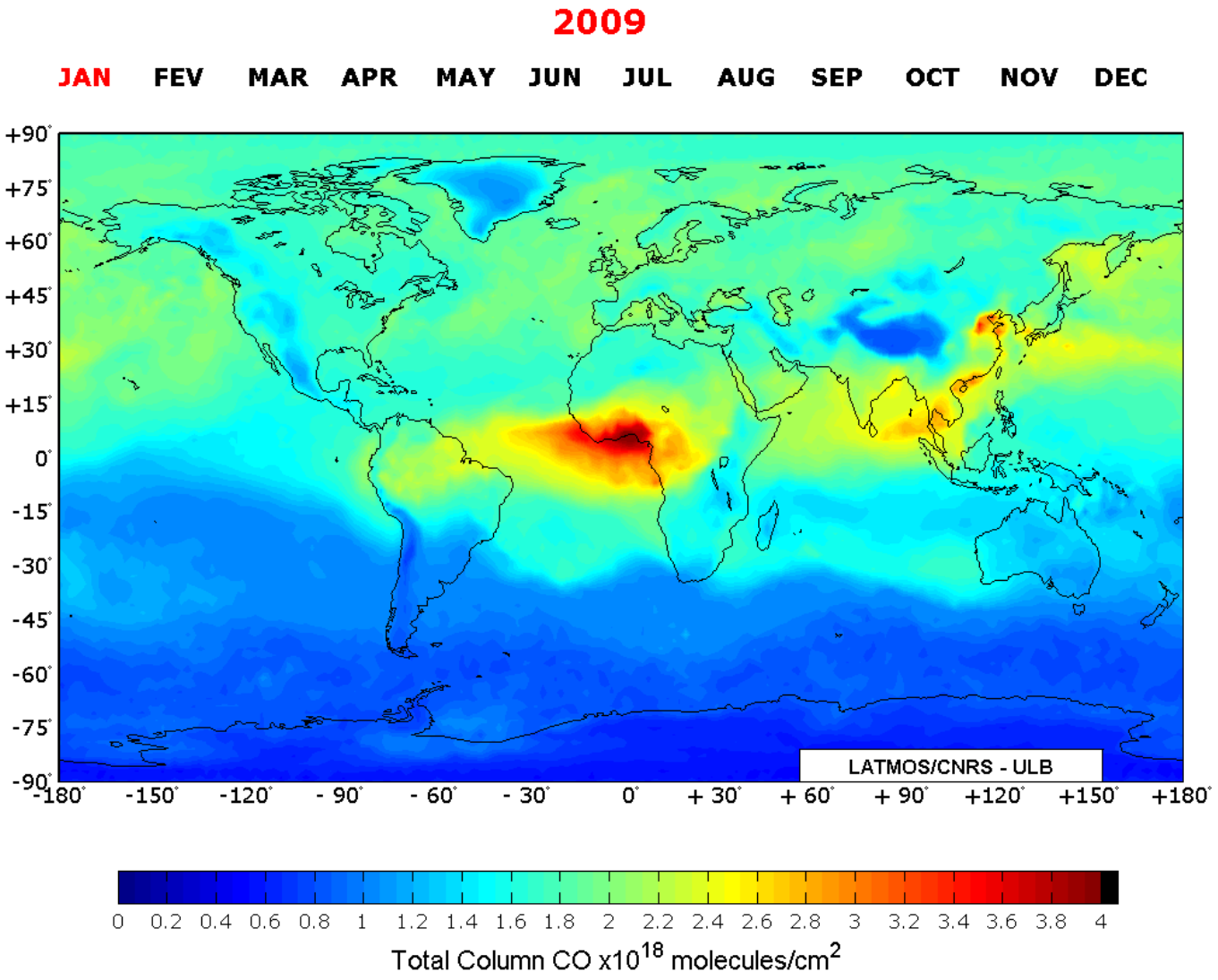


Clerbaux et Crevoisier, Atm. Env., 2013



LATMOS ULB

IASI CO Total Column on a global scale – 1 year

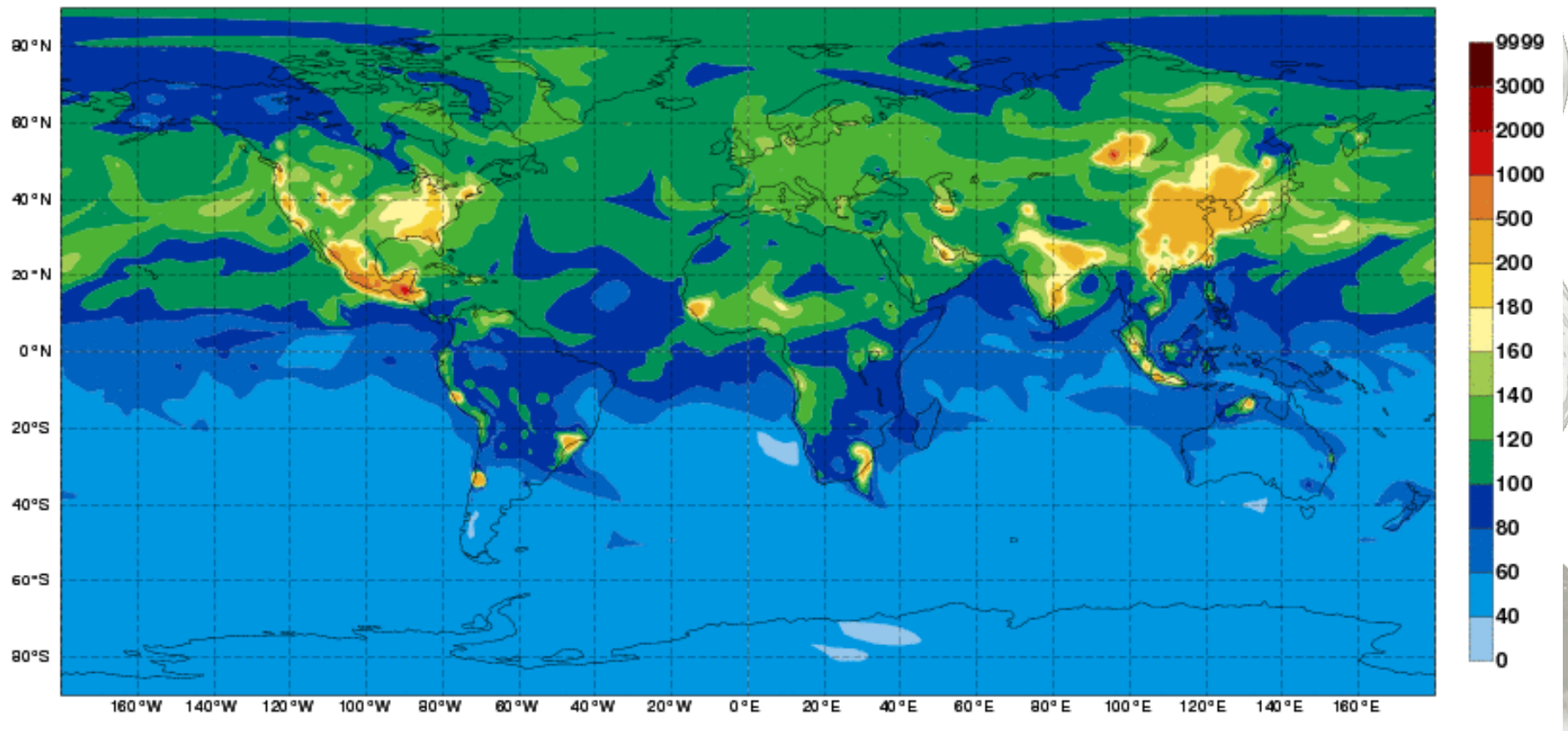


Courtesy M. George

LATMOS ULB

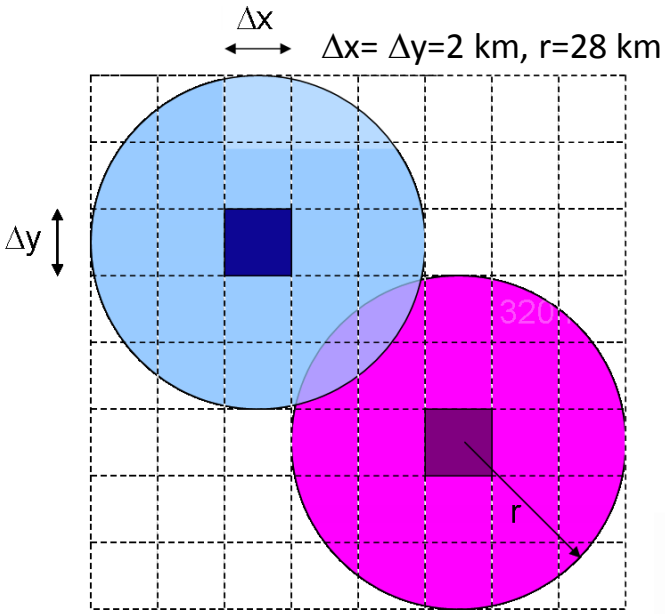
Assimilation of IASI CO Total Column in MACC

Monitoring atmospheric composition & climate

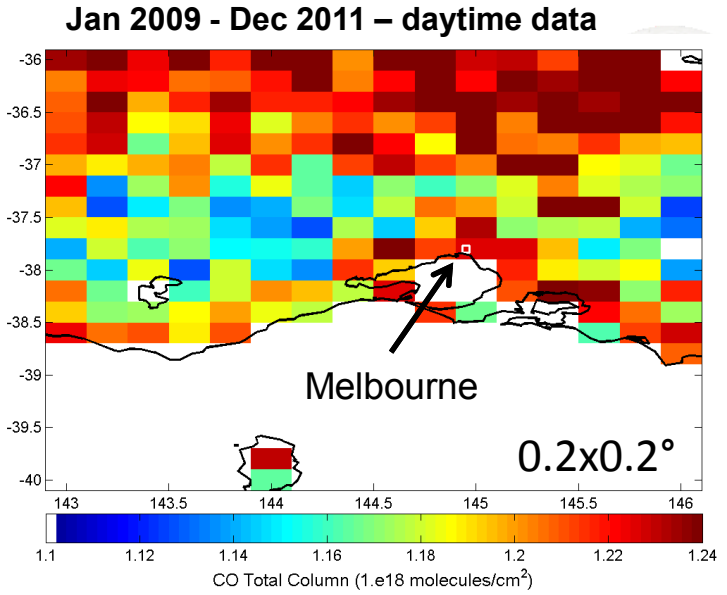


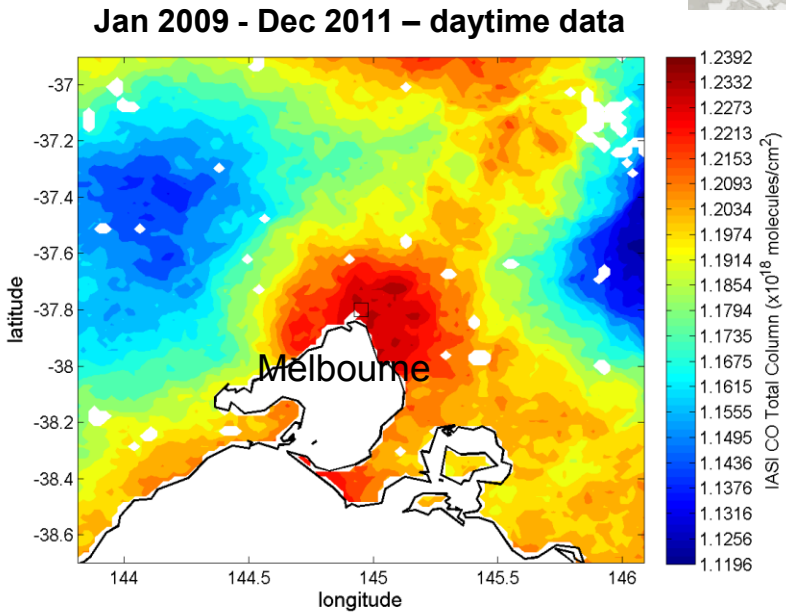
IASI CO Total Column on a city scale

- Pixel-averaging method to better resolve features in satellite data: need to use a large amount of data
- The value assigned to a grid box is the average of all data within radius r
- This technique oversamples the data (uses same point many times)



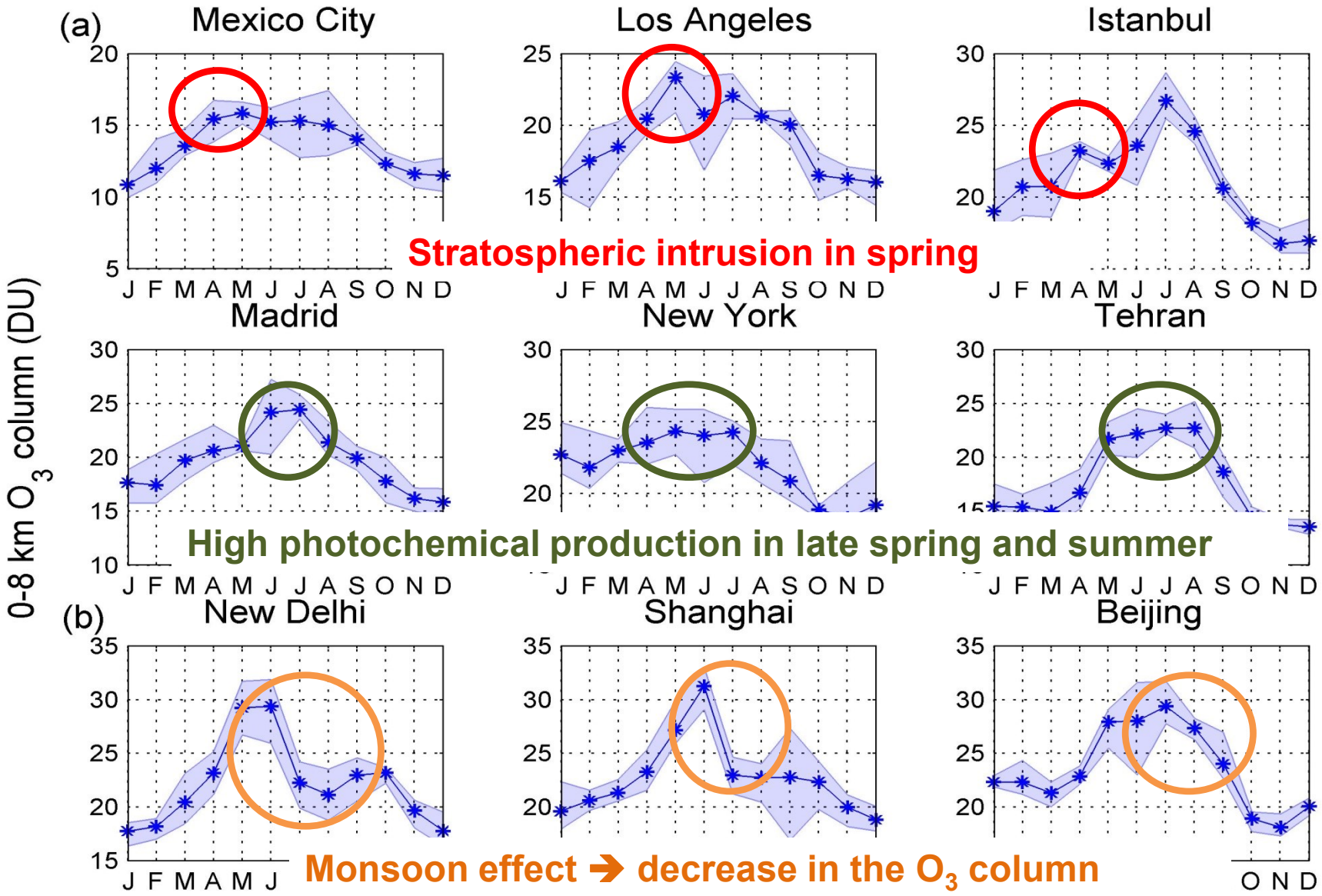
Pommier et al. (2013 – GRL under review)





Courtesy M. Pommier

IASI tropospheric O_3 on a city scale (2008-2011)

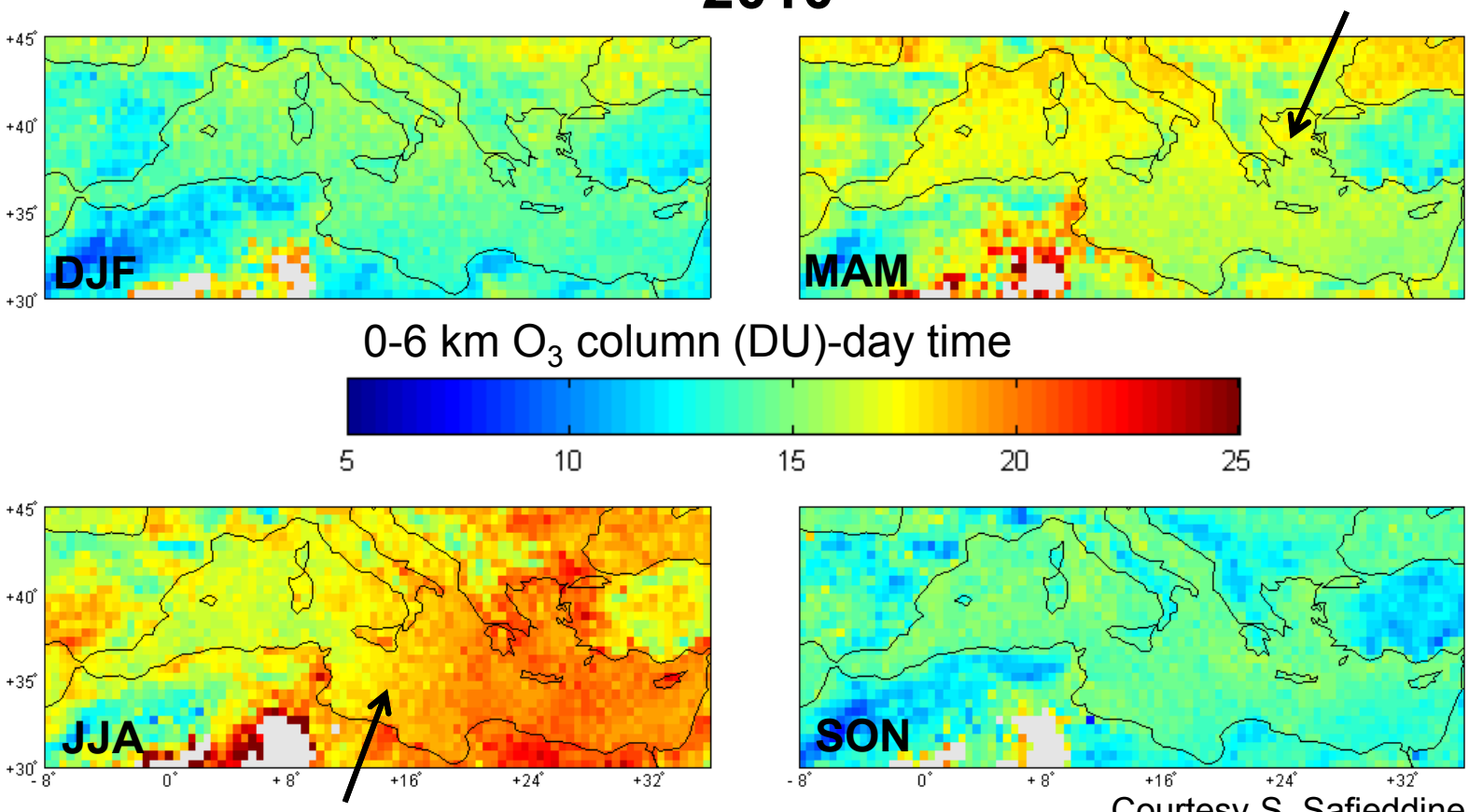


LATMOS ULB

Safieddine et al. (2013 – JGR under review)

IASI tropospheric O_3 on a regional scale

high values in spring due to stratospheric intrusion/photochemical production

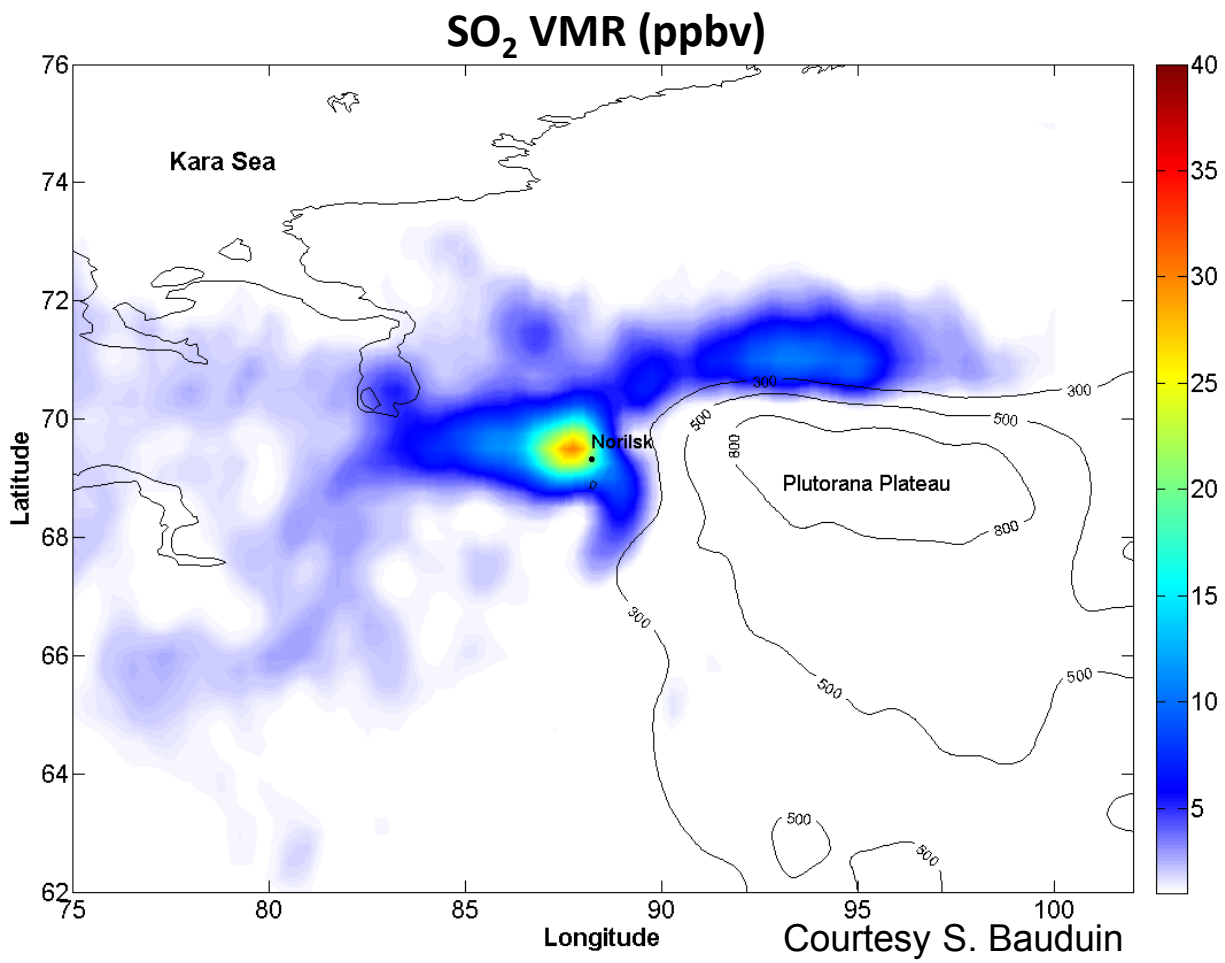


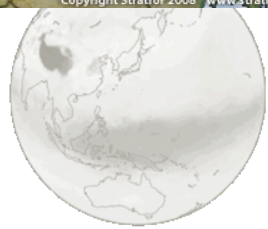
Maximum of O_3 observed during summertime

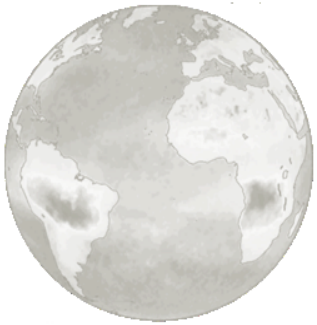
Courtesy S. Safieddine

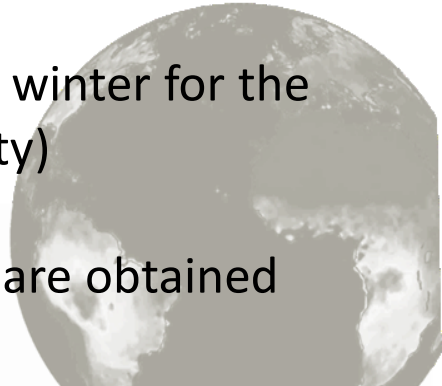
- Summertime O_3 maximum strongly impact regional air quality and radiative forcing
- Mediterranean region can be perturbed by long-range pollution import in addition to local emissions

IASI SO_2 concentrations in the area of Norilsk







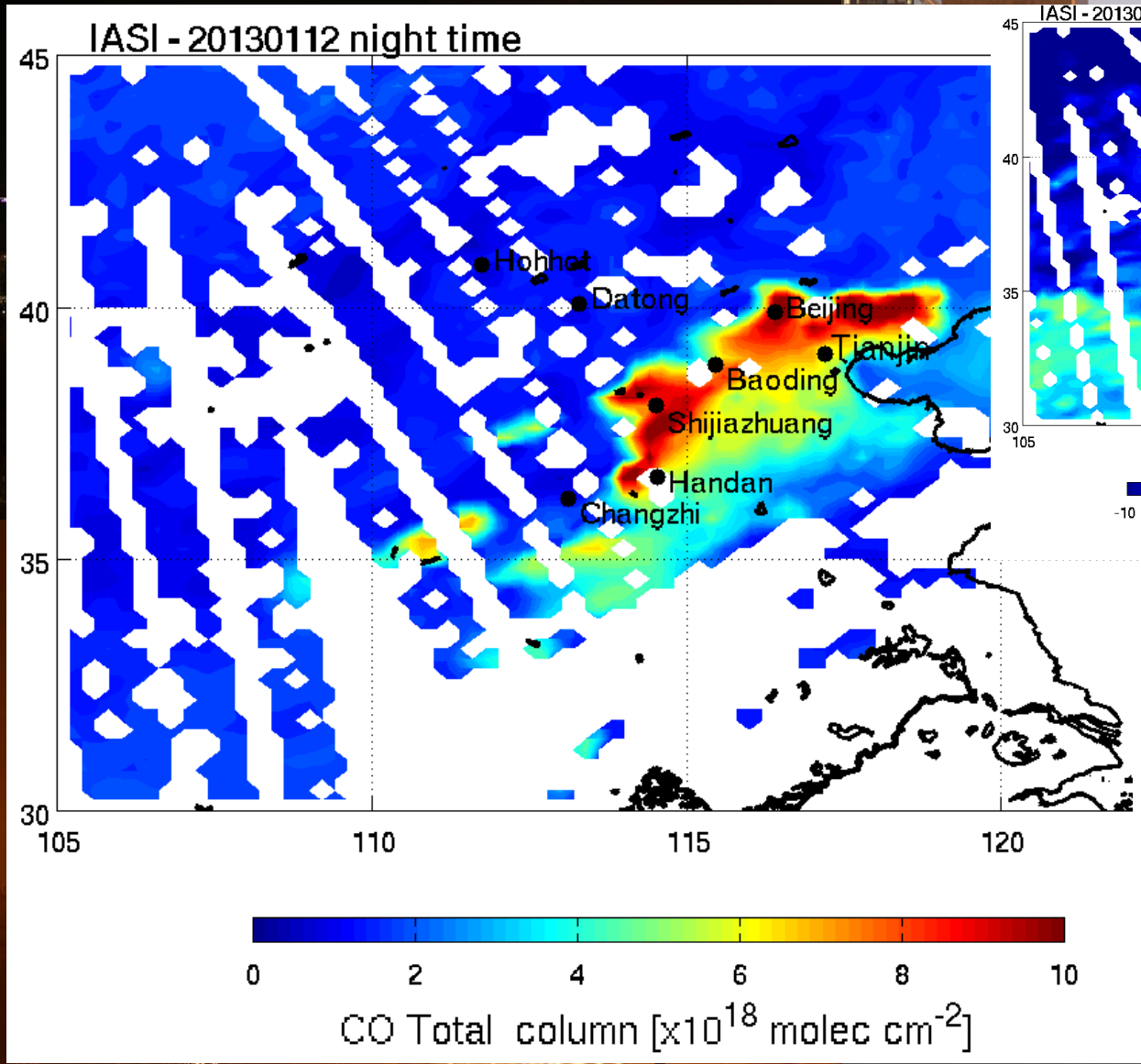


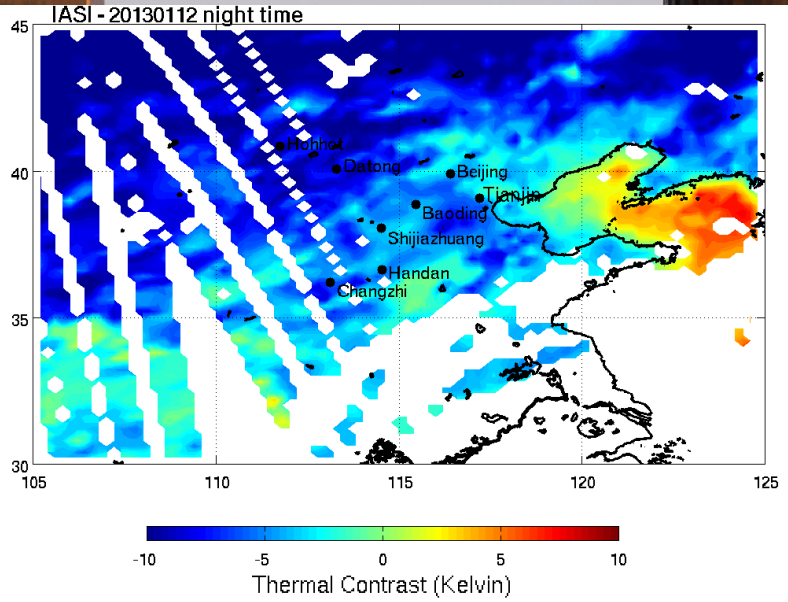
- SO_2 concentrations have been retrieved in the area of Norilsk in winter for the 2009-2011 period (high negative thermal contrast + low humidity)

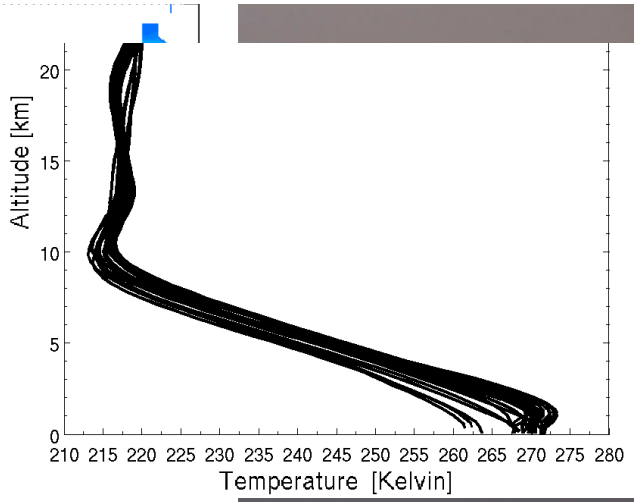
⇒ First time that spatial distribution of SO2 in the boundary layer are obtained

⇒ Capability of IASI to monitor surface pollution

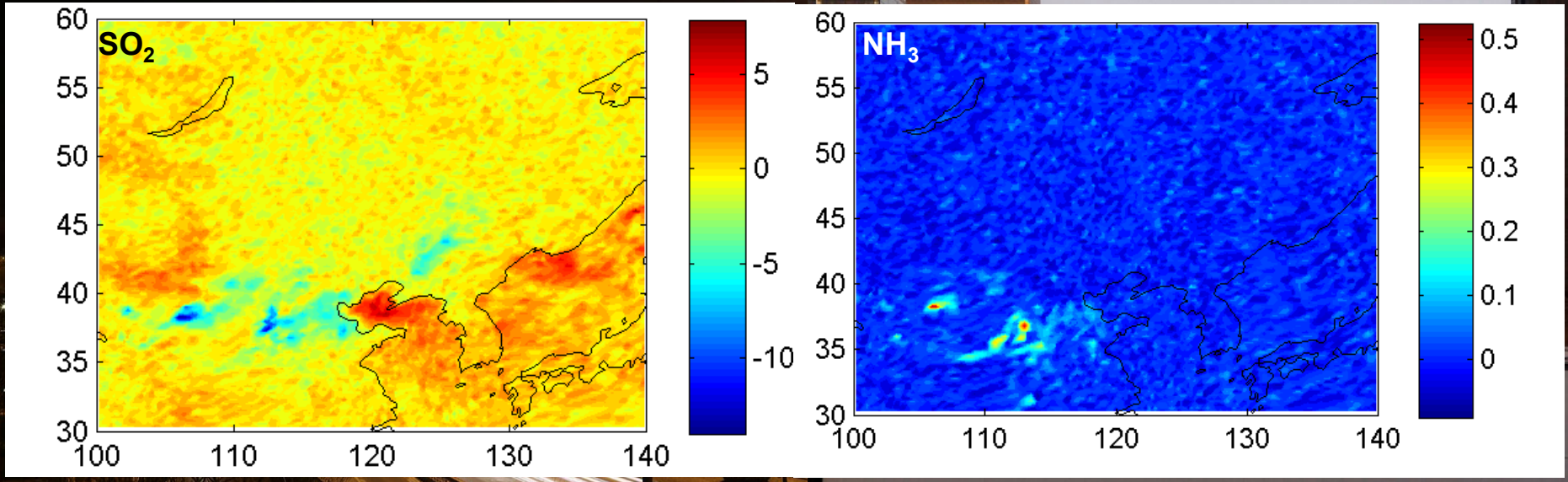
Winter pollution in China: case study of January 2013

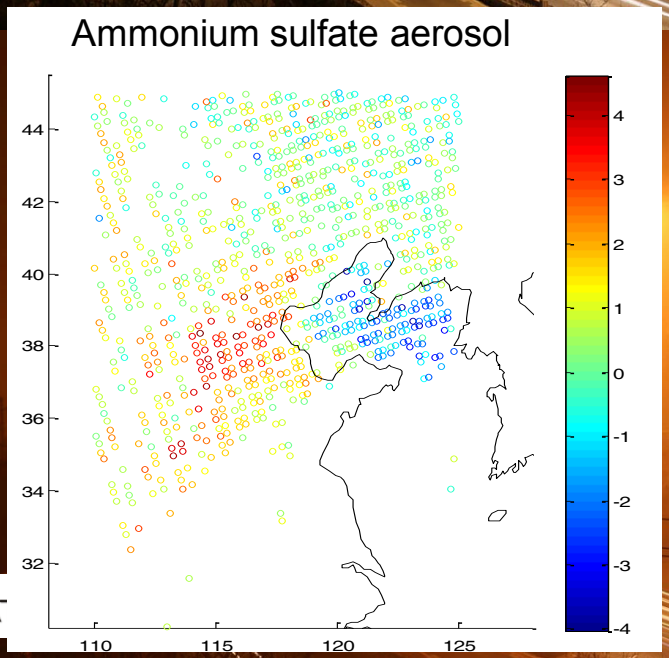






Can IASI see pollution in the Beijing area?





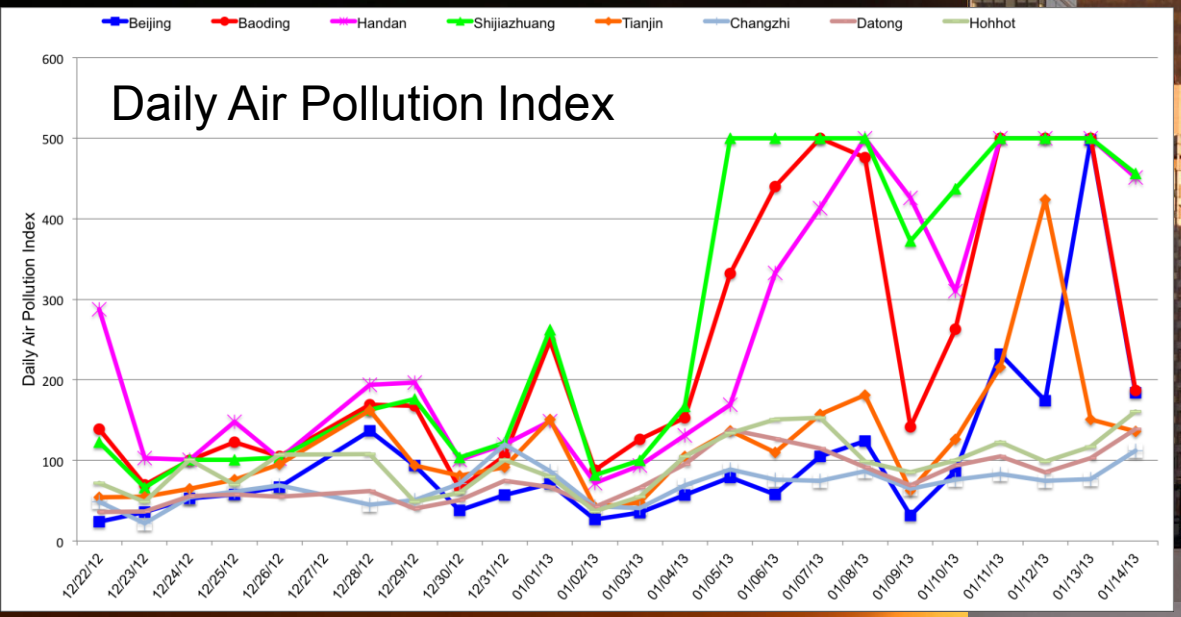
- Detections of NH_3, SO_2, and ammonium sulfate (major component of anthropogenic aerosols). Not so much in Beijing itself, but in the « industrial hub »

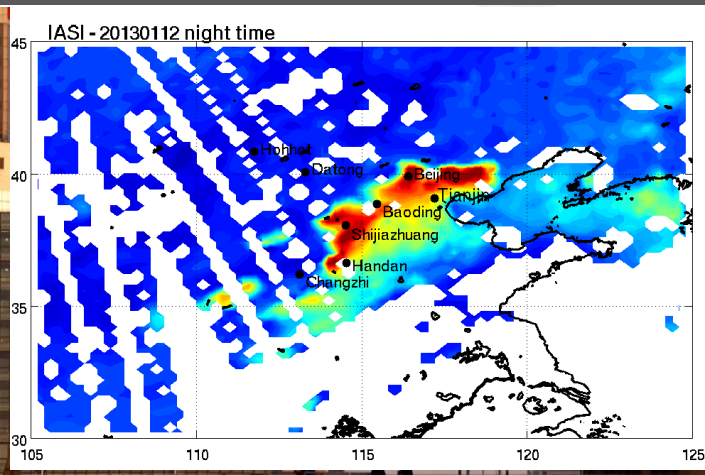
- Detections of ammonium sulfate are all in emission (related to negative thermal contrast).

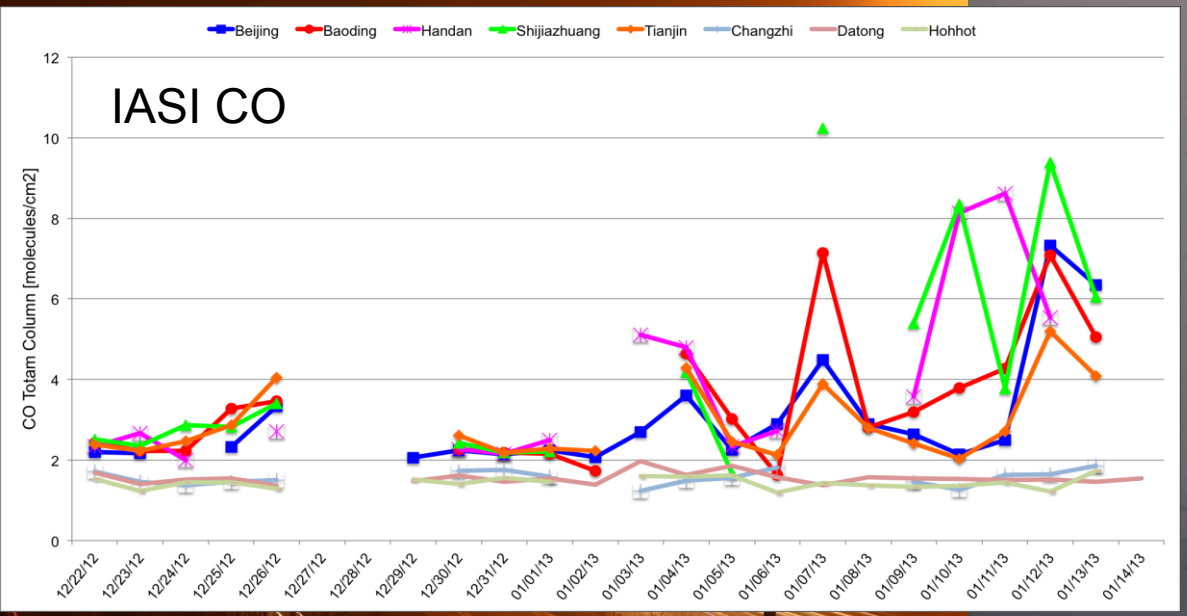
=> First time we see boundary layer aerosol so clearly in emission

Daily local air quality in the Beijing area

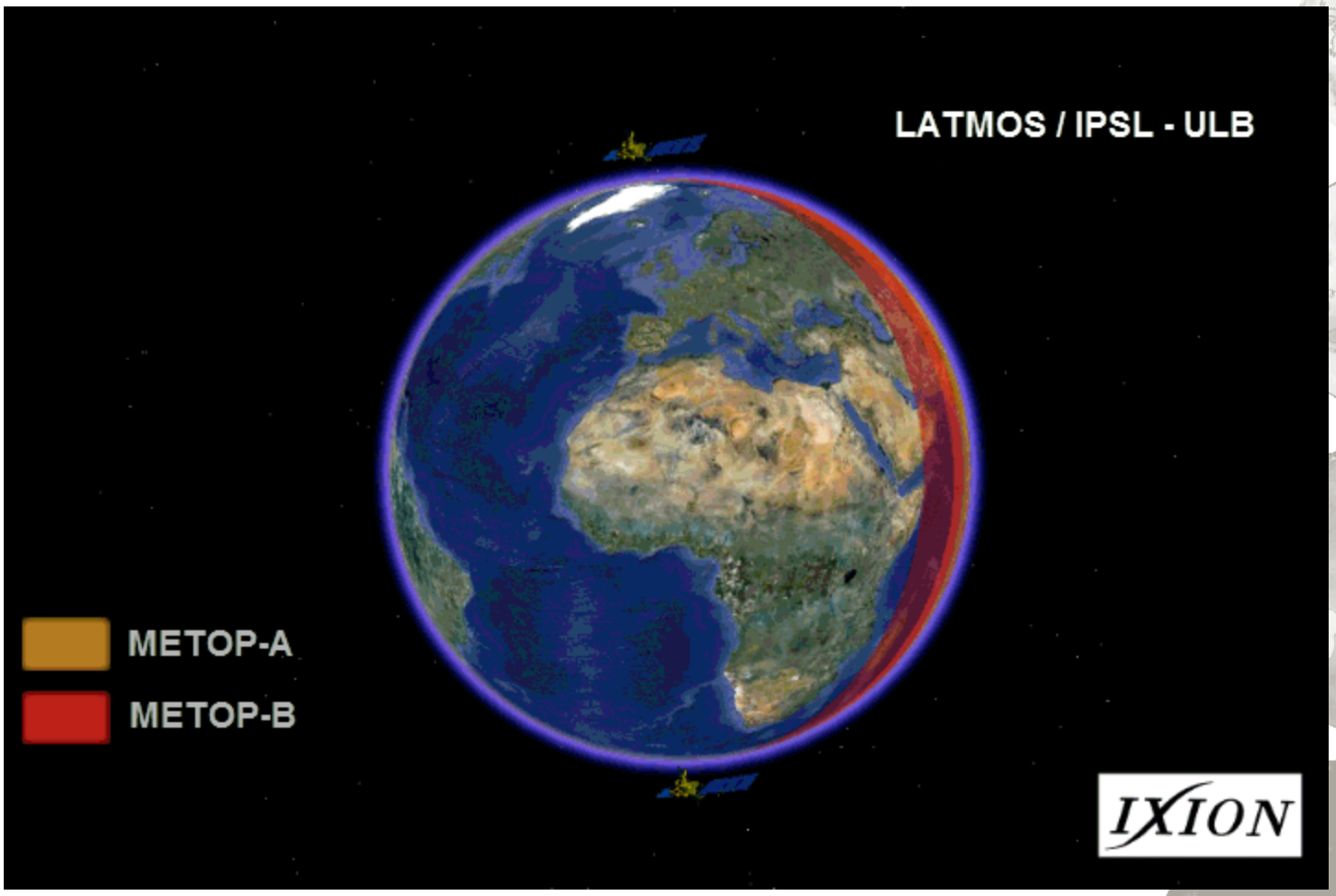
http://datacenter.mep.gov.cn







MetOp-B



Summary

- Numerous molecules are measured by IASI : more than expected!
- IASI is able to measure pollution in the boundary layer over cities in case favourable thermal contrast
- First time IASI see boundary layer ammonium sulfate so clearly
- IASI-B on MetOp-B is now operational => Increase the spatial coverage at the equator