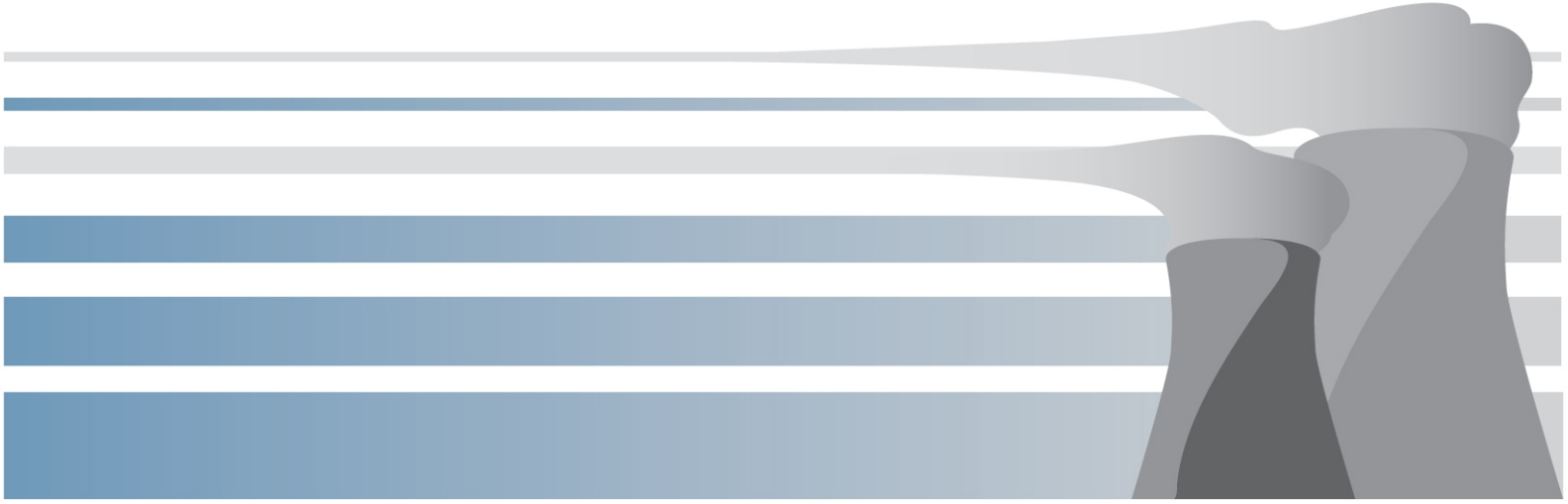


GlobEmission (ESA DUE program)

Project by KNMI, BIRA-IASB, FMI, TNO, VITO
presented by Ronald van der A

esa

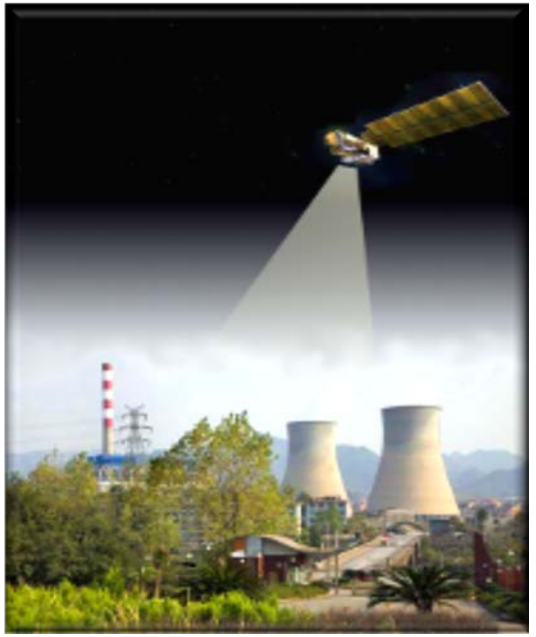
TNO

Royal Netherlands Meteorological Institute

vito

Scope of GlobEmission

- Within GlobEmission emission estimates derived from satellite observations are developed.
- Main advantages:
  - spatial consistency and high temporal resolution
  - monitoring of emission changes, trends & new spots
  - rapid availability to users



DUE project in 2011-2016

Committed end users

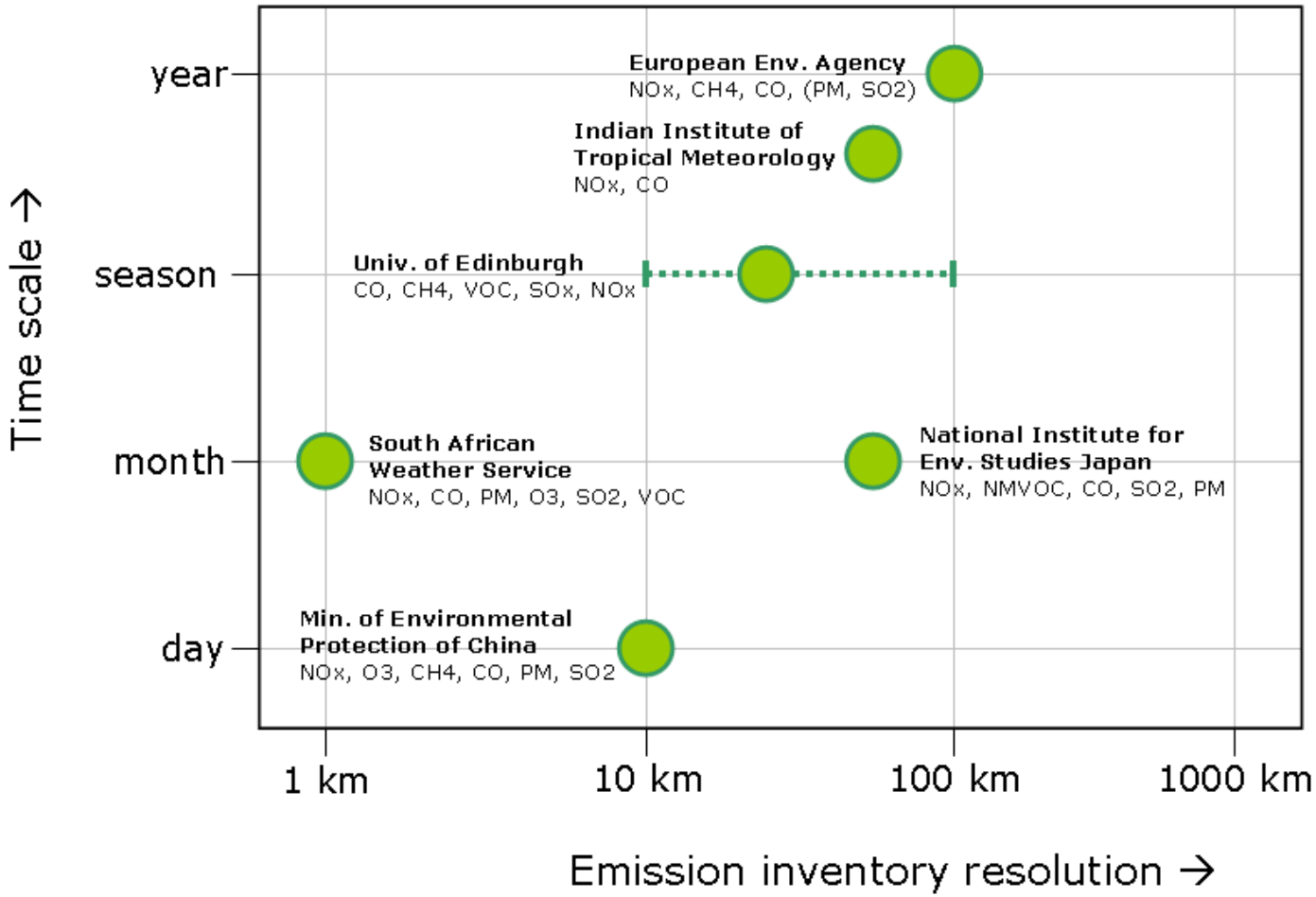
- European Environmental Agency
- LATMOS, France
- Satellite Environment Center of the Chinese Ministry of Environmental Protection
- Indian Institute of Tropical Meteorology
- South National Space Agency + South African Weather Service
- National Institute for Environmental Studies, Japan
- Qatar Environmental & Energy Research Institute

Recently added as committed end users:

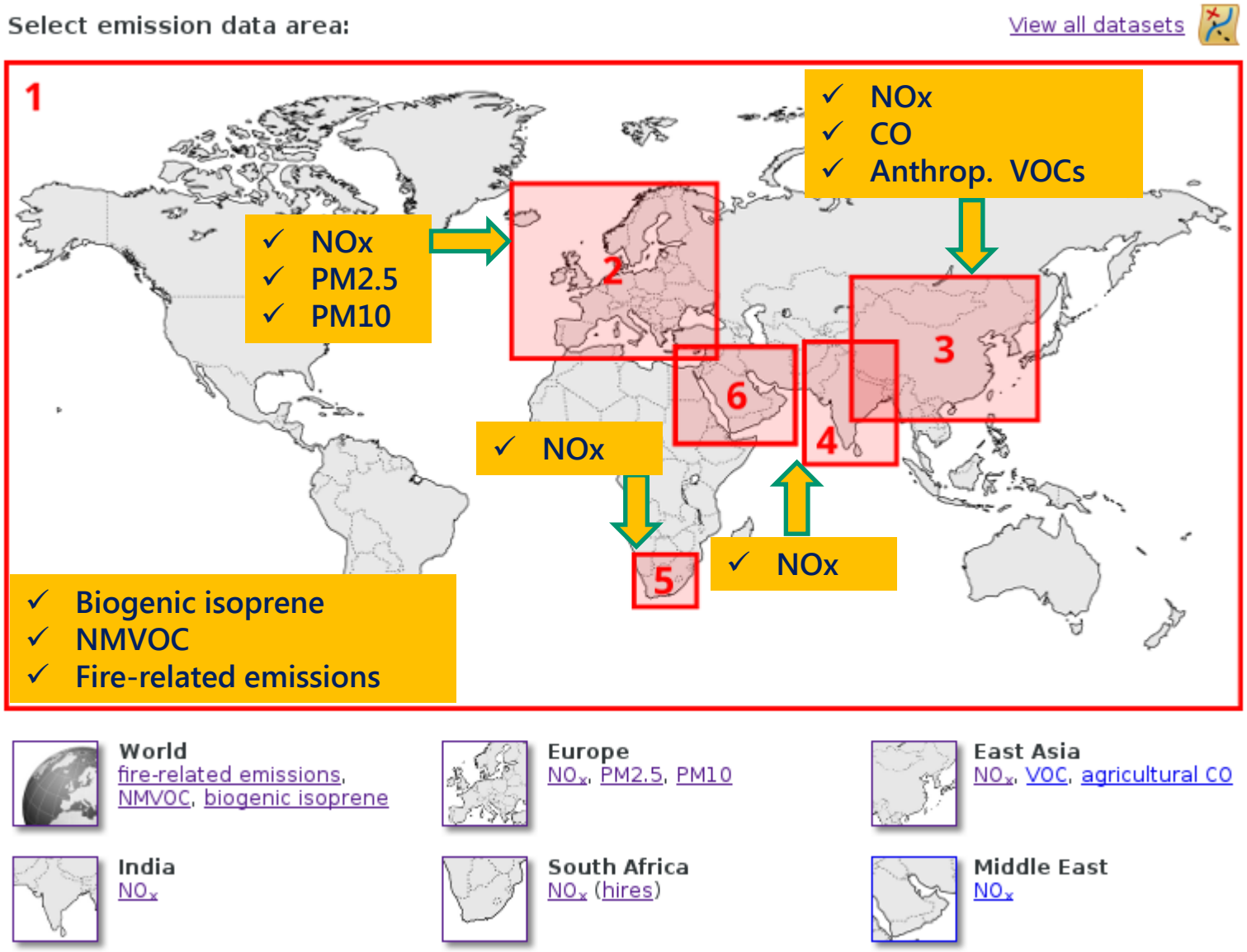
- SeogYeon Cho, Inha University, Korea
- Ying Xie, Shanghai Meteorological Service, China

User Requirements: Temporal/Spatial

- Species: NOx, CH_4, CO, NMVOC, SO_2, PM, O_3
- Accuracy: better than 30% - 80 %



Data portal: www.globemission.eu

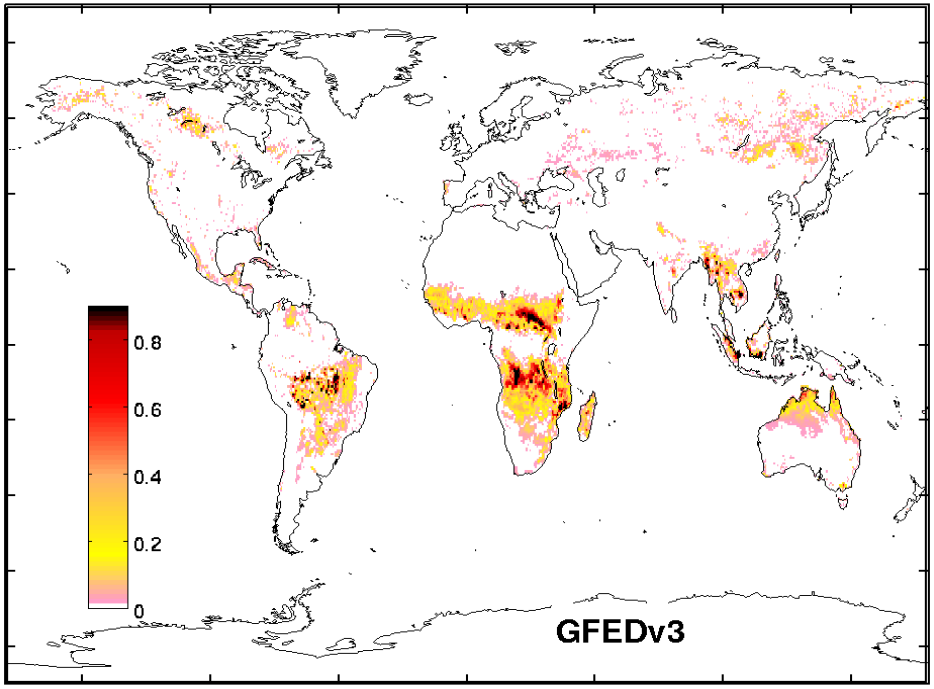


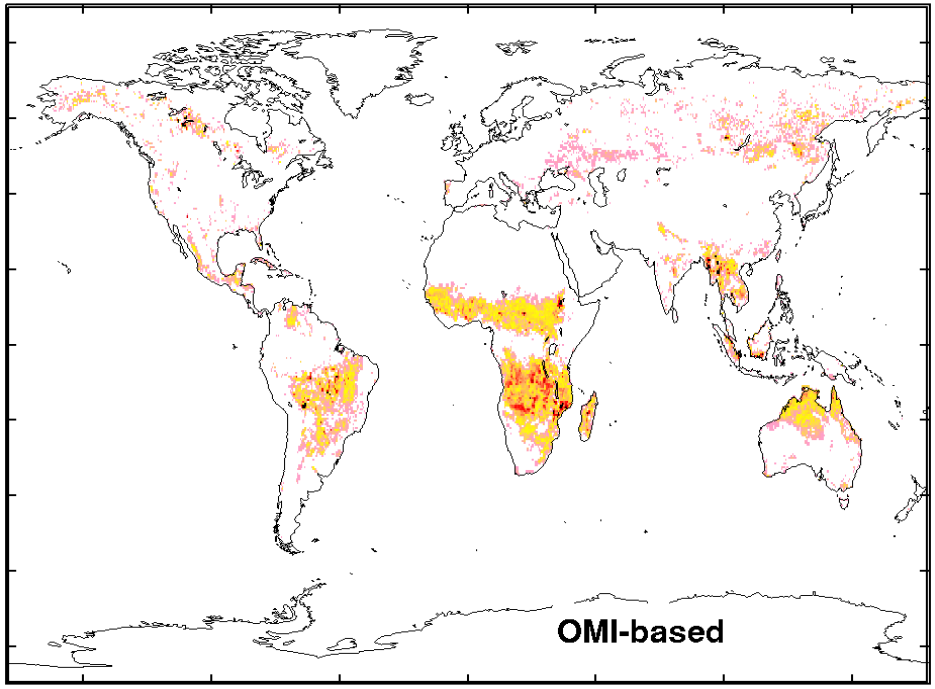
Service provider: FMI, BIRA-IASB

Main users: LATMOS (France), Univ. Amsterdam

GLOBAL EMISSIONS

BB emissions: Global picture





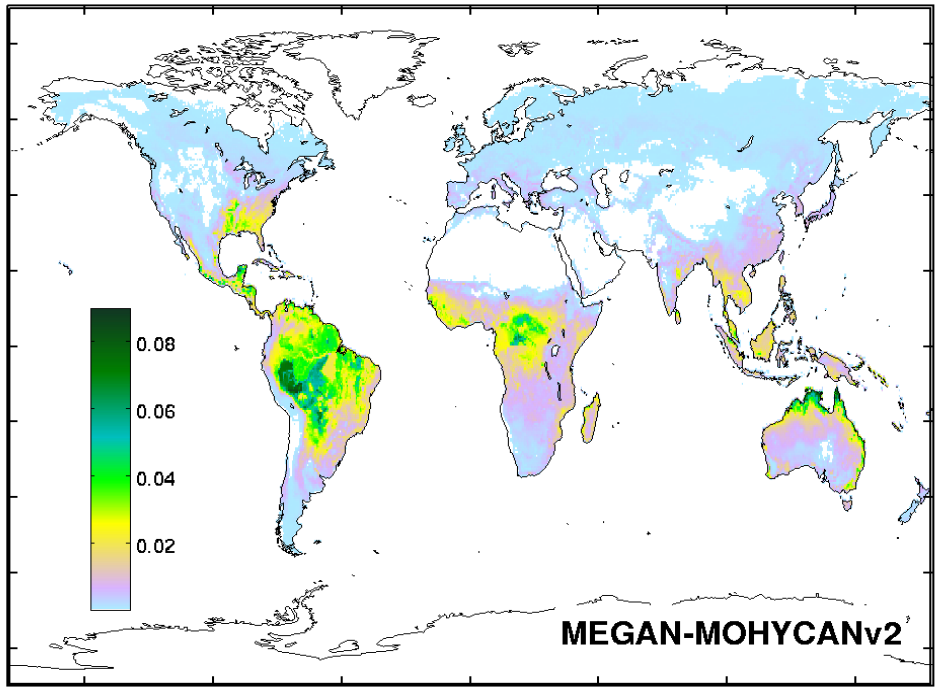
GFEDv3 = 1886 TgC/yr

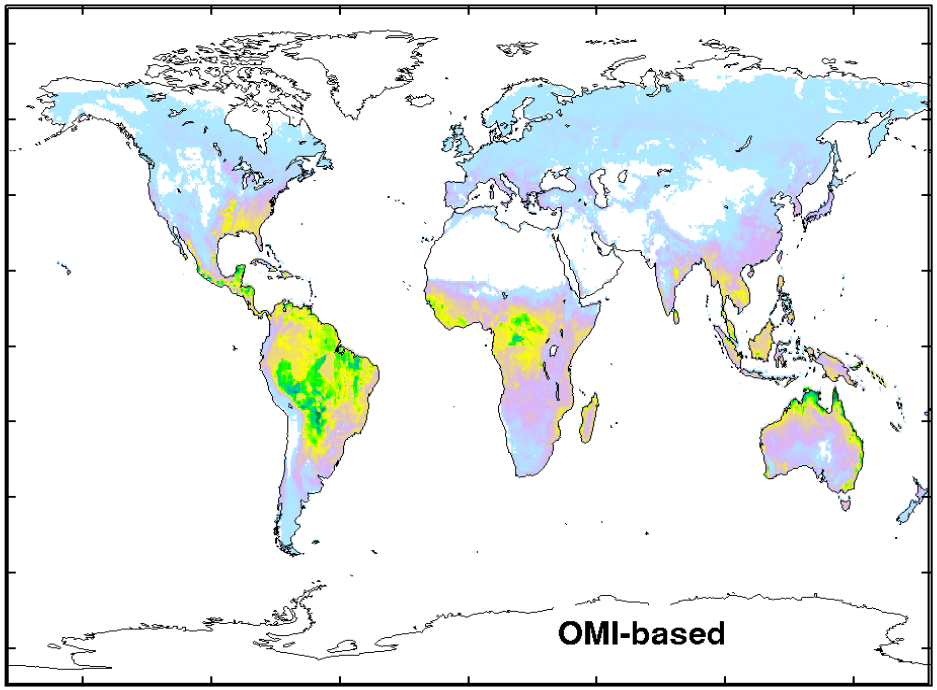
OMI-based = 1559 TgC/yr

17% emission reduction

in average between 2005 and 2013

Isoprene : Global picture





MEGAN-MOHYCANv2 = 343Tg/yr

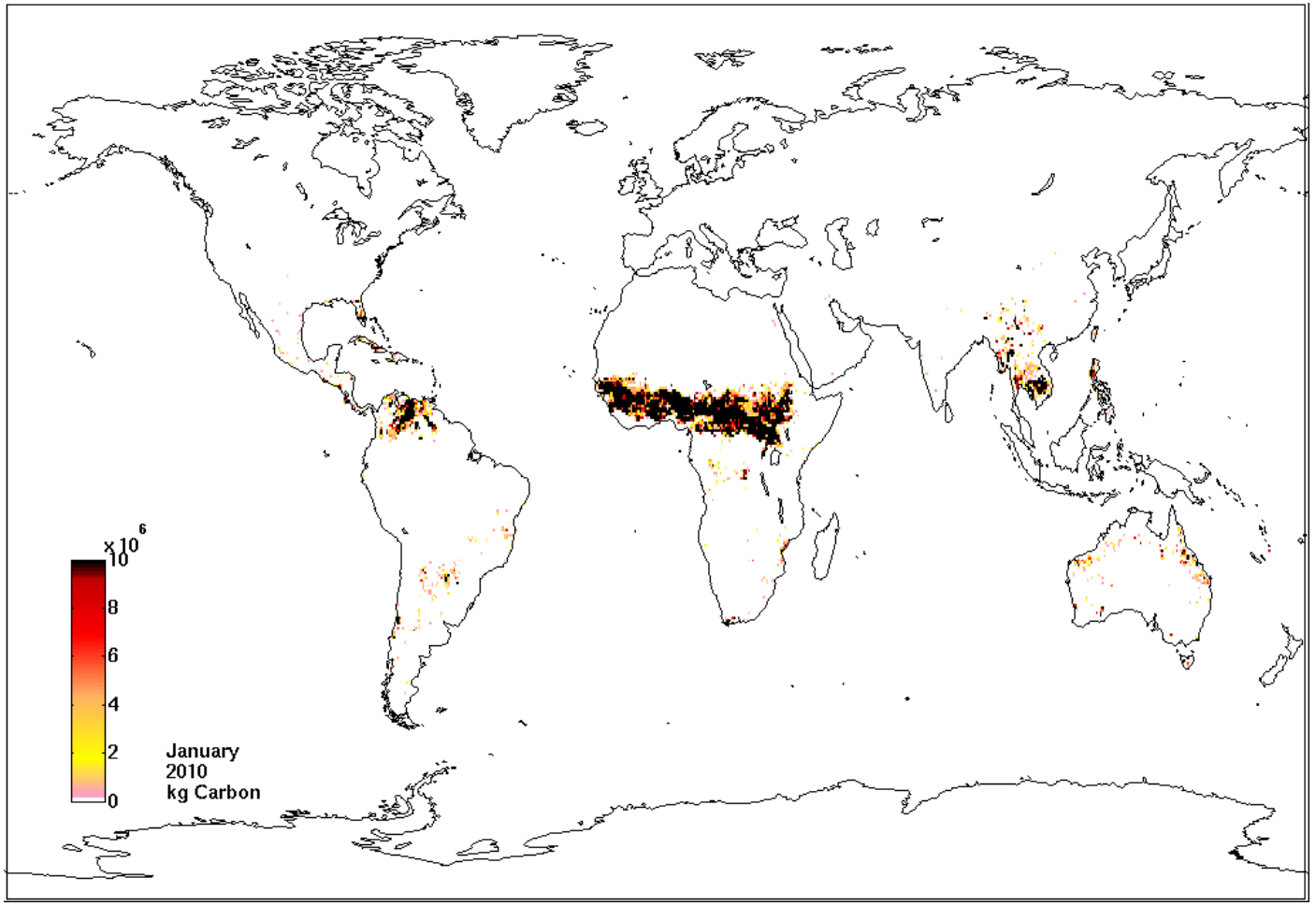
OMI-based=307 Tg/yr

12 % emission reduction

Strongest in the tropics:

40% for South America, 25 % for equatorial Africa and 10% for Equatorial Asia.

OMI-based fire emissions for 2010 and 2011



Emission peaks:

- Russia in August 2010
- Amazonia in September 2010
- Indochina in March
- Siberian fires in 2010.

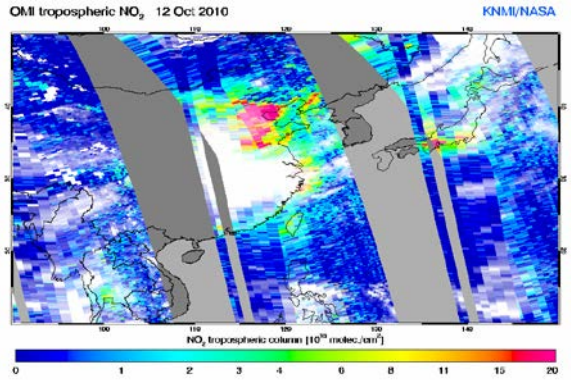
Service provider: KNMI, FMI, BIRA-IASB

Main users: MEP (China), NIES (Japan), Inha Uni.(Korea), Shanghai Met Office

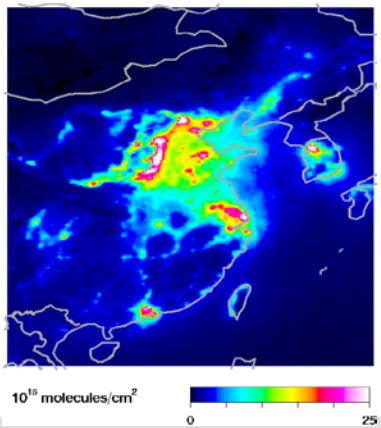
REGIONAL EMISSIONS
EAST ASIA

NOx emissions China

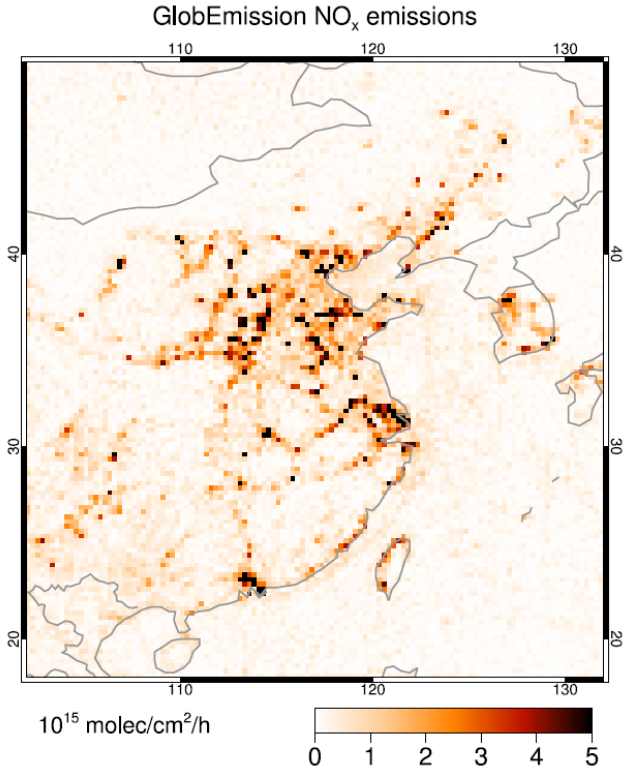
- Monthly NOx emissions (2007-2012)
- OMI and GOME-2



Satellite observations



Concentrations

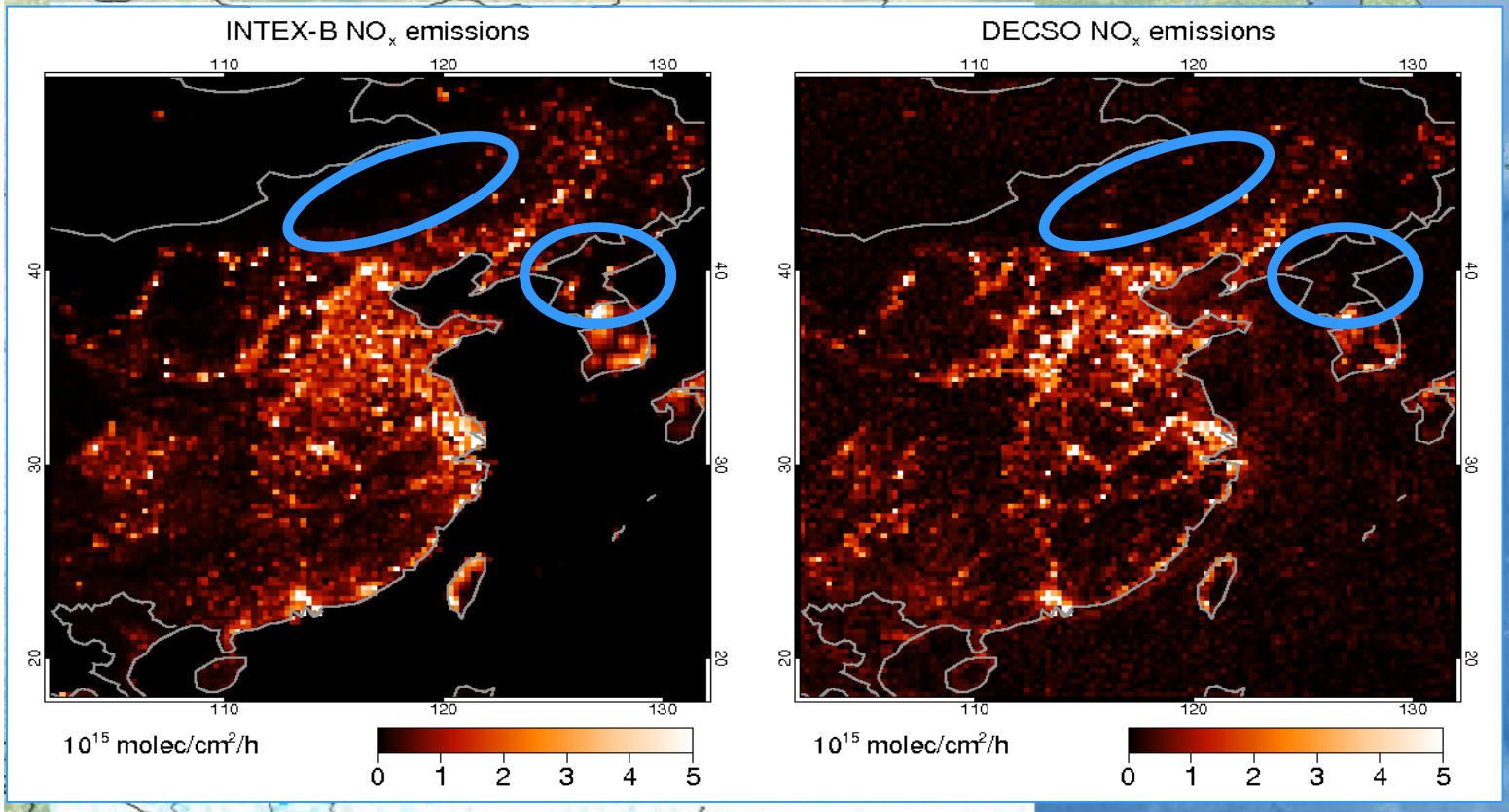


Emissions

CHINA

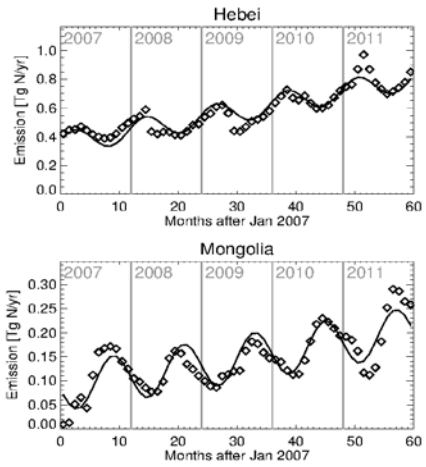
❑ NOx emissions

DESCO inversion algorithm enables estimation at high resolution (10-25 km)

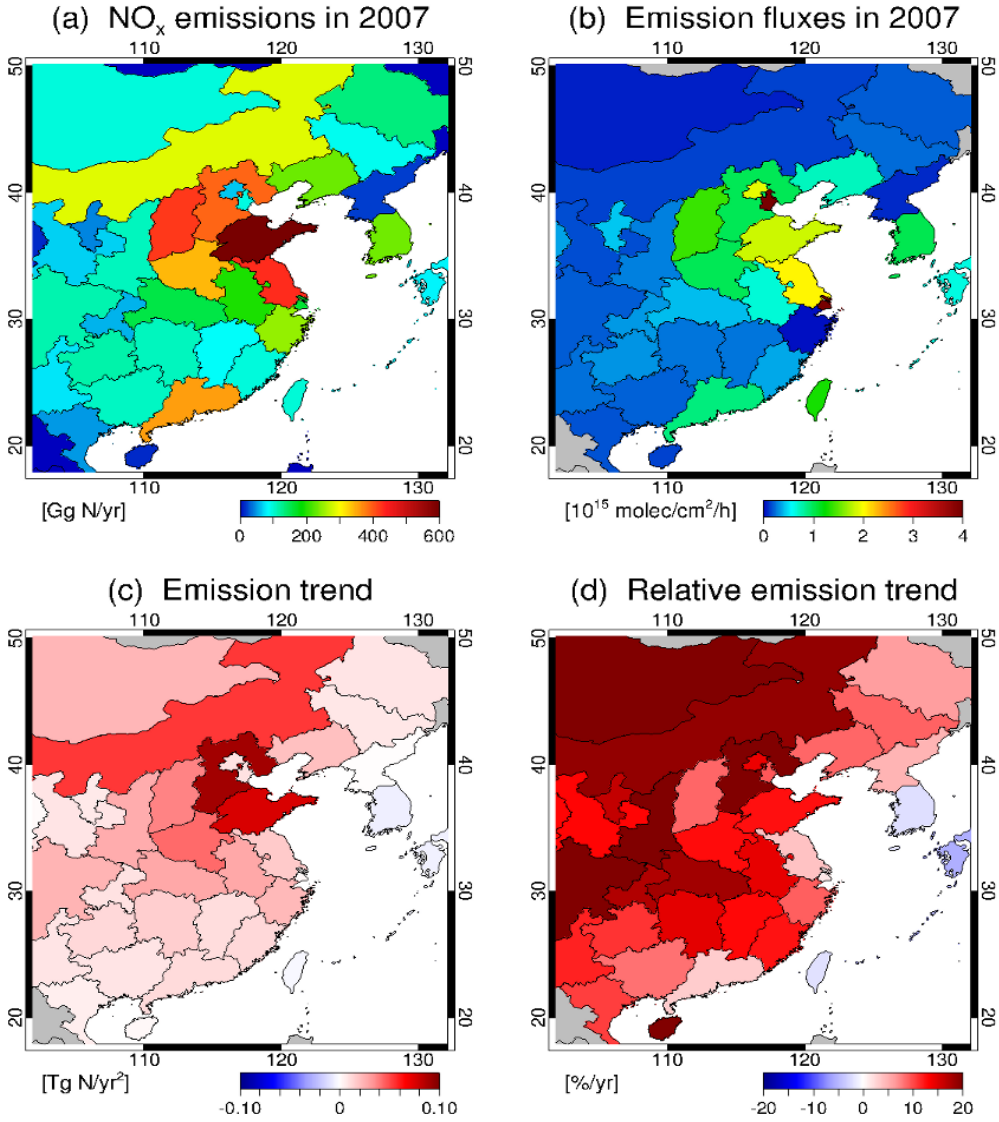


- New power plants in Inner Mongolia
- Distinct emissions along great rivers
- Low emissions in North Korea
- Ship emissions

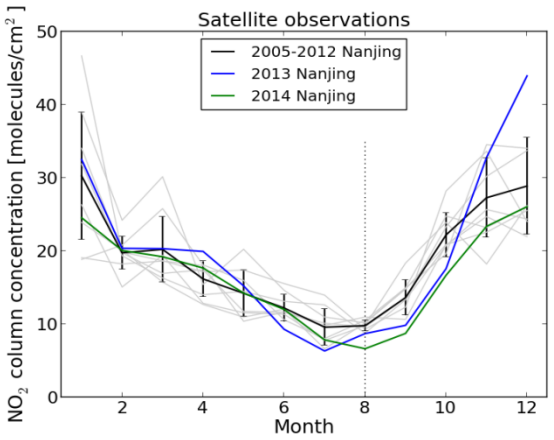
Emission trends



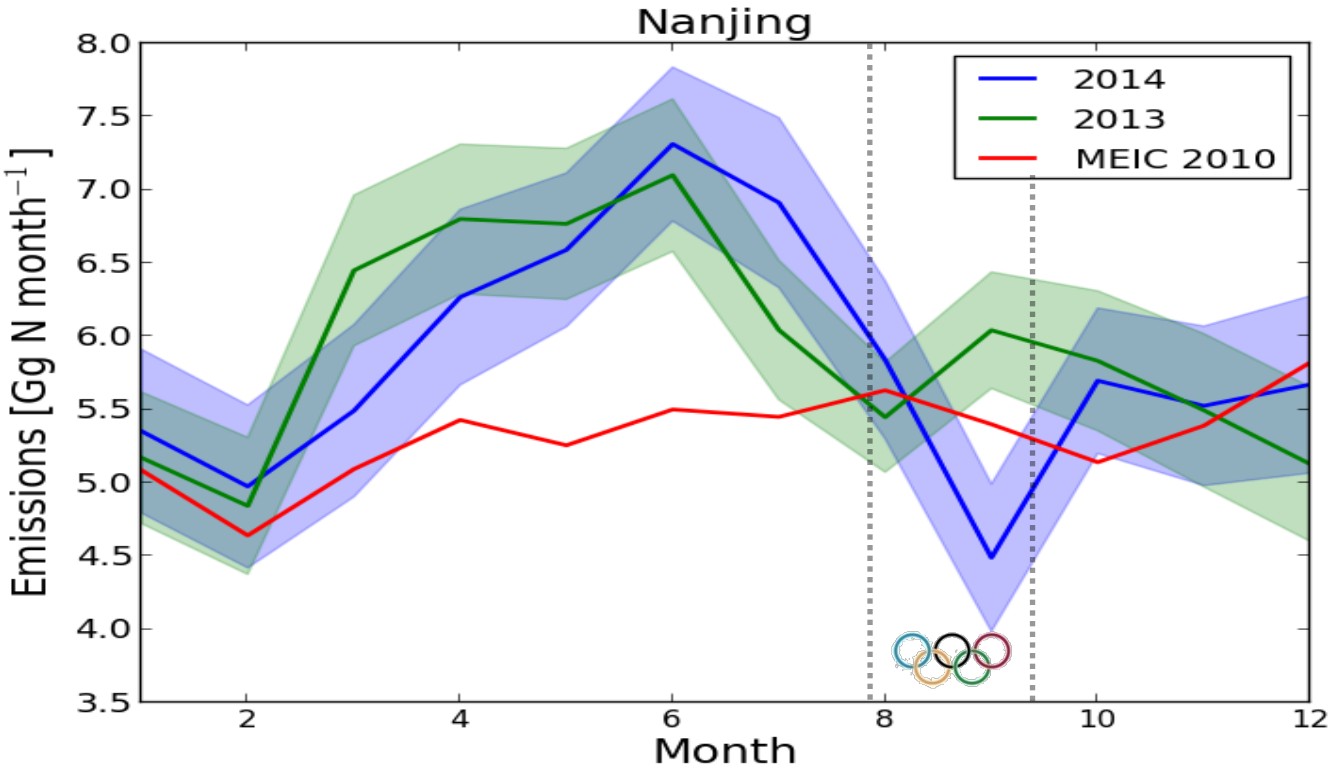
Mijling et al. (2013) *Regional nitrogen oxides emission trends in East Asia observed from space*, Atmos. Chem. Phys.



Case study:



OMI observations of NO2



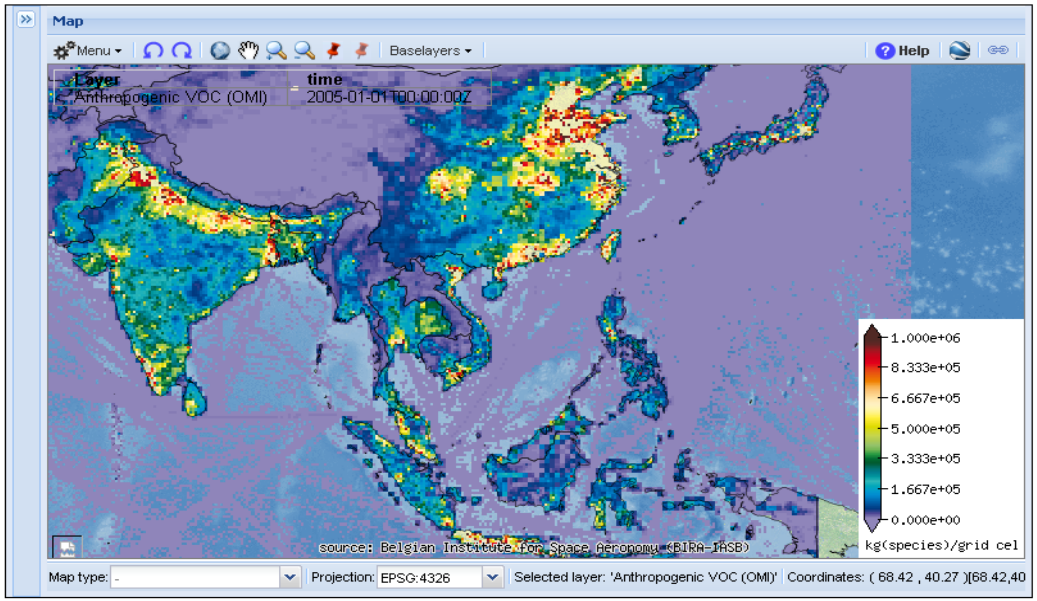
The monthly NO_x emission estimates by DECSO in Nanjing for **2013** and **2014**, and the MEIC inventory of **2010.**

Ding et al., Atmos. Chem. Phys. Discuss., 15, 2015

Regional anthropogenic VOC and aerosol emissions

Select species: TNMVOC_OMI : OMI based Anthropogenic VOC emissions - Asia

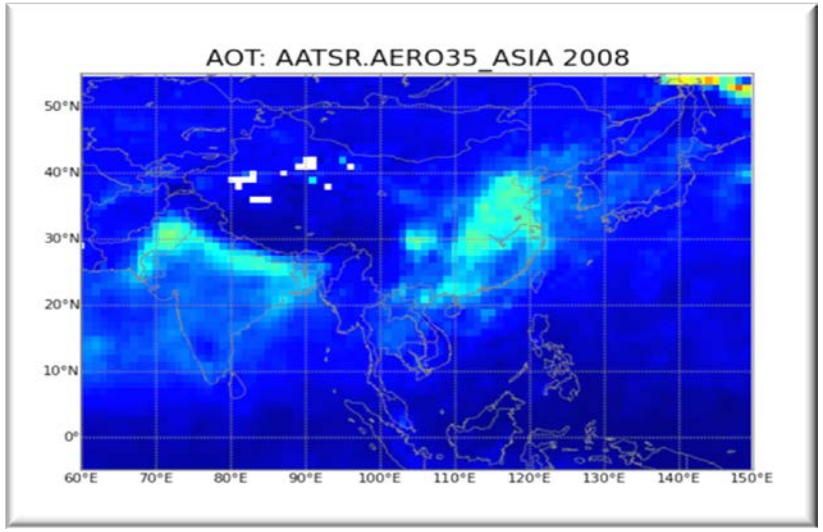
satellite data at TEMIS



Show

Total anthropogenic VOC emission estimates

2005	(May	Jun	Jul)
2006	(May	Jun	Jul)
2007	(May	Jun	Jul)
2008	(May	Jun	Jul)
2009	(May	Jun	Jul)
2010	(May	Jun	Jul)
2011	(May	Jun	Jul)
2012	(May	Jun	Jul)
2013	(May	Jun	Jul)



After assimilation of MODIS AOD data

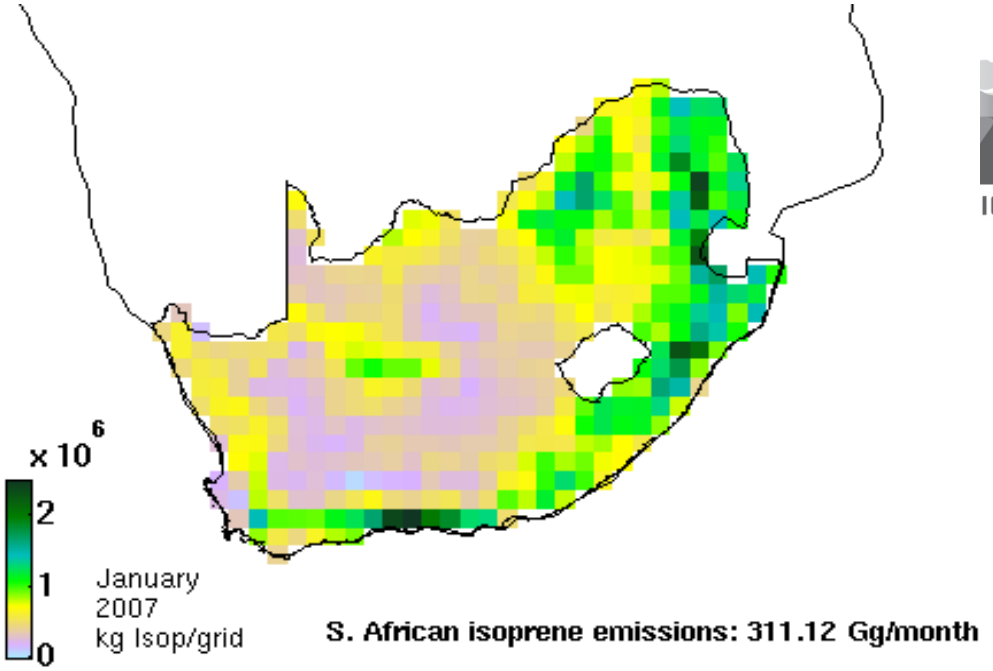
Service provider: KNMI, FMI, BIRA-IASB, VITO

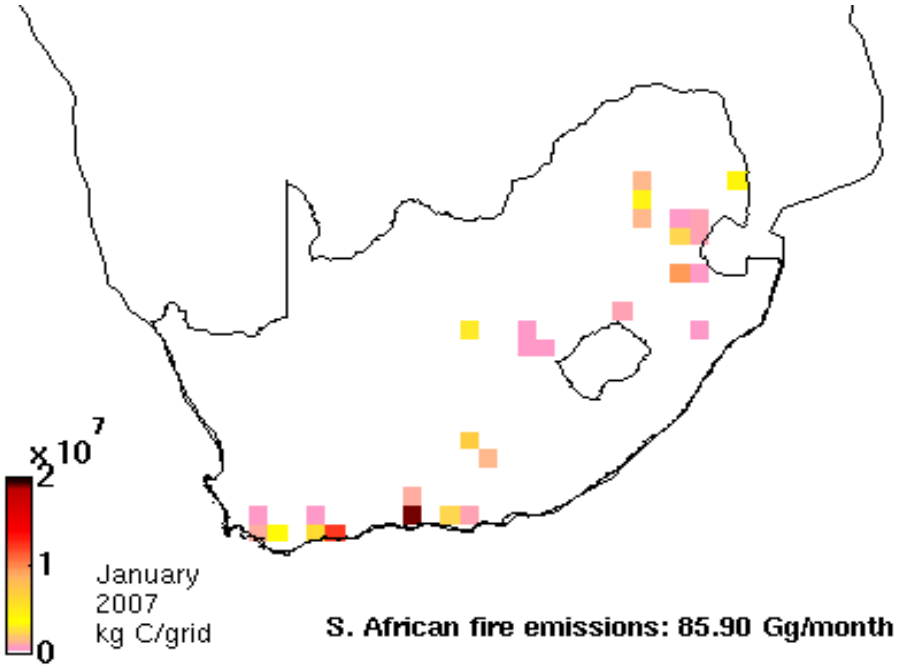
Main users: SAWS and SANSA (South Africa)

REGIONAL EMISSIONS SOUTH AFRICA

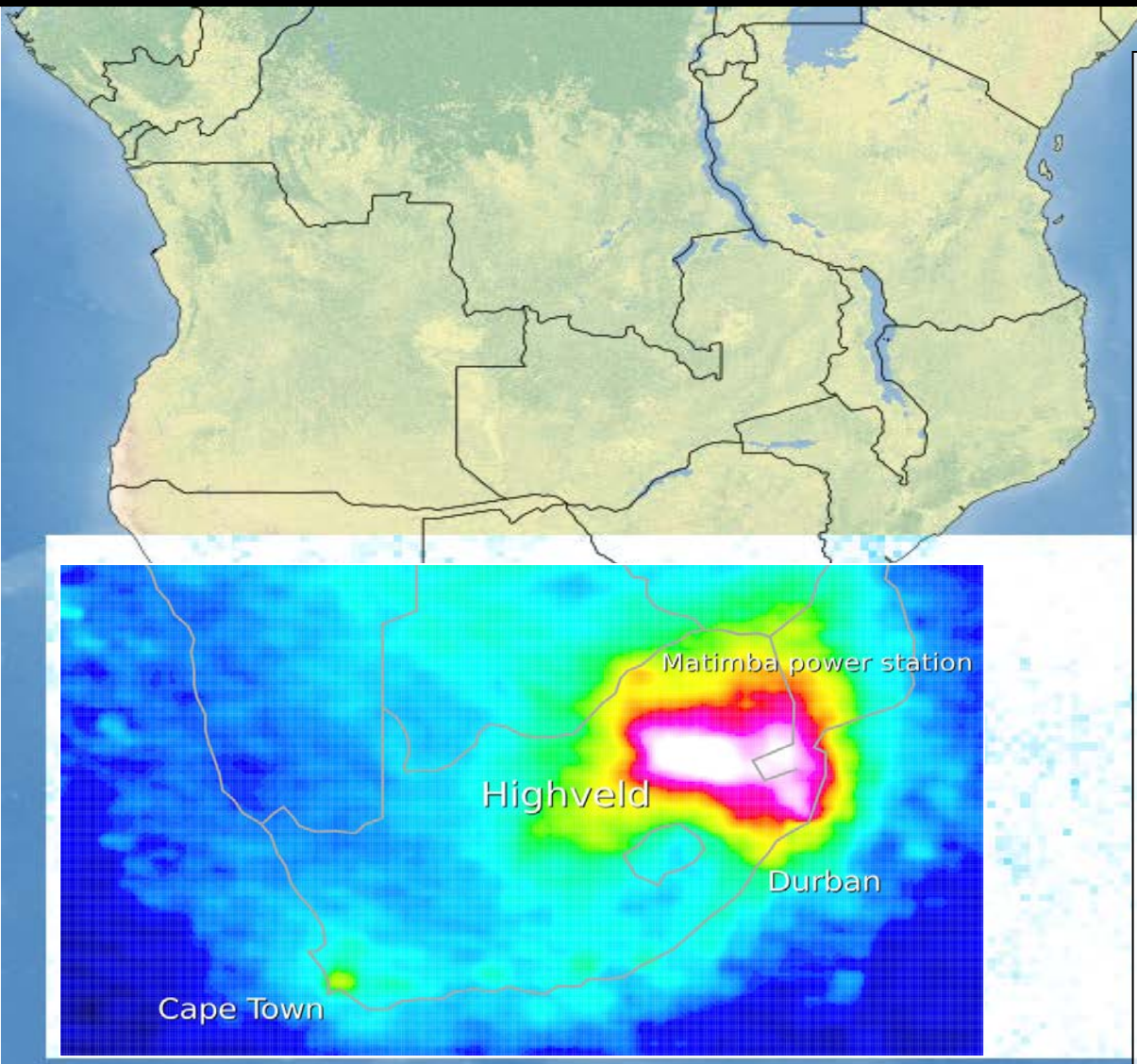
- ✓ GOME-2 HCHO data
- ✓ IMAGES CTM and adjoint

- ✓ VOC emissions from fires
- ✓ Biogenic isoprene emissions





South Africa: NOx

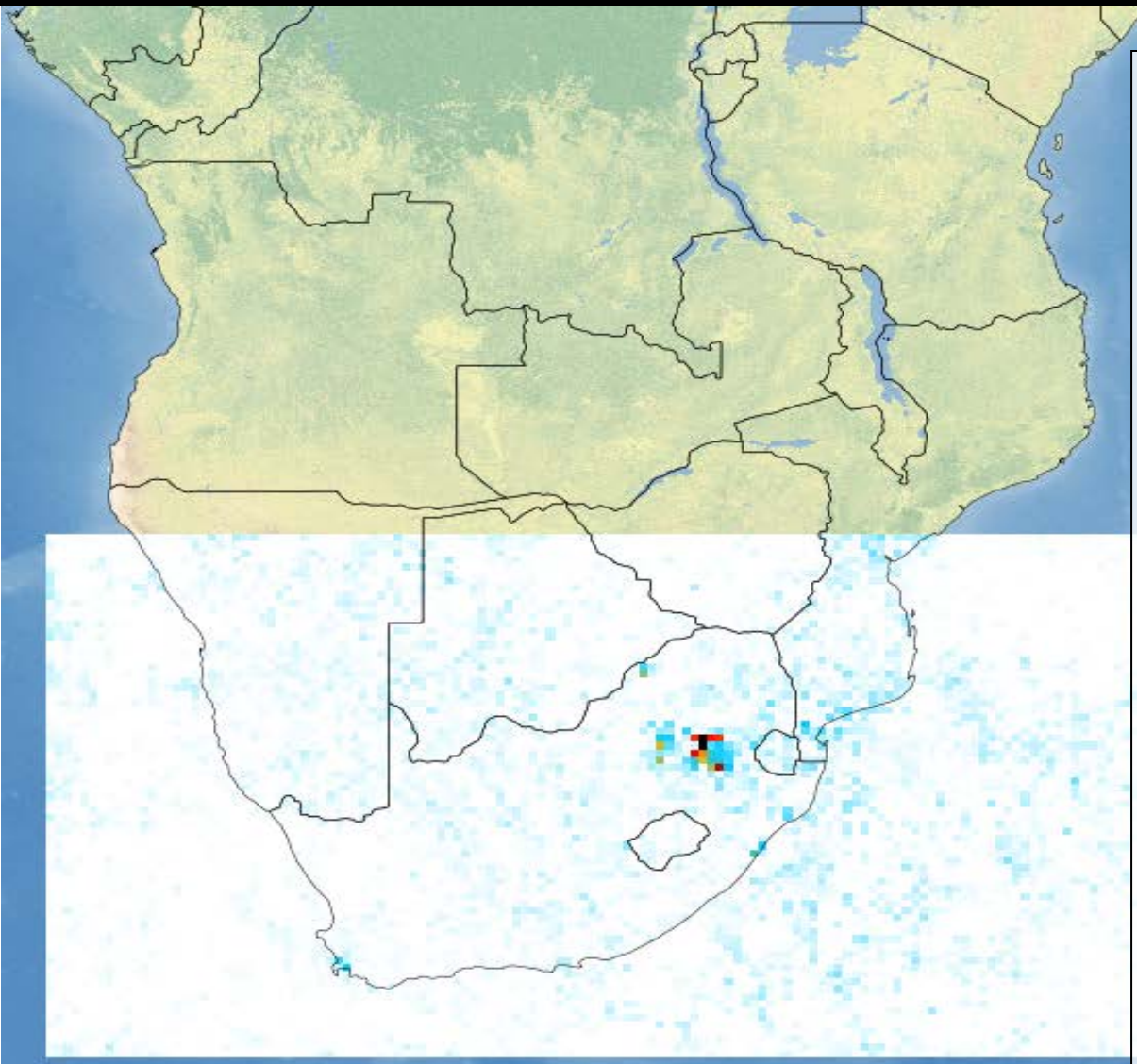


- Monthly NOx emissions (2009-2010)
- Based on OMI
- Initial inventory EDGAR v4.2

Implementation issues:

- Low emissions, except for a few hot spots located close to each other.
- wrong initial hot spot positions

South Africa: NOx

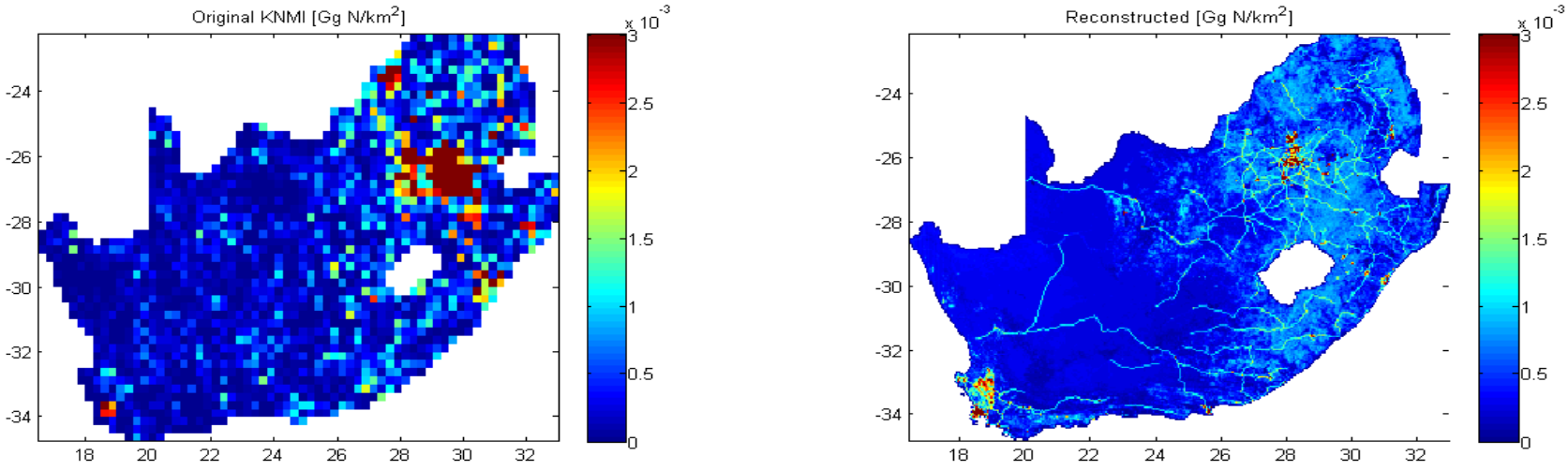


- Monthly NOx emissions (2009-2010)
- Based on OMI
- Initial inventory EDGAR v4.2

Implementation issues:

- Low emissions, except for a few hot spots located close to each other.
- wrong initial hot spot positions

High Resolution NO_x Inventory for South Africa

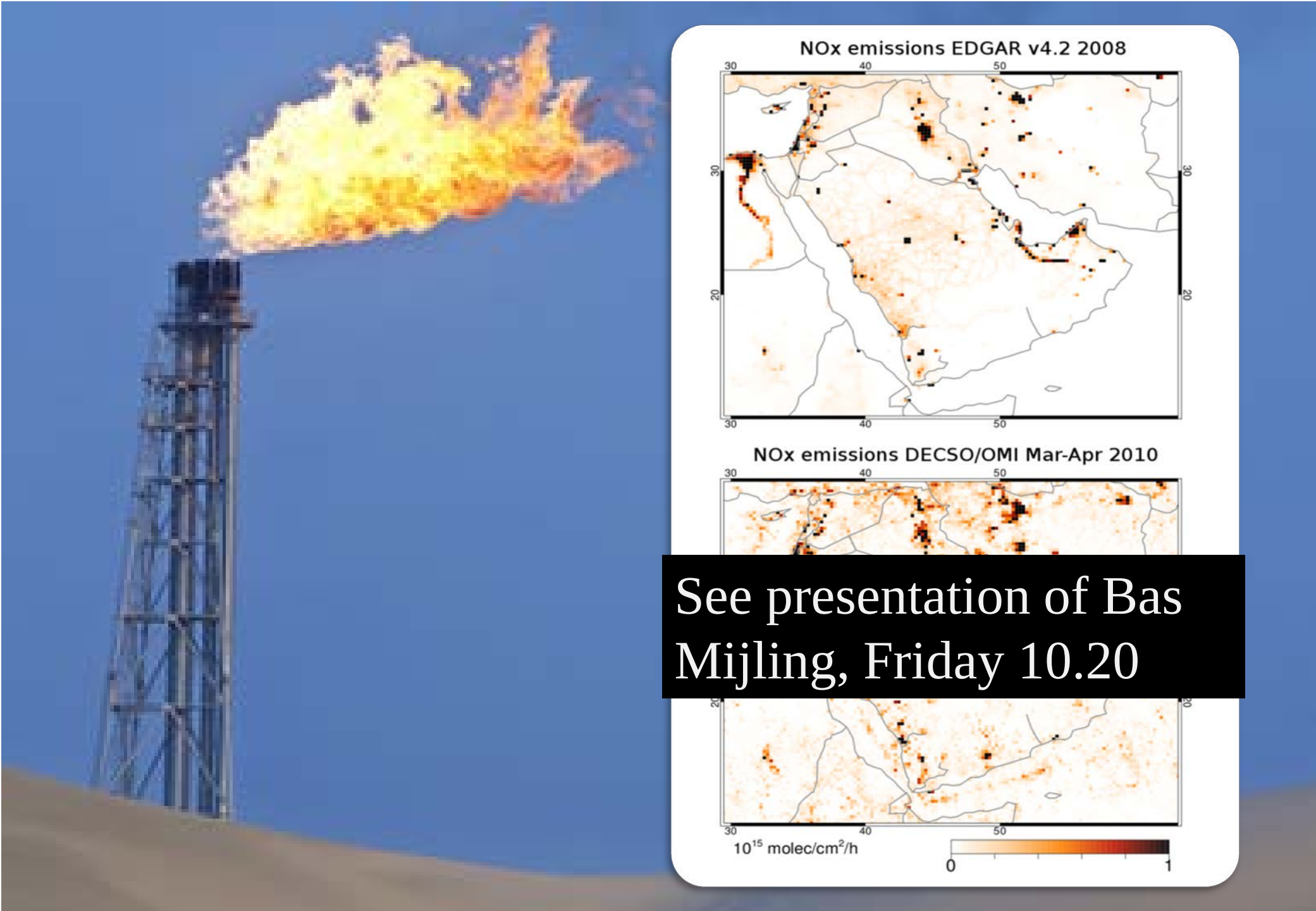


- **GlobEmission – phase I:** highest spatial resolution required by the South African Weather Service (SAWS), hence spatial disaggregation activities of the regional emission inventories.
- **GlobEmission – phase II:** Qatar Environment and Energy Research Institute (QEERI) showing interest in NO_x and anthropogenic VOC emissions for the air quality modelling in the Middle-East region, in particular in Qatar.

Service provider: KNMI, BIRA-IASB, VITO

Main users: QEERI (Qatar)

REGIONAL EMISSIONS MIDDLE EAST

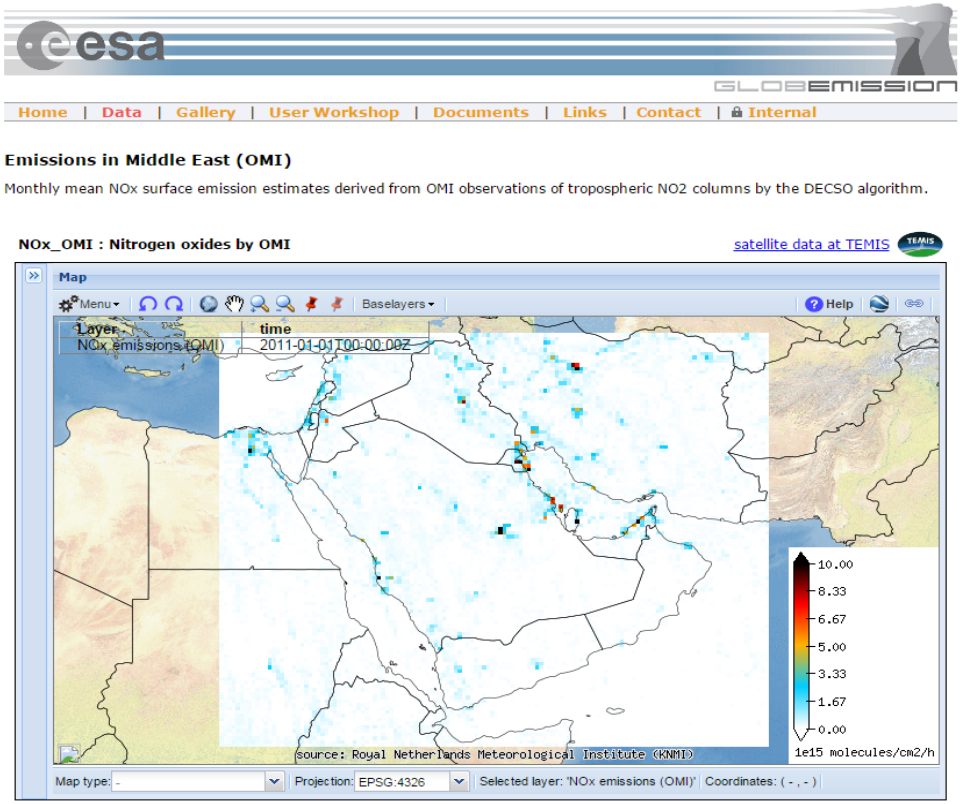


See presentation of Bas Mijling, Friday 10.20

From low to high Resolution Emission Inventory

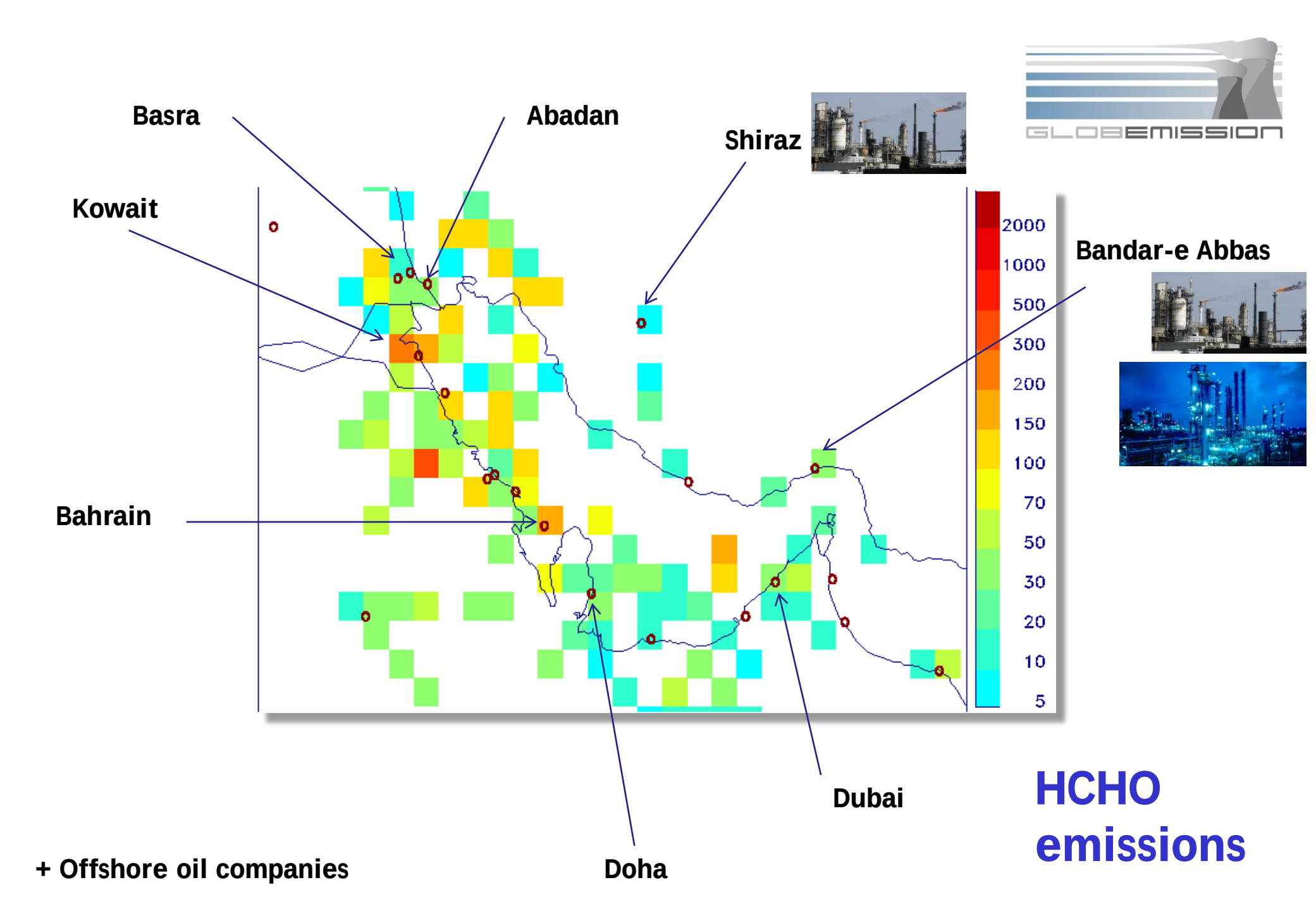
» *Regional emission inventory for Qatar*

» KNMI will provided emission estimates of NO_x on a 0.25° resolution.



Satellite instruments:	GOME-2 and OMI
Spatial resolution:	0.25° × 0.25°
Domain:	10.25°N to 37.75°N 29.50°E to 63.50°E
Temporal frequency	Monthly averaged
Time span	2010 – present

» **VITO will apply spatial disaggregation techniques to increase the resolution of the inventory to 0.05° for Qatar.**


Basra
Abadan
Shiraz
Kowait
Bandar-e Abbas
Bahrain
Dubai
Doha
2000
1000
500
300
200
150
100
70
50
30
20
10
5
+ Offshore oil companies
HCHO
emissions

Service provider: KNMI, FMI, TNO

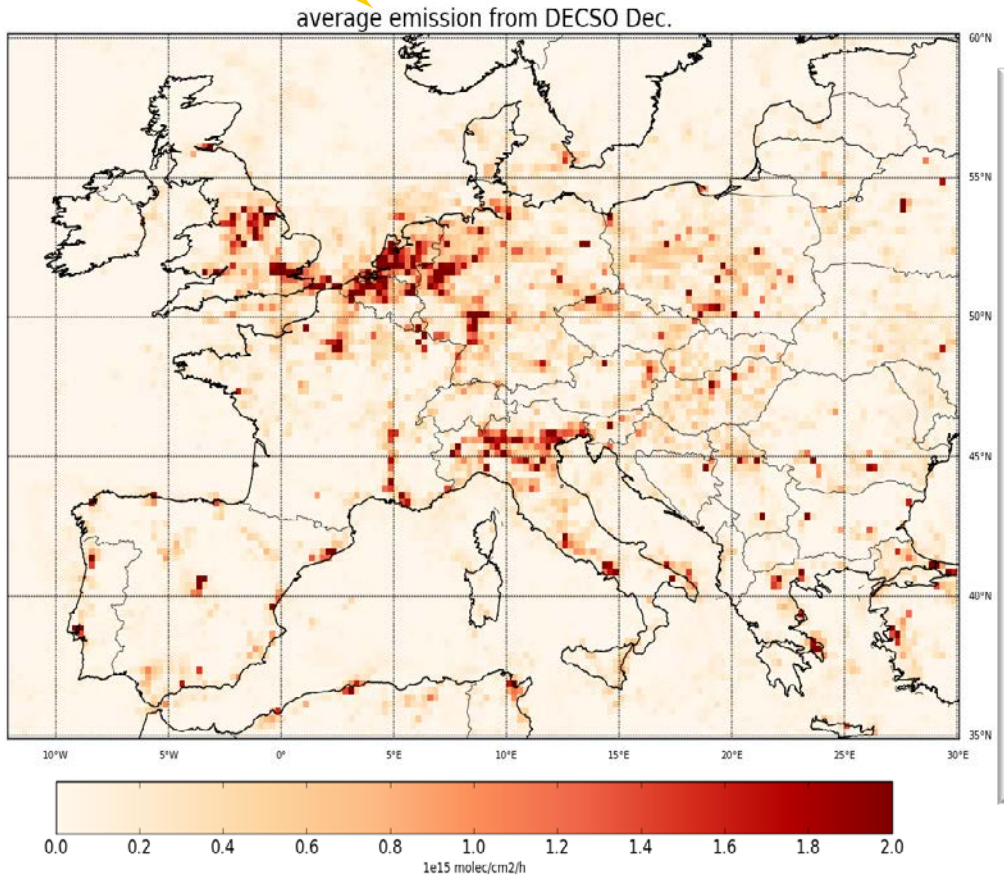
Main users: European Environmental Agency

REGIONAL EMISSIONS EUROPE

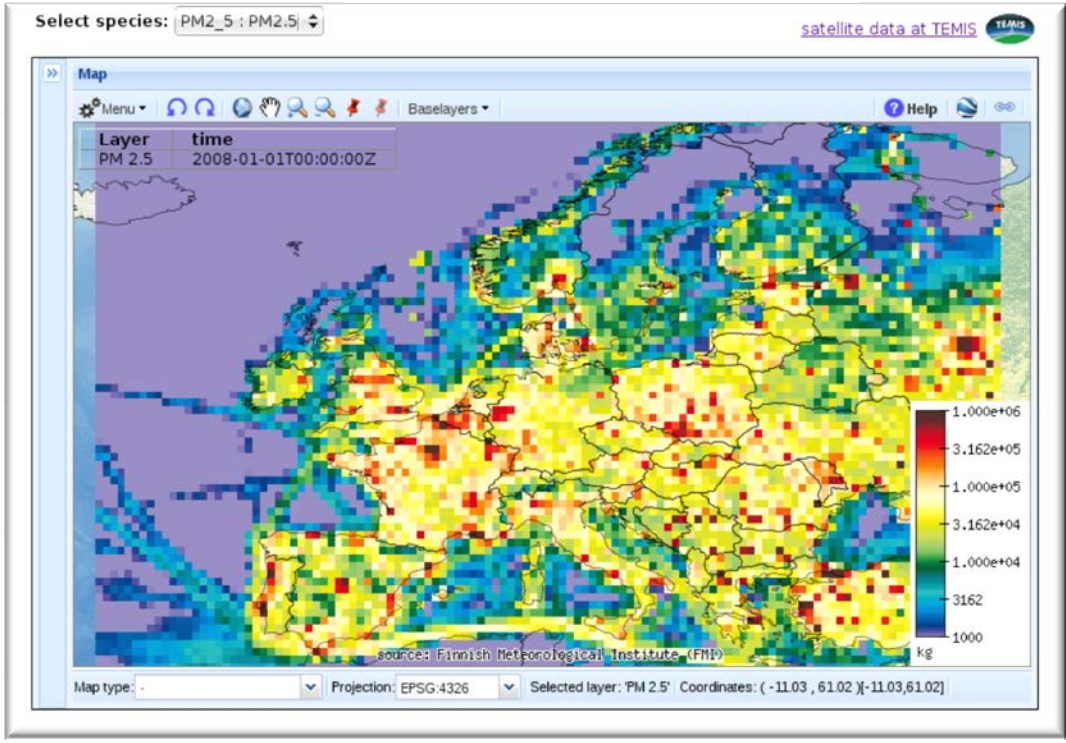
NO_x and PM2.5 emissions in Europe

Preliminary!

NOx Dec. 2009
DECSO+OMI



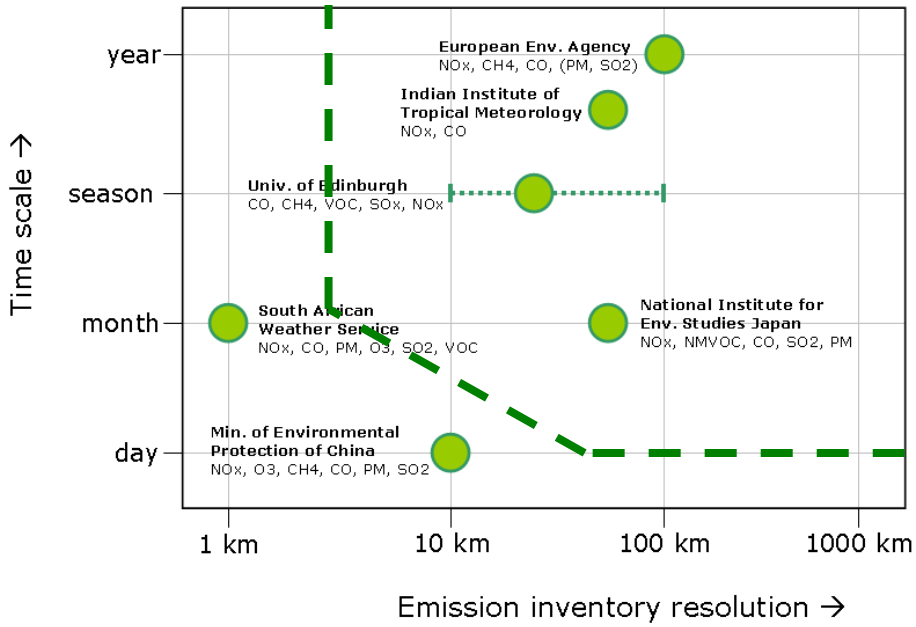
PM2.5 2008
MODIS



www.globemission.eu

SUMMARY

Are the user requirements met ?



Specific user requirements:

- Species: NOx, CH_4, CO, NMVOC, SO_2, PM
- Accuracy: better than 30% - 80 %
- Spatial resolution: 1 km - 50 km
- Time resolution: daily – annual
- Regional and Global

GlobEmission:

NOx, CO, NMVOC , SO_2, PM

ok, but more validation needed

GlobEmission: 5 km – 50 km

GlobEmission: daily - monthly

ok

Conclusions GlobEmission

- For several users/regions services are providing emission estimates constrained by satellite observations
- Strengths:
  - Fast updates,
  - Fair comparison between regions
  - Weaknesses in existing inventories identified
- Easy access via the web-portal: **www.globemission.eu**
- User feedback via workshops, validation and assessment reports

- Users need higher resolution emission maps => need for higher resolution satellite observations (e.g. S5p)

TNO Royal Netherlands Meteorological Institute vito

Persons involved in GlobEmission:

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Bas Mijling
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Jenny Stavrakou
Michel Van Roozendael
Maite Bauwens
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Gerrit de Leeuw
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Nele Veldeman
Bino Maiheu
Lyana Curier
Martijn Schaap
Renske Timmermans
Hugo Dernier van der Gon