CO and NH_3 (and a bit of SO_2) from IASI

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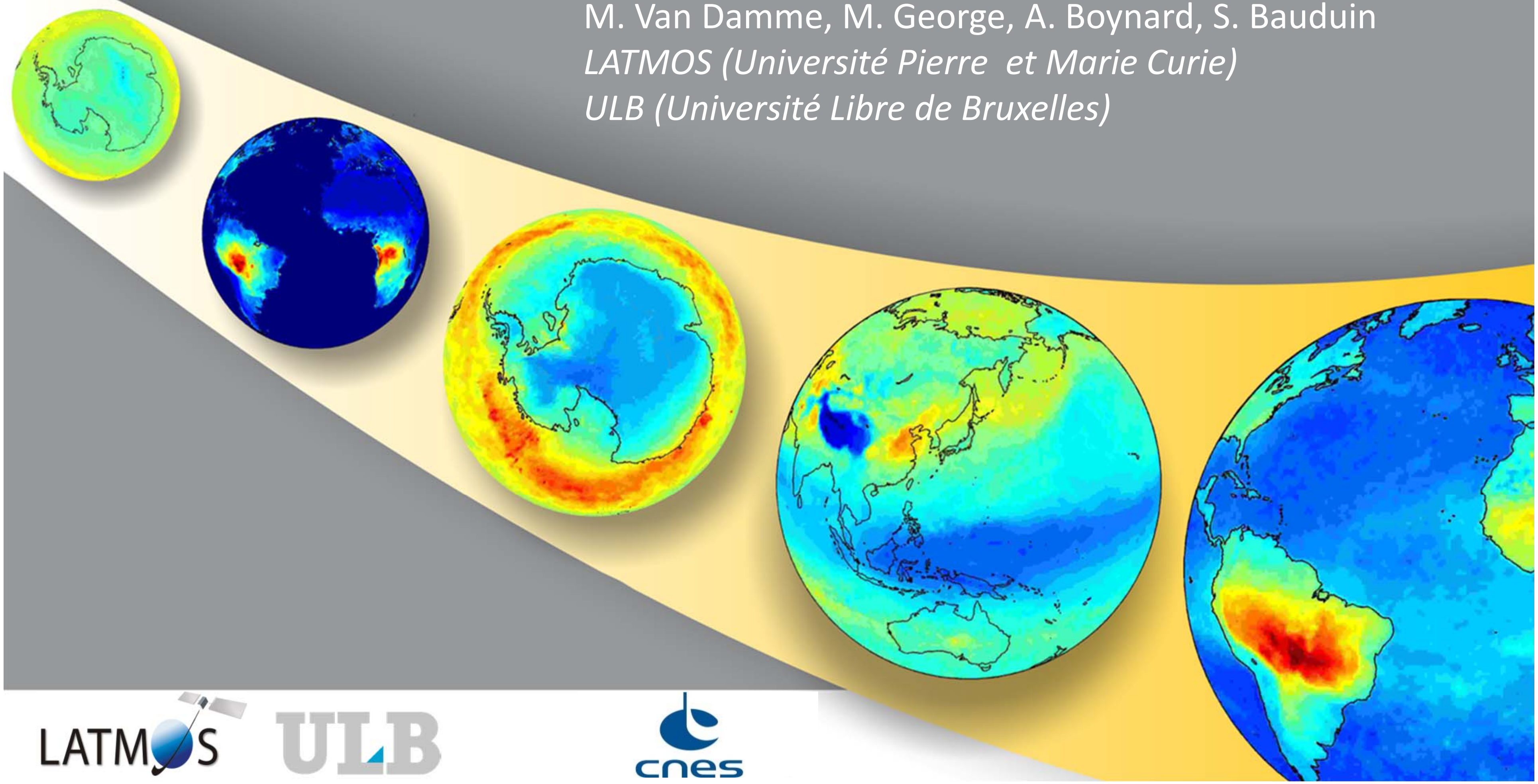
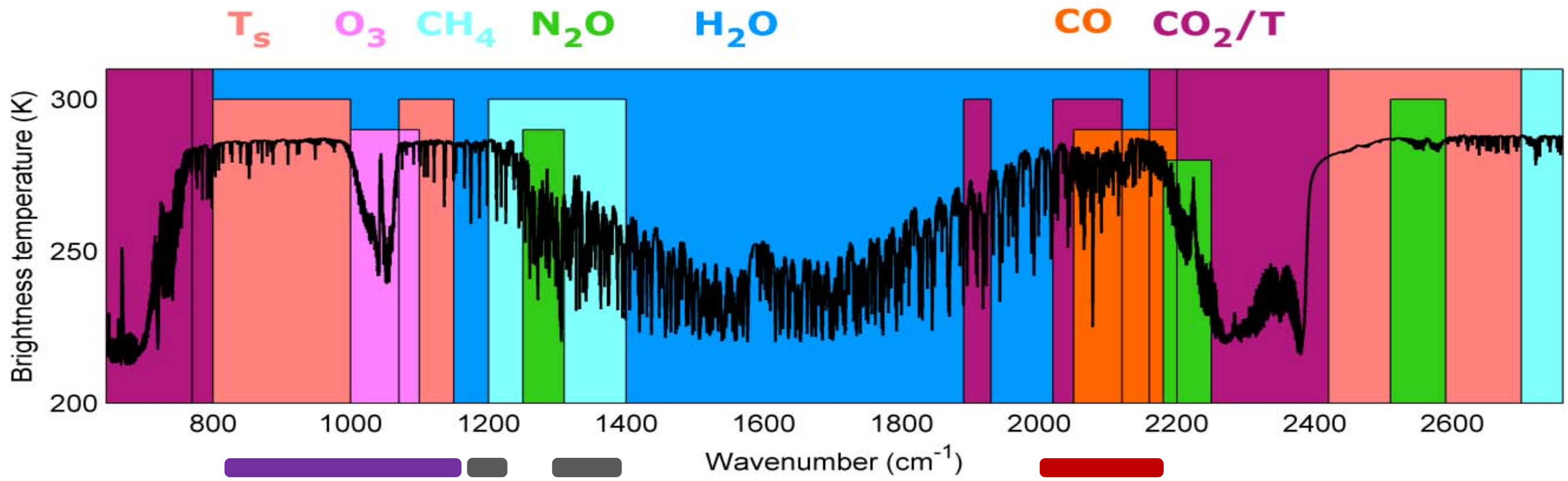
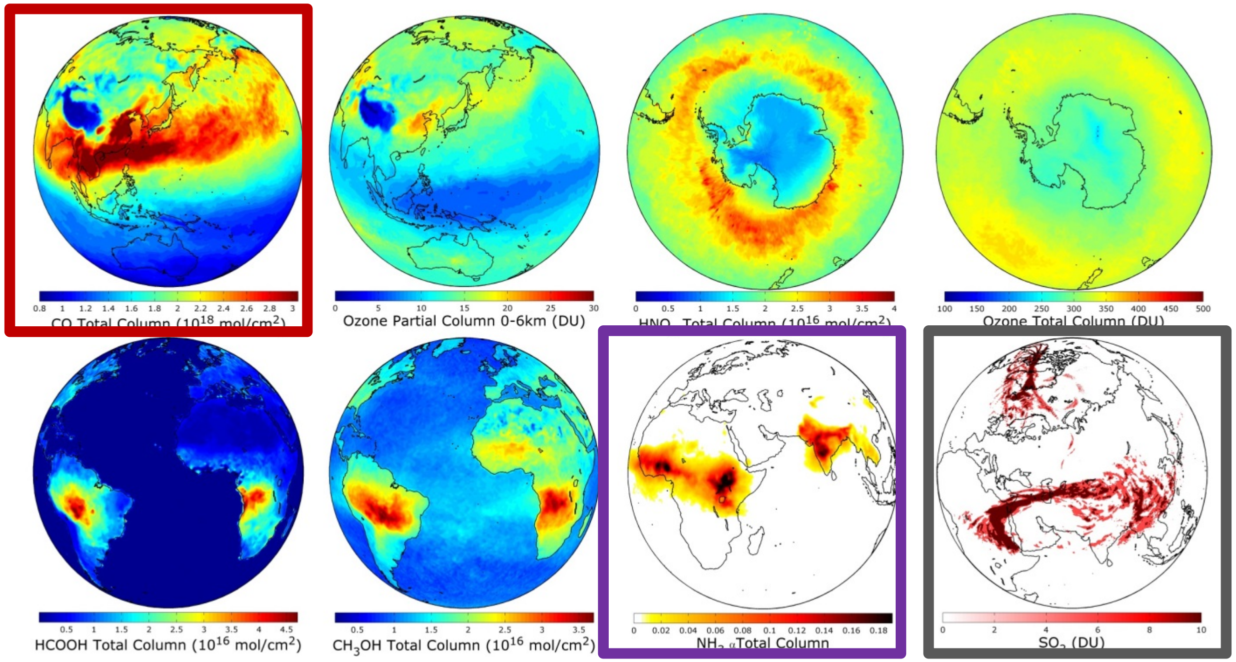
LATMOS (Université Pierre et Marie Curie)
ULB (Université Libre de Bruxelles)







CO « profiles »
in NRT
with a 12 km footprint
day/night
global coverage

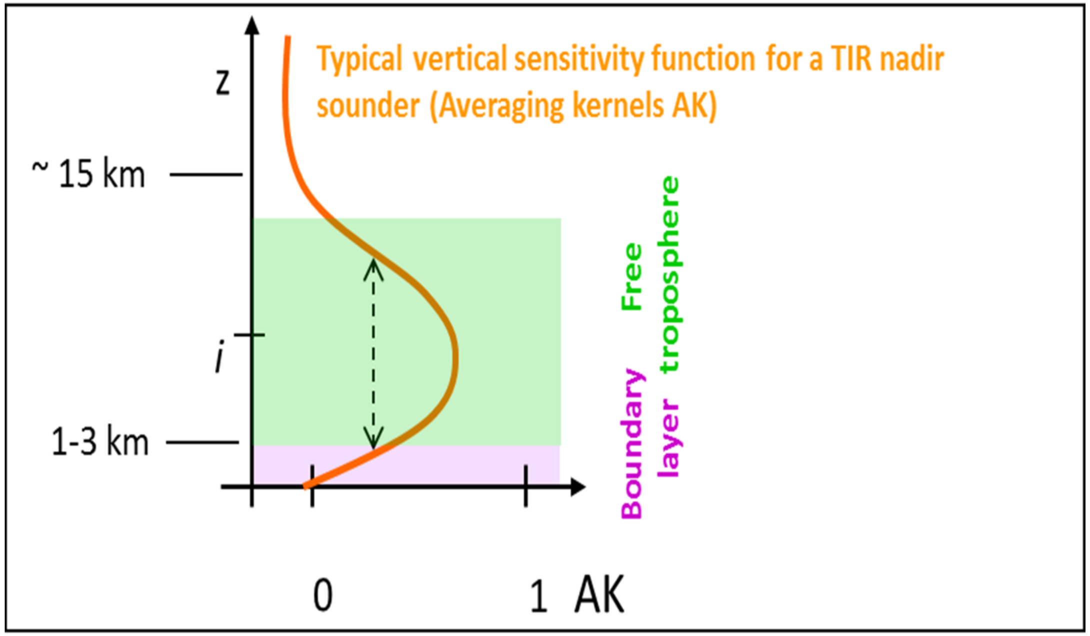
+ NH_3 total columns
Research mode

+ SO_2 volcano/anthropo

What can be seen by IASI for high pollution events?

Boundary layer pollution

Usual picture



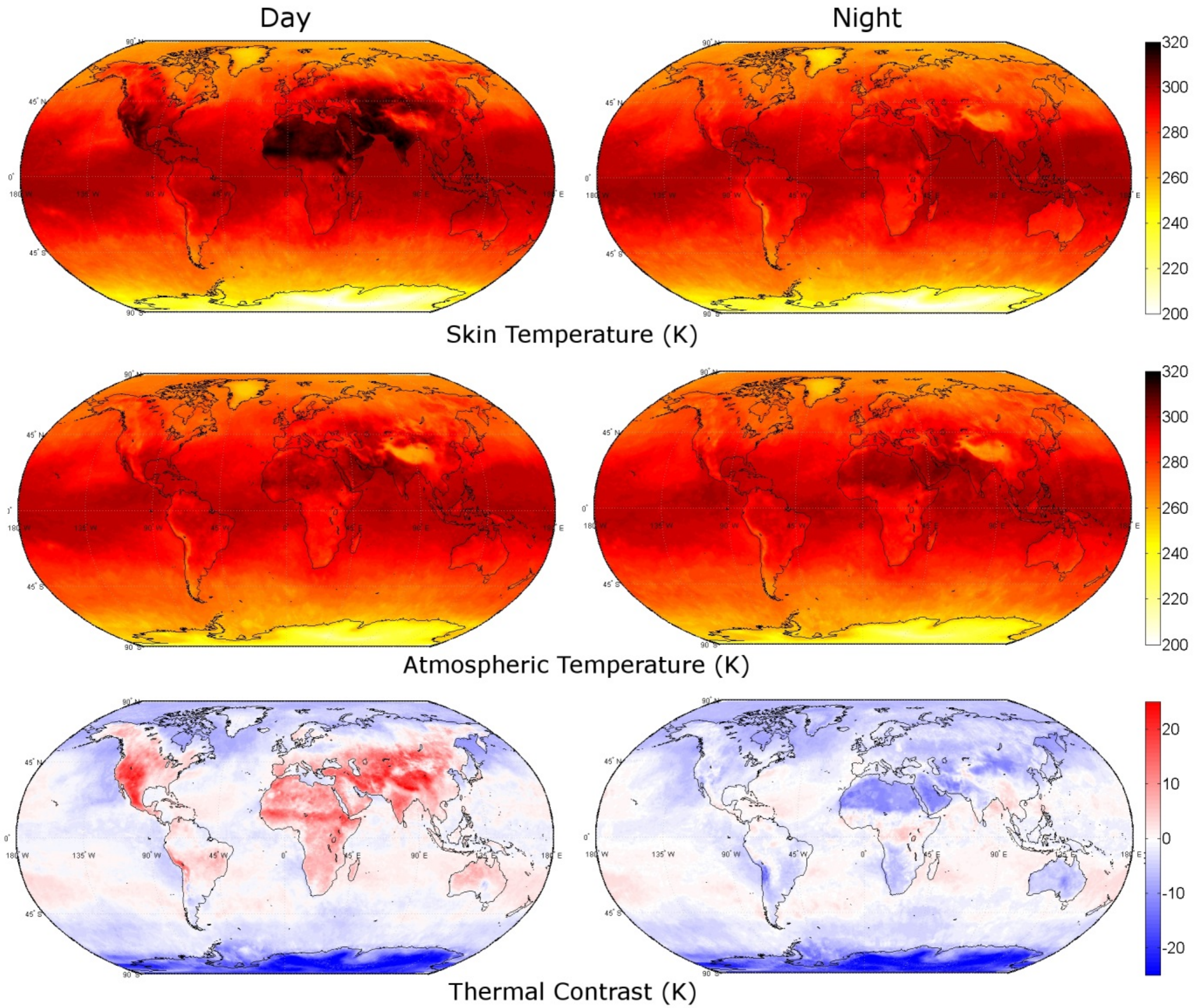
Thermal infrared nadir sounders are usually considered as being sensitive to The mid troposphere

Depends on temperature contrast

Credit: P. –F Coheur (ULB)

What can be seen by IASI for high pollution events?

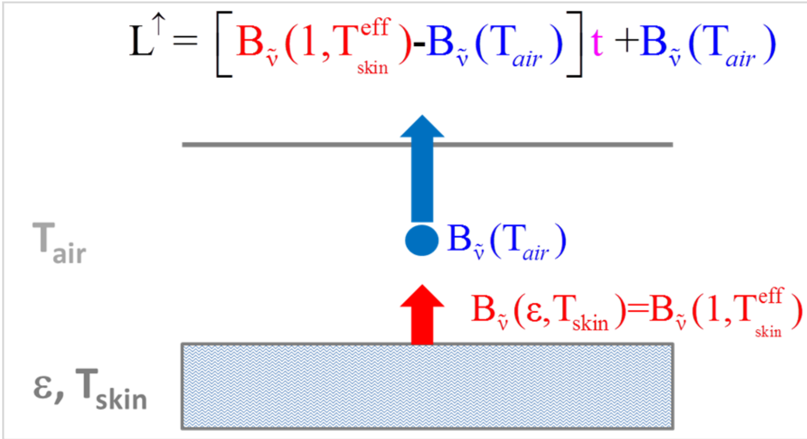
Thermal contrast



Clerbaux et al, ACP I2009

What can be seen by IASI for high pollution events?

Boundary layer pollution



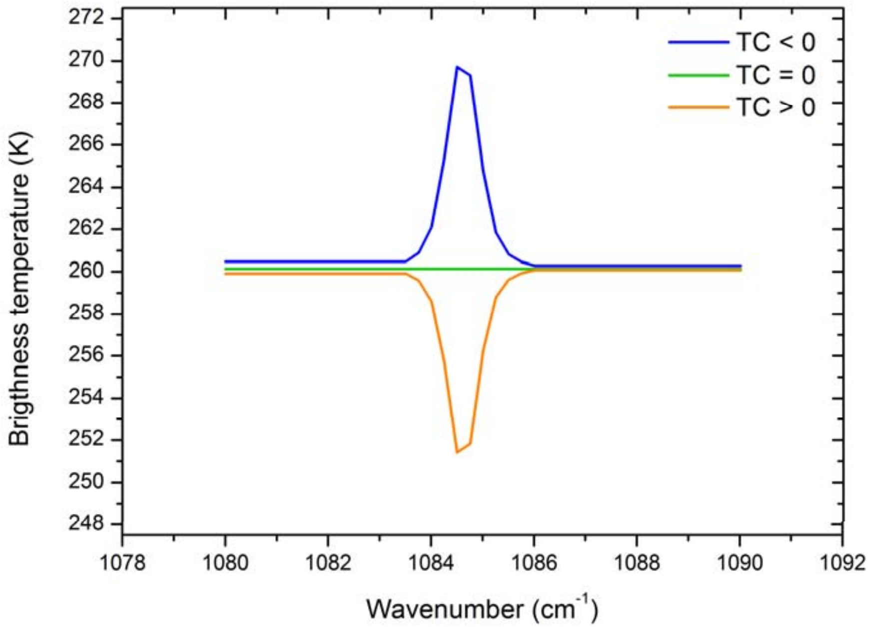
How deep the instrument will see depends on temperature contrasts

$T_1 = T_{skin}^{eff}$ → **No signal.** Emission and absorption cancel out

$T_1 < T_{skin}^{eff}$ → **Absorption** from the first layer (usual case during daytime)

$T_1 > T_{skin}^{eff}$ → **Emission** from the first layer (temperature inversion; night-time mainly)

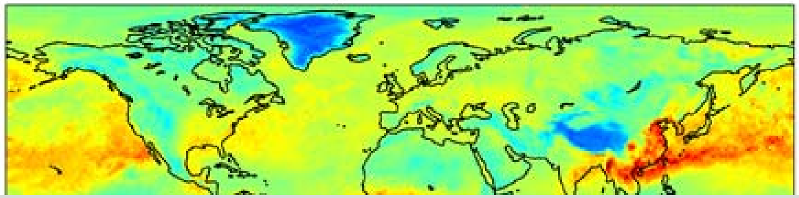
The larger the temperature contrast *(positive or negative)* the better



Credit P-F. Coheur

Carbon monoxide

April 2013

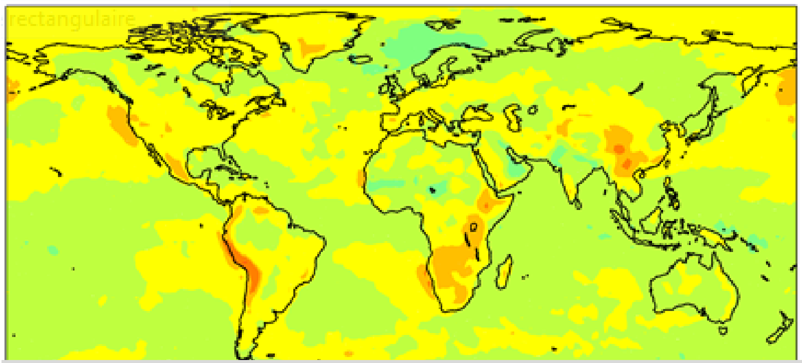


Produced when incomplete combustion occurs (industry, heating systems, traffic, biomass burning)

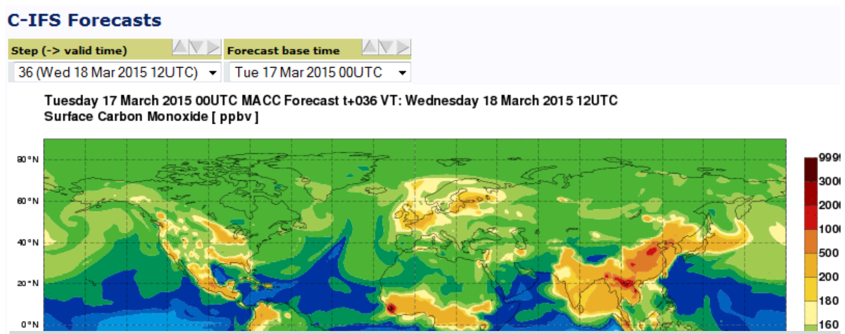
Pollution plumes tracker

Emissivity sources

April 2013



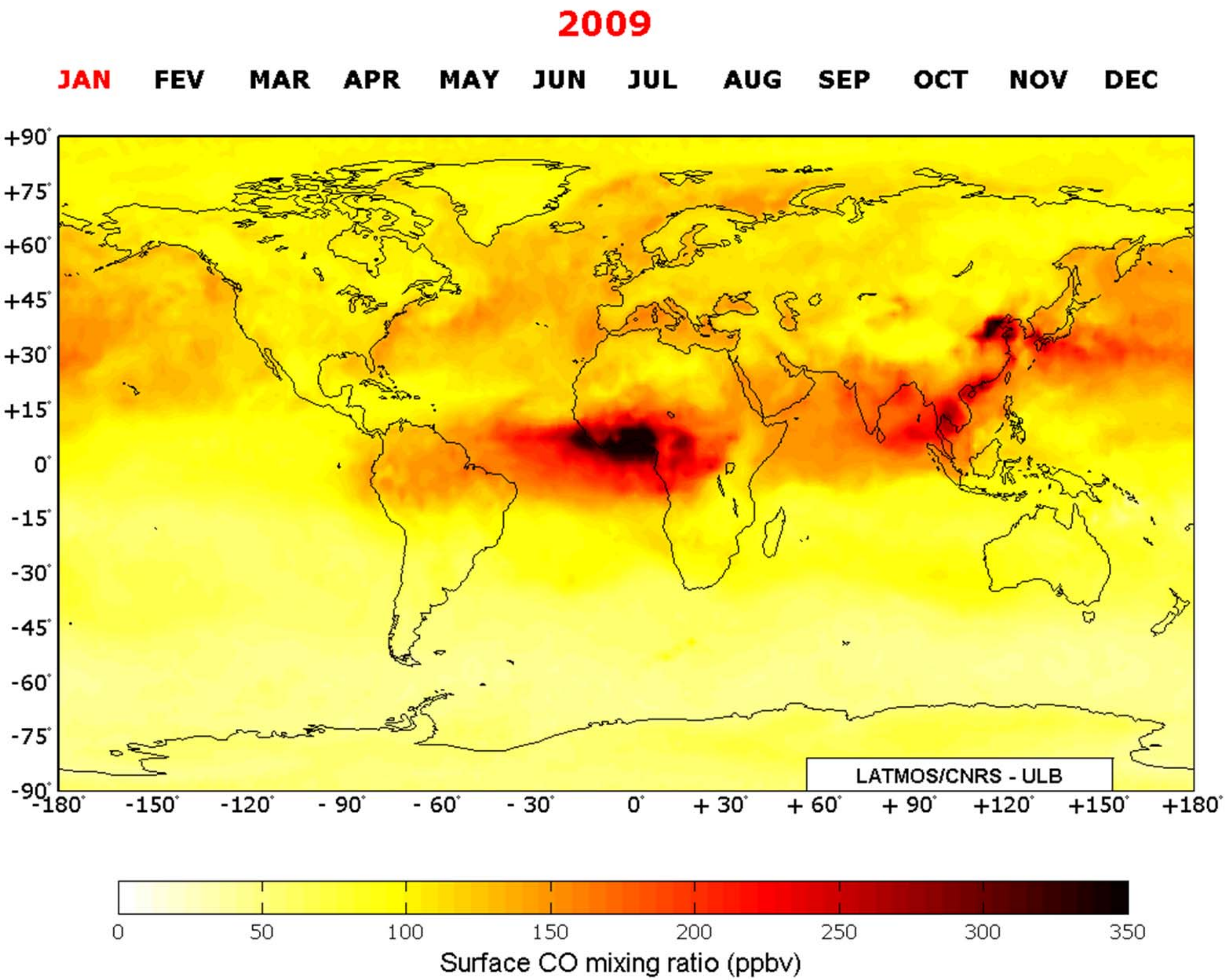
IASI: global, day and night, 12/50 km horiz res.
Sensitivity mid tropo (5-10 km) . DOFS 1 to 2
Thermal contrast key



Users

Copernicus Atmospheric Service
106 registered scientific users through Ether

Carbon monoxide : global 2009

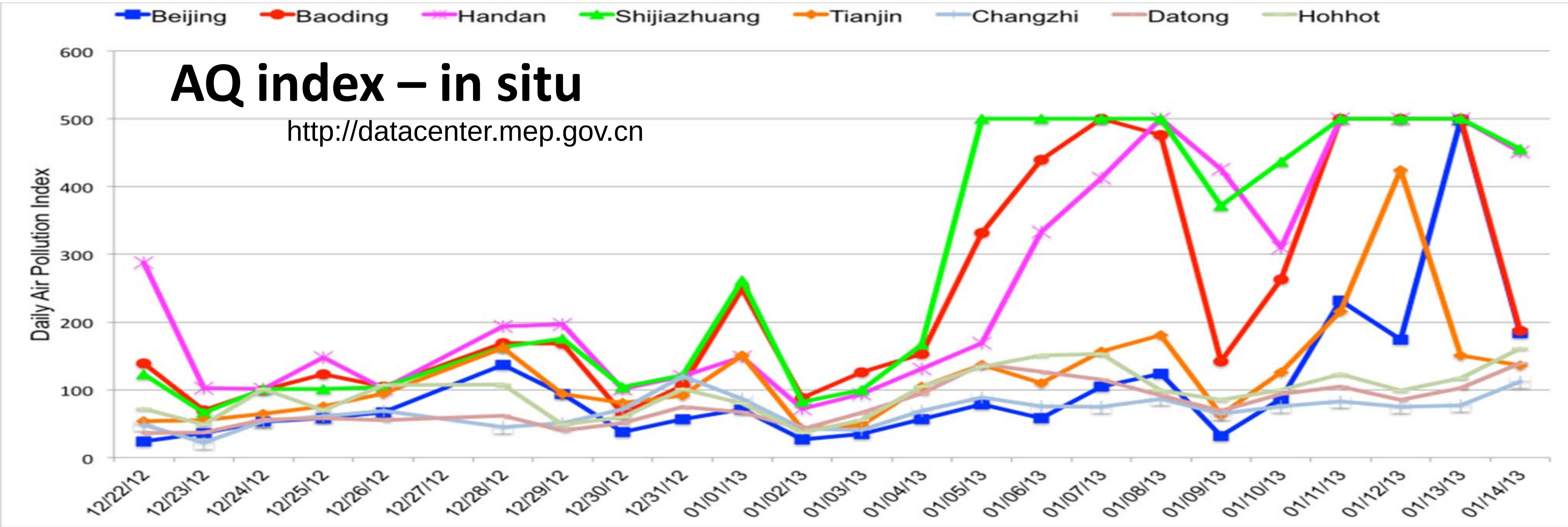


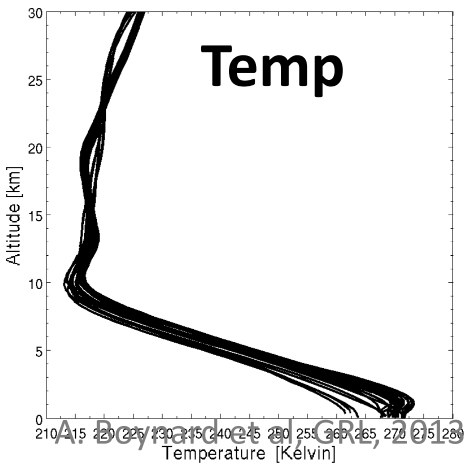
es

, LATMOS

China : January 2013

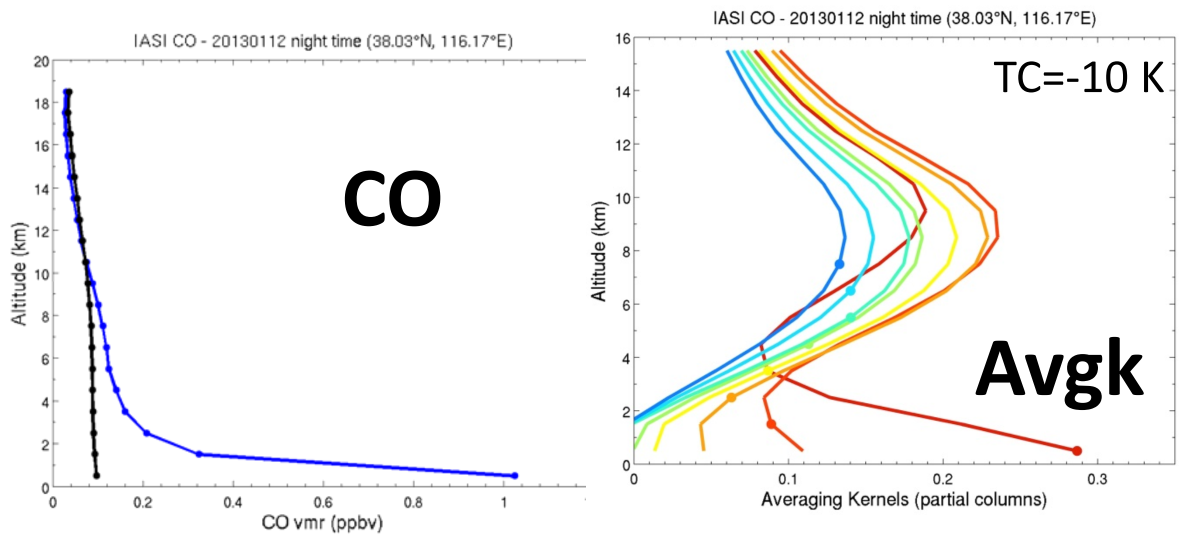
China : January 2013



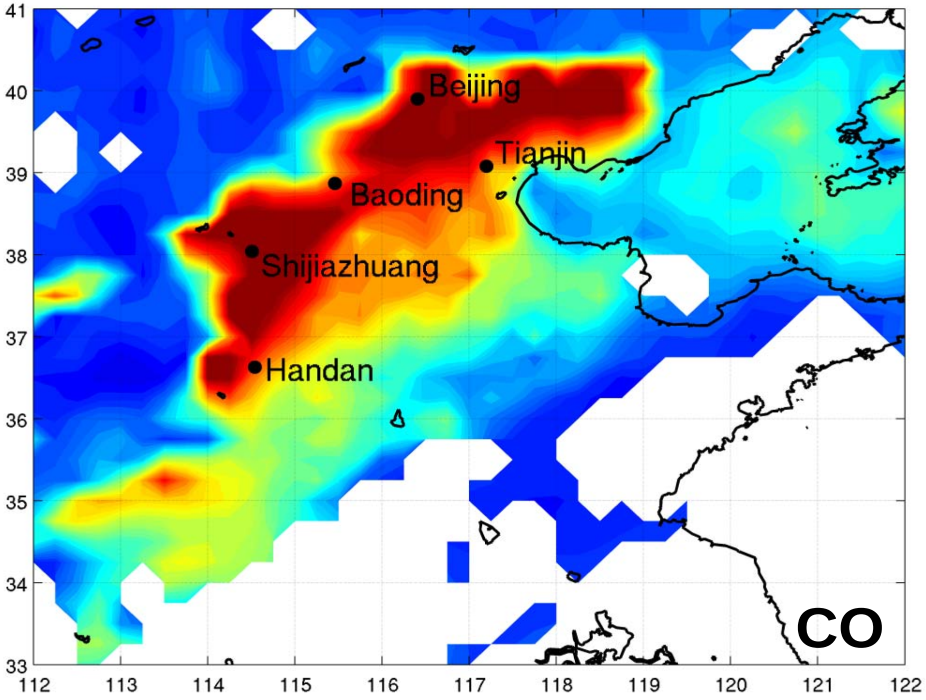


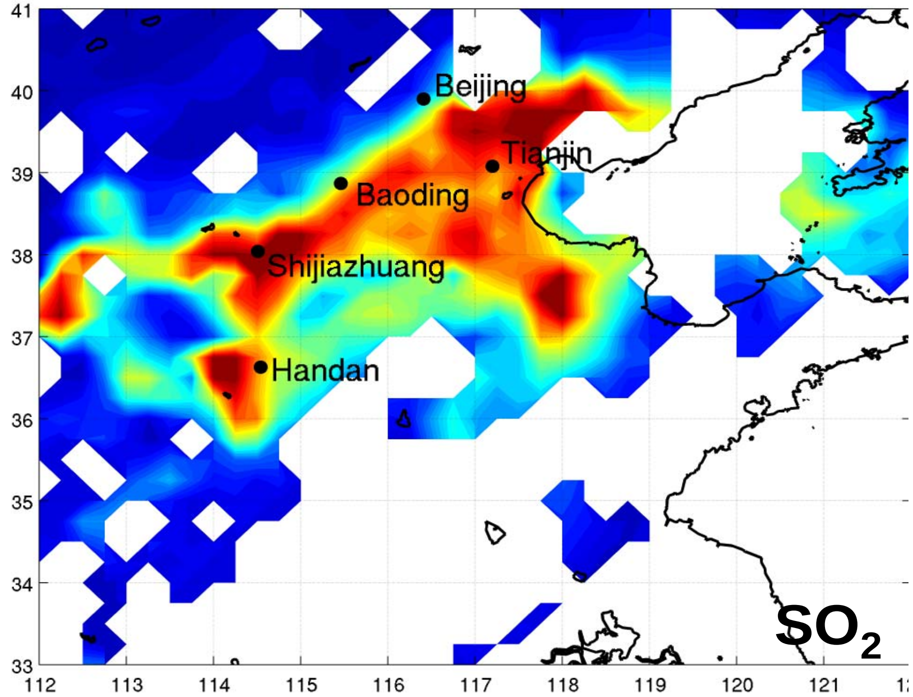
A. Boynard et al., GRL, 2013

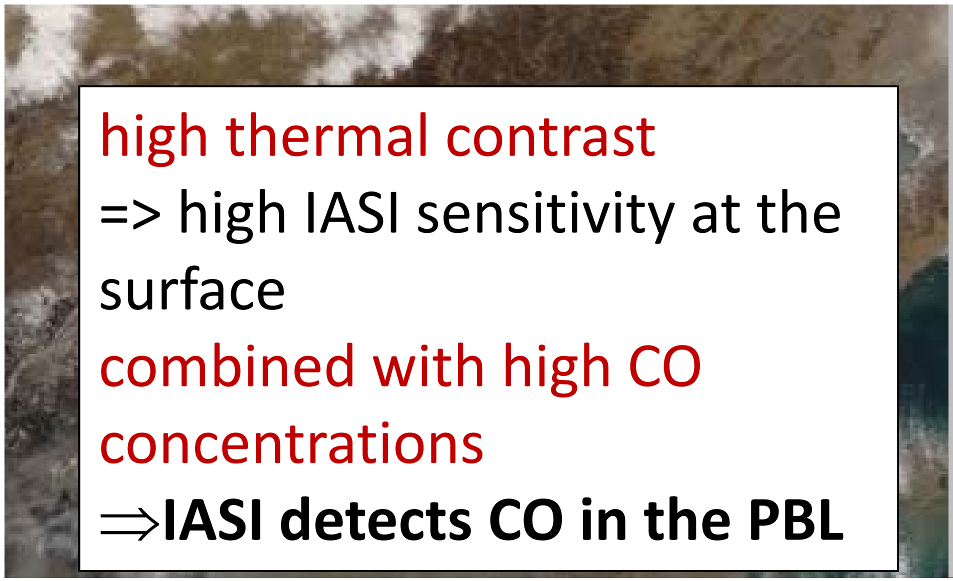
IASI CO retrieval



CO and SO_2: January 2013







high thermal contrast

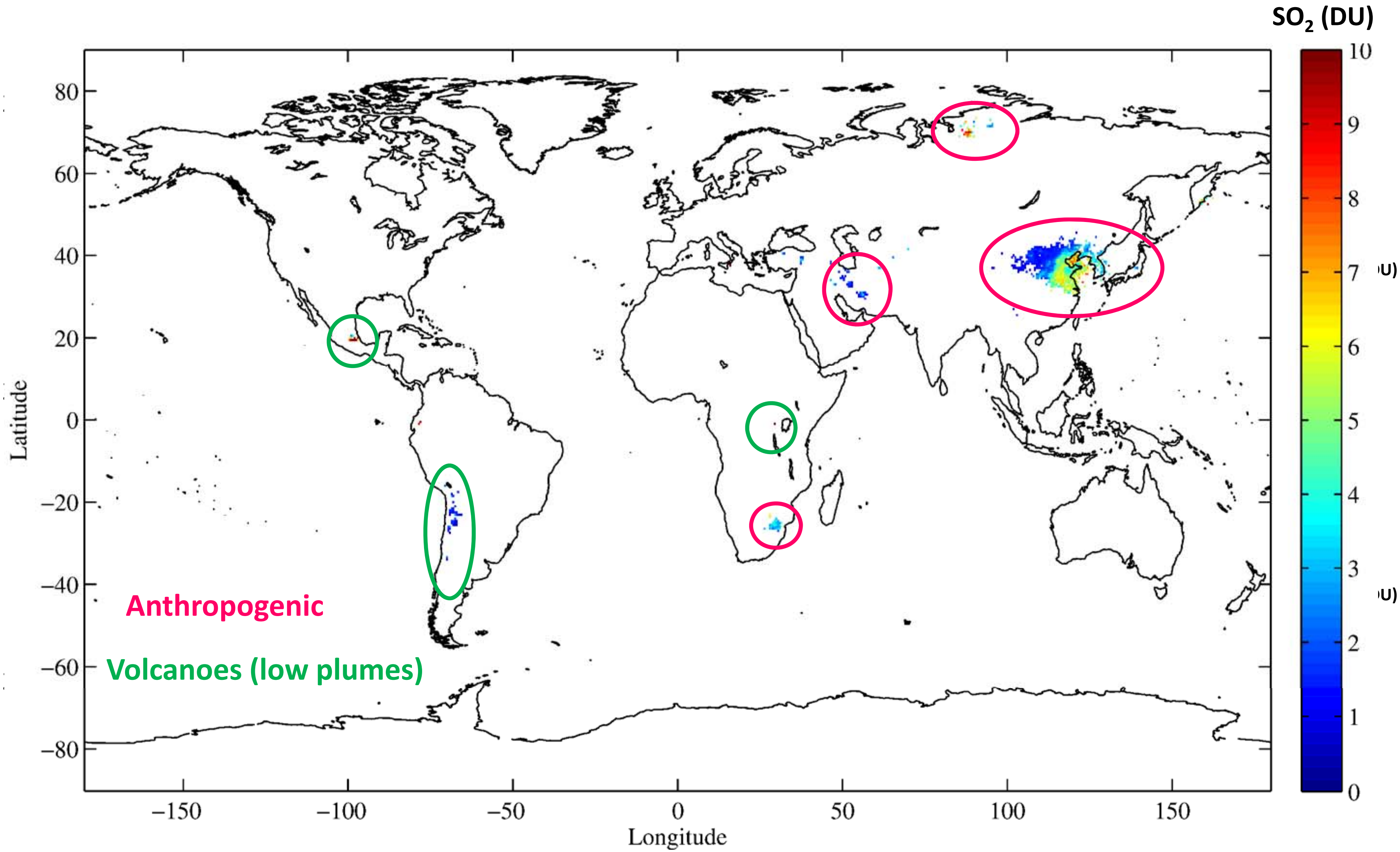
=> high IASI sensitivity at the surface

combined with high CO concentrations

⇒IASI detects CO in the PBL

Boynard et al, GRL 2014

SO_2 global scale (2008-2014)

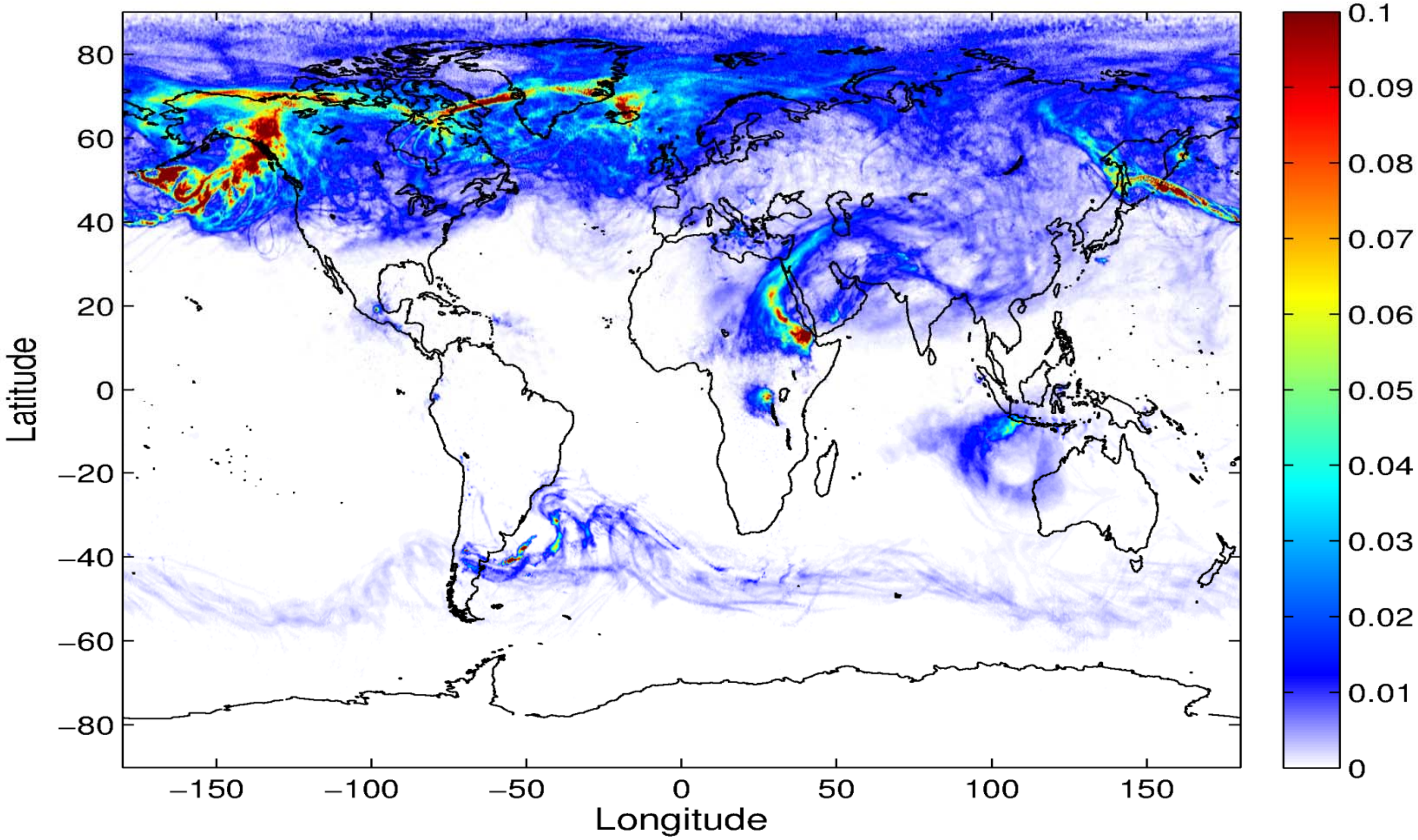


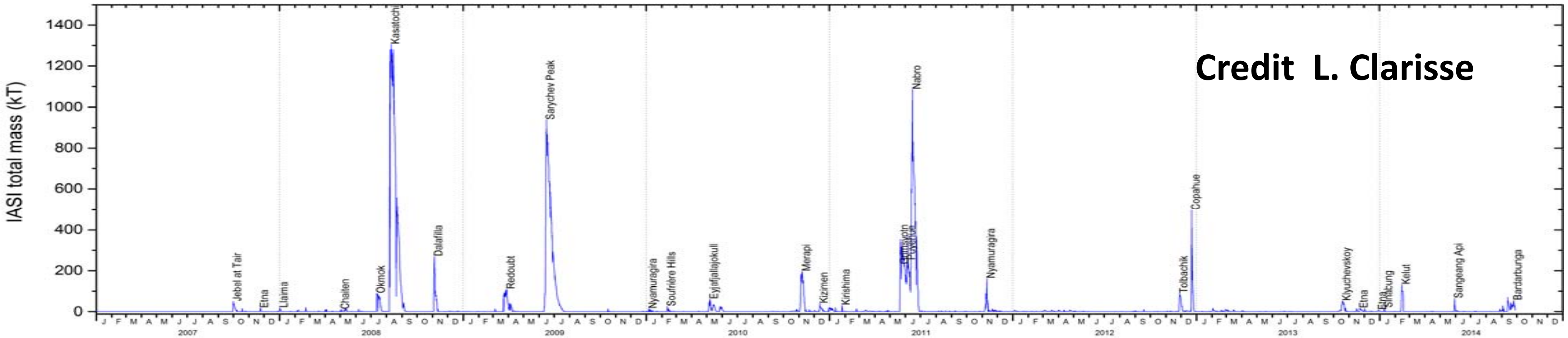
Credit S. Bauduin

SO_2 global scale (2008-2014)

Detection of SO_2 at high altitudes (average 2008-2014)

Large volcanic eruptions are filtered out because plumes are at high altitudes!

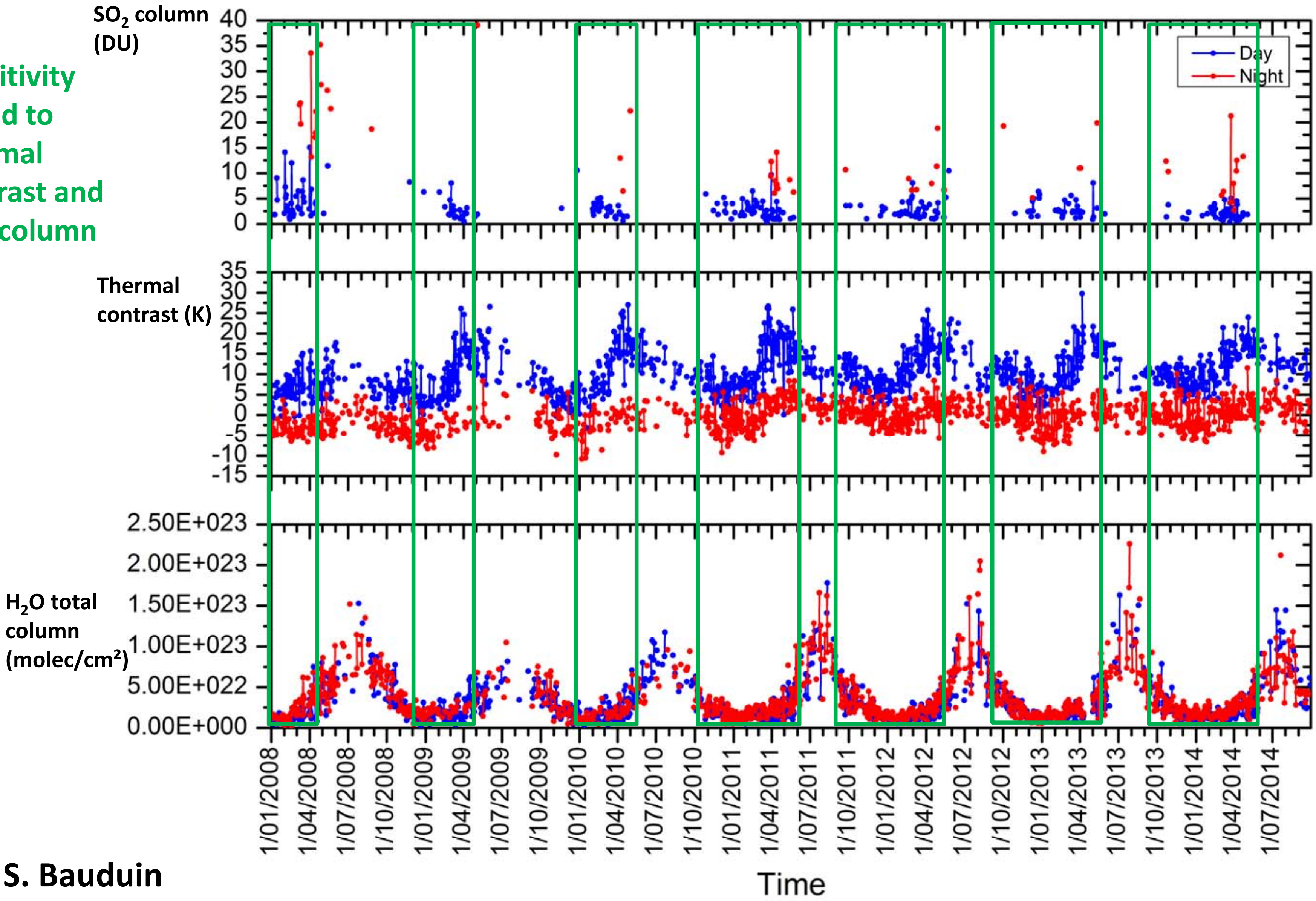




Credit L. Clarisse

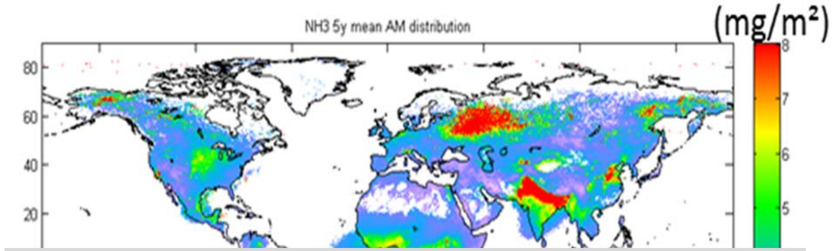
SO_2 Beijing (2008-2014)

- Sensitivity linked to thermal contrast and H_2O column



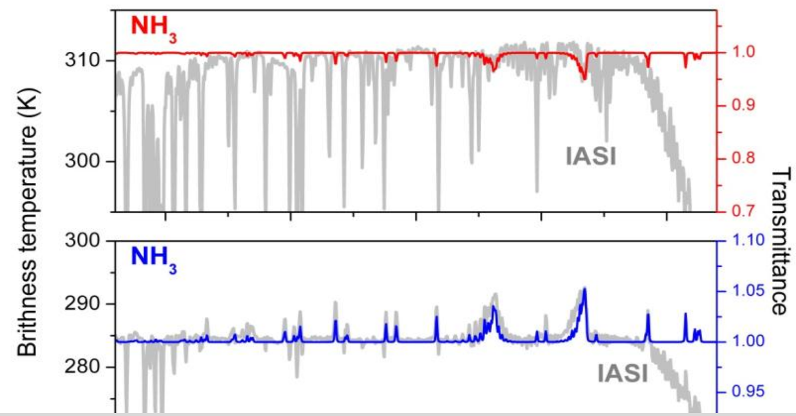
Credit S. Bauduin

Ammonia

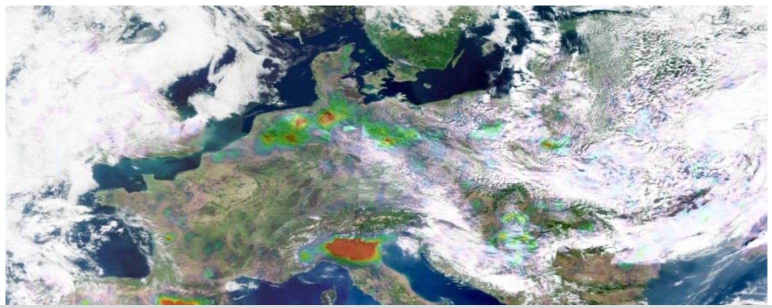


Fertilizers and catering
AQ (PM formation)
acidification/eutrophication ecosystems
Nitrogen cycle (climate…)

Emission sources



IASI: Global but limited to places with high Tc
Sensitivity at the surface

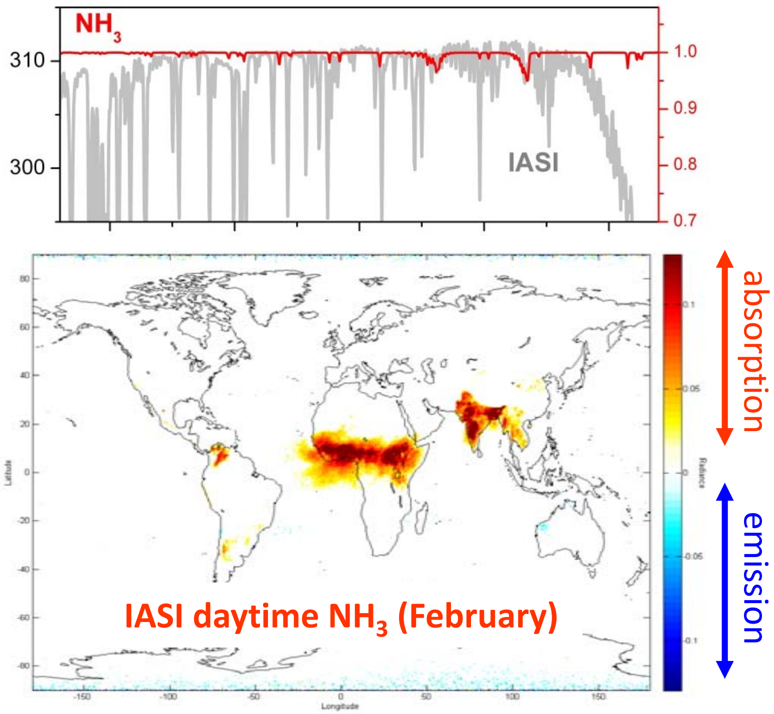


Users
A lot of scientific requests
Regional models for emission inventories
Copernicus Atmospheric Service (potentially)
CCI as a precursor of aerosols (TBD)

What can be seen by IASI for high pollution events?

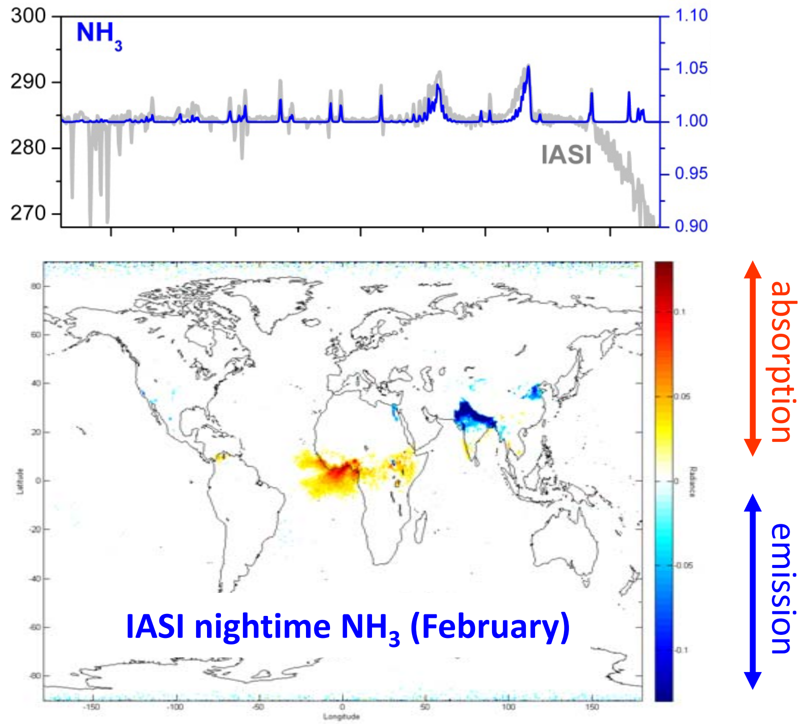
Boundary layer pollution

$T_1 < T_{skin}^{eff}$ → **Absorption** from the first layer (usual case during daytime)



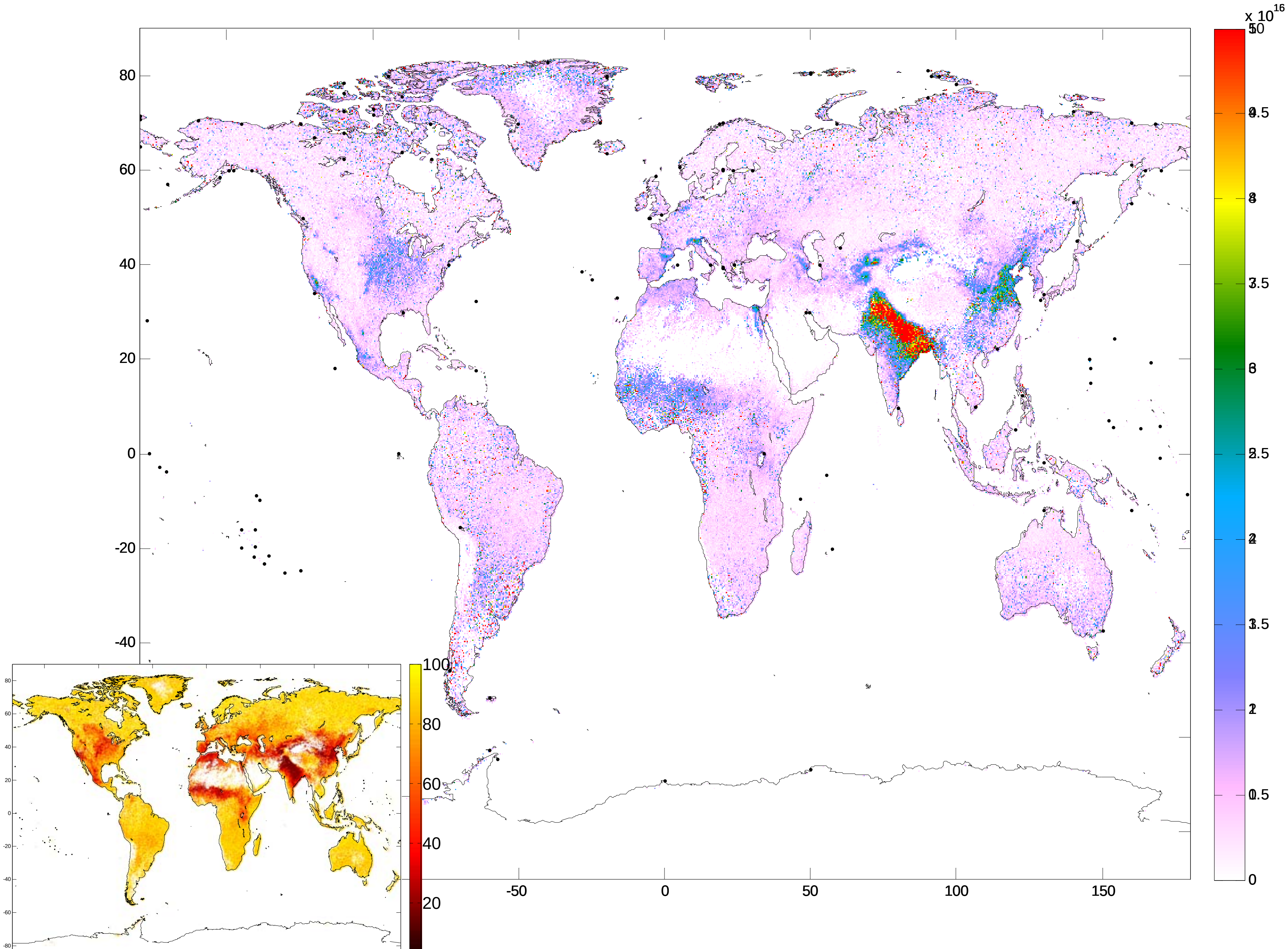
IASI daytime NH_3 (February)

$T_1 > T_{skin}^{eff}$ → **Emission** from the first layer (temp. inversion; night-time mainly)



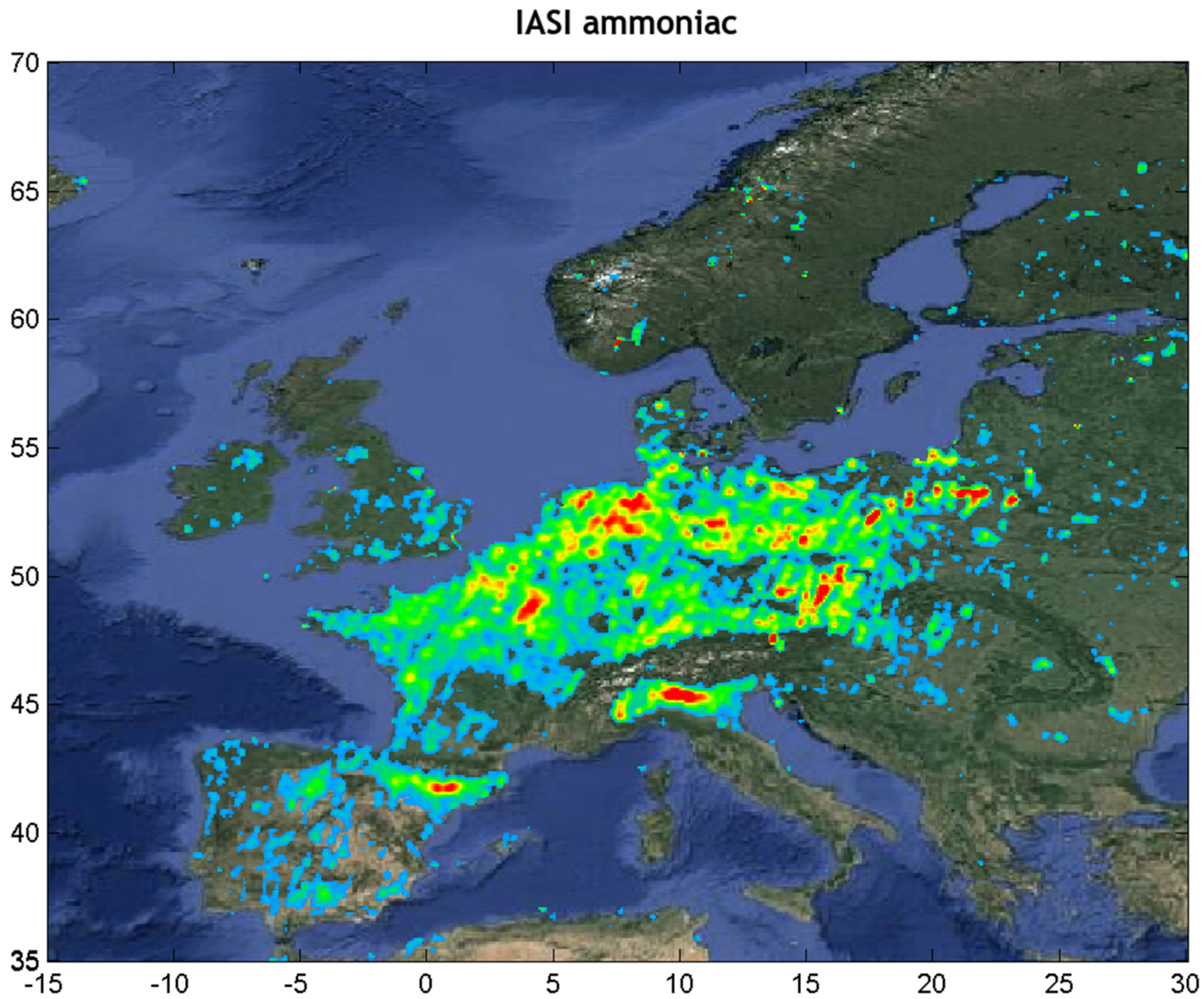
IASI nightime NH_3 (February)

Credit P. –F Coheur



Credit M. Van Damme

PM, April 2015



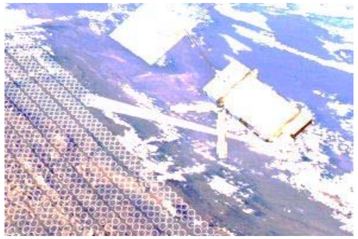
Credit M. Van Damme

Perspectives

2006 … 2012 …. 2018 …. 2021 … 2026 … 2035

IASI-A / METOP-A

IASI-B / METOP-B



IASI-C / METOP-C

IASI-NG on METOP SG

IASI-A + IASI-B (+ IASI-C)

Consistent set of +15 years of CO observation (AQ4ECV)

IASI NG ~2021

Spectral resolution x2 (0.25 cm^{-1})

Reduction of noise by a factor of 2

better assessment of the lower troposphere

+ detection limit