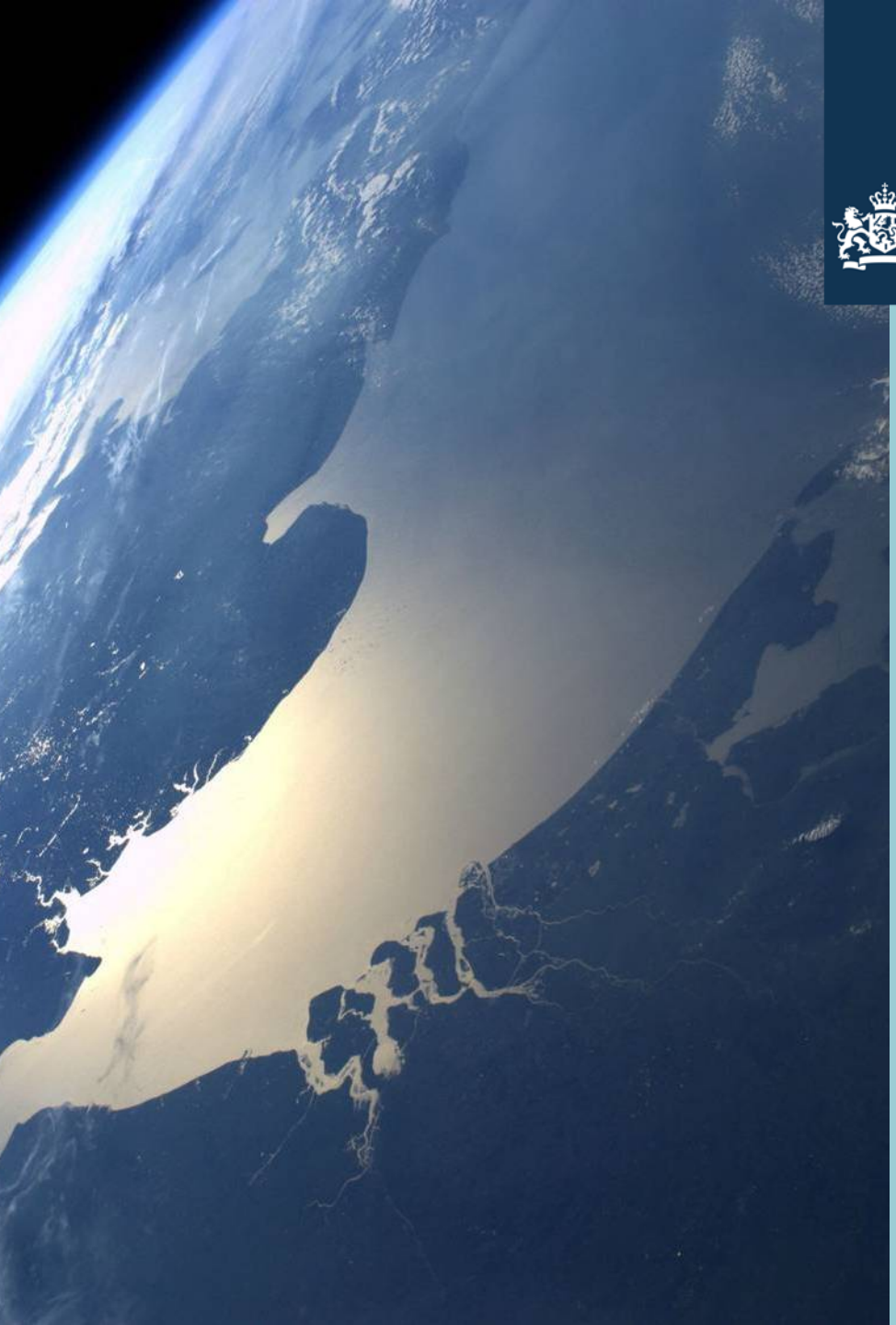


Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

GLOBE European Aerosol Campaign 2013-2014

KNMI, NSO, NEMO SLC, GLOBE Nederland

Elise Hendriks

April 2014

GLOBE European Aerosol Campaign

GLOBE Aerosols community in Europe,
- and globe.gov portal - in support of GLOBE Aerosols teachers:

- European measurement campaigns in spring and fall
- Measurement instructions, instrument and background information
- Teaching materials
- Observations
- Teacher-scientist, teacher-teacher communication

Globe Europe Aerosols Campaign at globe.gov

See: http://www.globe.gov/web/europe-aerosols-campaign/overview

GLOBE European Aerosol Campaign

- Pilot: fall campaign 2013
- Kick-off: spring campaign 2014

  3 March – 9 May

Coming up… fall 2014:

World wide GLOBE Aerosols campaign!

Globe Europe Aerosols Campaign flyer 2014

Smog in Paris and elsewhere in Europe

News headlines in the Netherlands:

".. Parijs 'stikt' in het mooie weer"

14 March 2014, nrc.nl

"Smogalarm in België afgekondigd"

12 March 2014, nu.nl

"Smog boven Nederland: krijgt u er last van?"

4 April 2014, volkskrant.nl

View over Paris, 24-25 March 2014 source: Instagram

Traffic measures Brussels, 12-14 March 2014, source: ANP

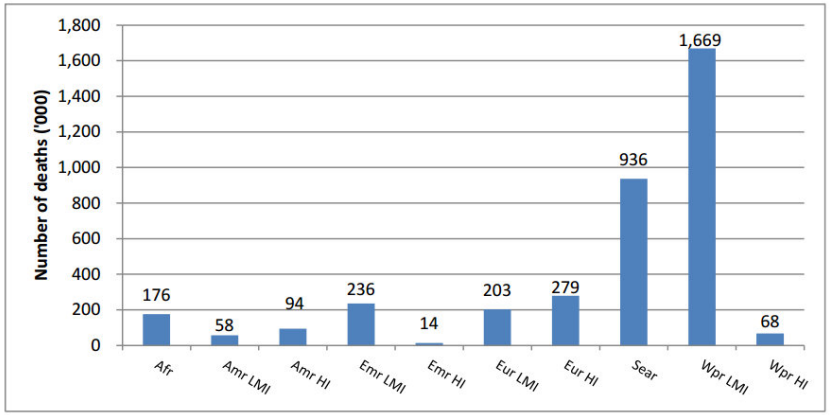
"Paris, where are you?" 17 March 2014 source: indeevs.com

Air pollution and health

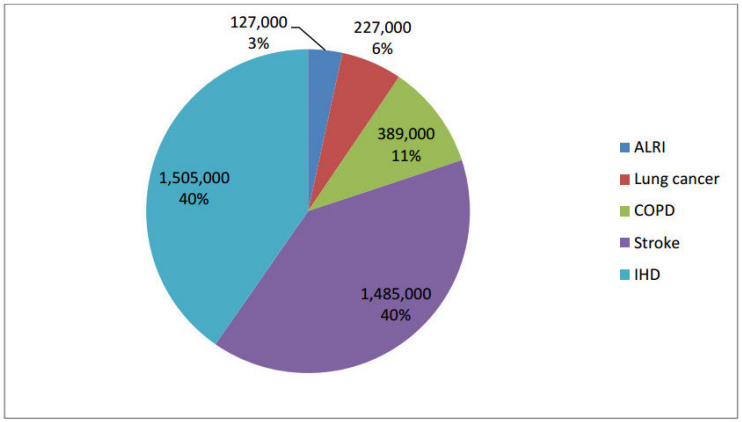
World Health Organisation (WHO), March 2014:

"... in 2012 around 7 million people died - one in eight of total global deaths – as a result of air pollution exposure."

"... air pollution is now the world's largest single environmental health risk."



Total number of deaths as a result of ambient air pollution (WHO, 2014)



Deaths as a result of ambient air pollution, divided by disease (WHO, 2014)

Air quality and climate change

Air pollution has significant impacts on air quality and climate change, and plays a complex role

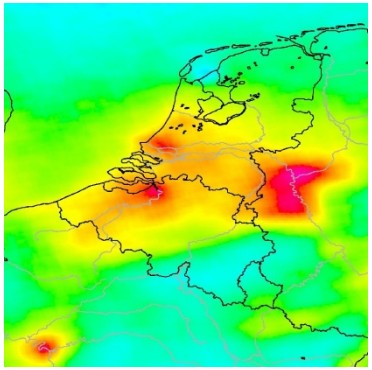
Air pollution: trace gases and particles in Earth atmosphere:

- Nitrogen oxides (NOx), sulphur oxides (SOx), ozone (O3), methane (CH4), ..
- *aerosols*

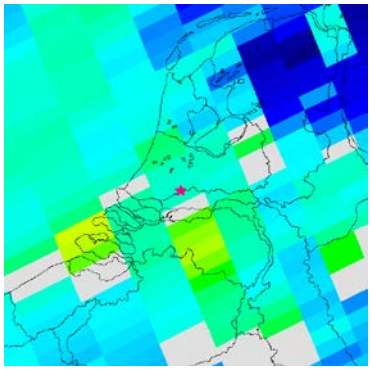
Climate change: *aerosols*, methane, and ozone

Traffic exhaust

Moscow smog in 2010 (source: wikipedia)



OMI nitrogen dioxide

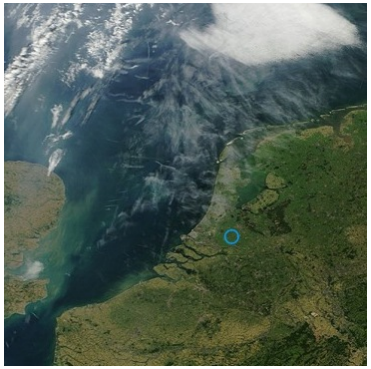


OMI aerosol optical thickness

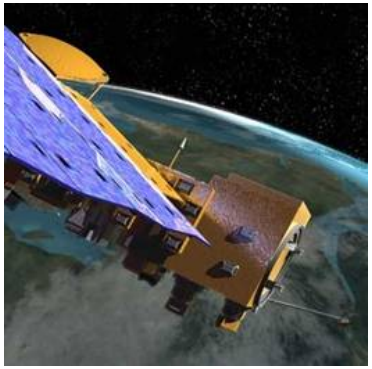
Observations of air pollution

- Earth Observation (EO): satellite observations
- Airplane flight campaigns
- Balloons: profiling
- Ground measurements: professional, crowd sourcing, GLOBE students

...satellite observations need validation with ground and other types of observations (ground truthing)



The Netherlands, MODIS (source: NASA)



AURA satellite (source: NASA)

Ground observations, BSRN site Cabauw, The Netherlands

Weather belloon, KNMI

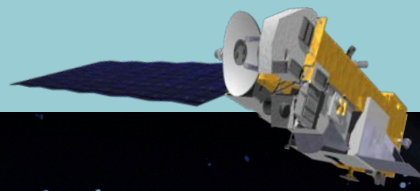
NO2 profiling over Cabauw

Earth Observation

Earth observations increase our understanding of air pollution, its origins and behaviour, and its impacts on air quality, environment, and climate change

UK and the Netherlands, Belgium from ISS op 3 May 2011 (foto: NASA/Astronaut Ron Garan)

Earth Observation for air pollution



EOS-AURA with o.a. OMI

Sentinel 5-P with TROPOMI

Satellite instruments for monitoring and scientific research of air pollution:

Ozone Monitoring Instrument, OMI (2004-) aboard NASA satellite EOS-AURA

Successor of OMI: *TROPospheric Monitoring Instrument*, TROPOMI (2016-) aboard ESA Sentinel 5-P

Present other instruments that observe air pollution, esp. aerosols: *MODIS, Calipso, GOME-2*

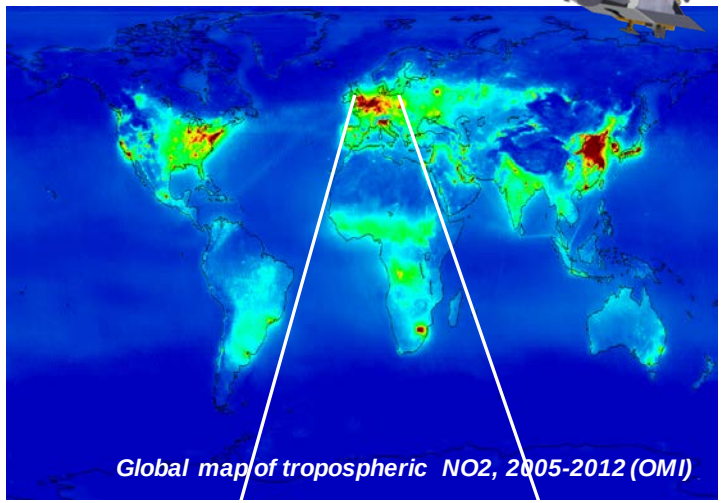
Visualisation of TROPOMI (source: Astrium – Airbus Group)

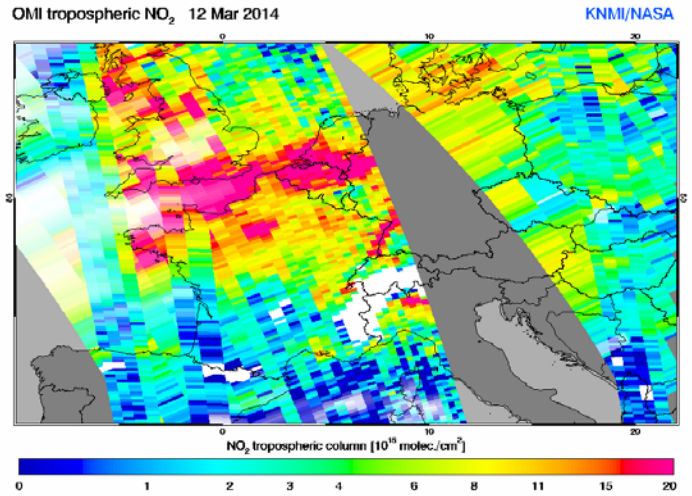
Satellite observations of air pollution

Example:

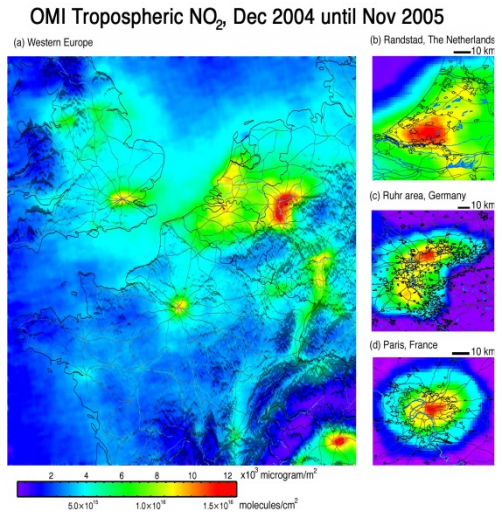
OMI nitrogen dioxide (NO_2)

NO_x emissions are partly closely related to aerosol emissions: traffic, ships, industry





OMI NO2, Smog period 11-16 March Paris



Satellite observations of aerosols

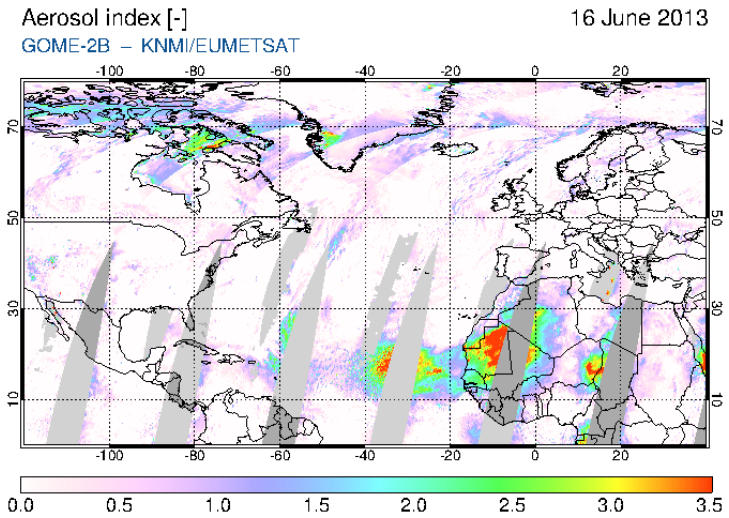
Example:

Canadian forest fire

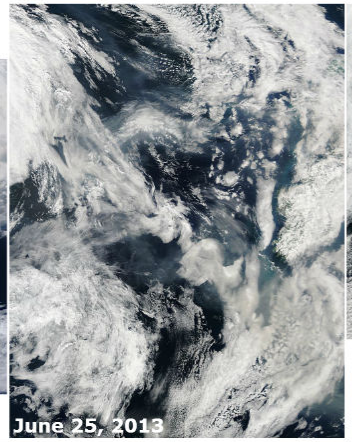
smoke plumes reach

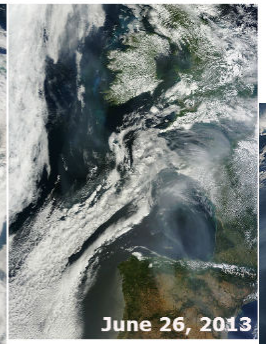
Europe

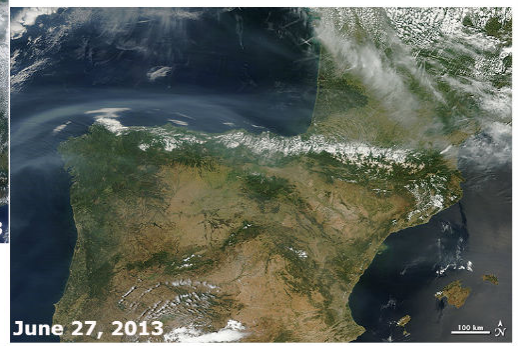
June-July 2013



Smoke plumes, GOME-2B 16 June to 9 July 2013







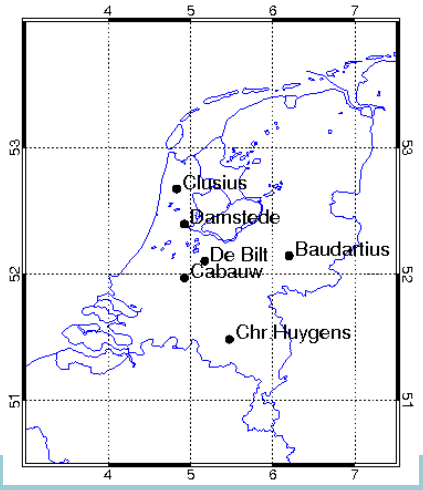
MODIS observations Europe 24-27 June 2013 (source: NASA)

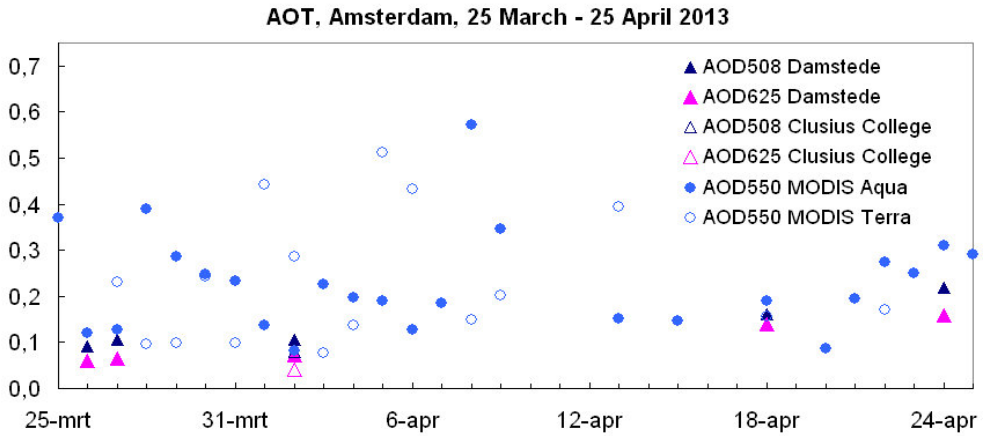
GLOBE Aerosols Campaign in 2013

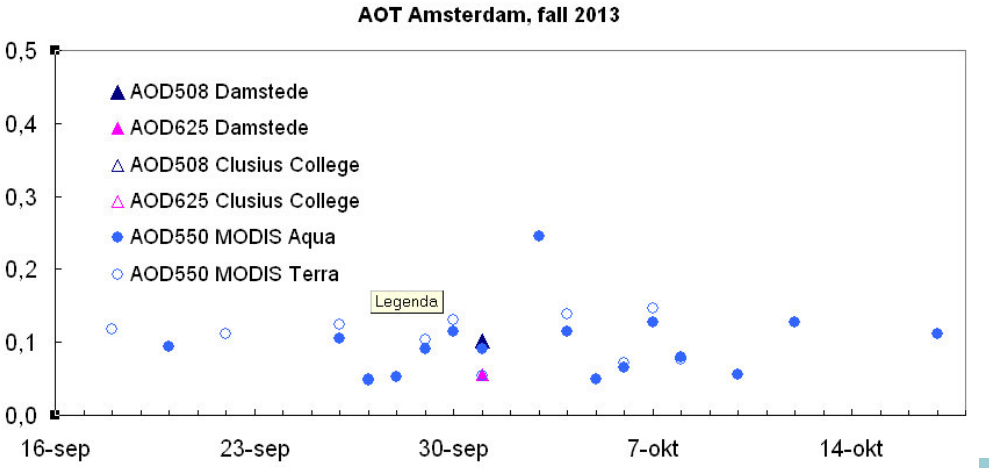
Spring campaign – *separate campaigns in NL, France, ..*

Fall campaign – *pilot European campaign*

GLOBE and MODIS AOT Amsterdam area





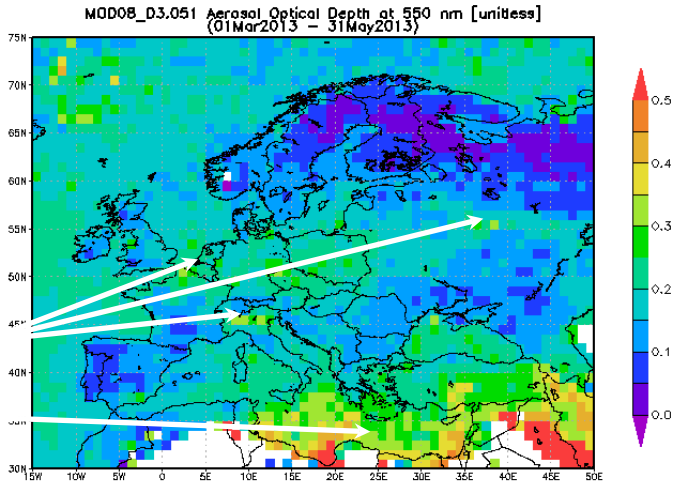


GLOBE European Aerosols Campaign in 2013

MODIS Terra over Europe,
spring versus fall period:

- $AOD_{spring} > AOD_{fall}$
- Greater day-to-day AOD variation in spring
- More clear sky days in spring

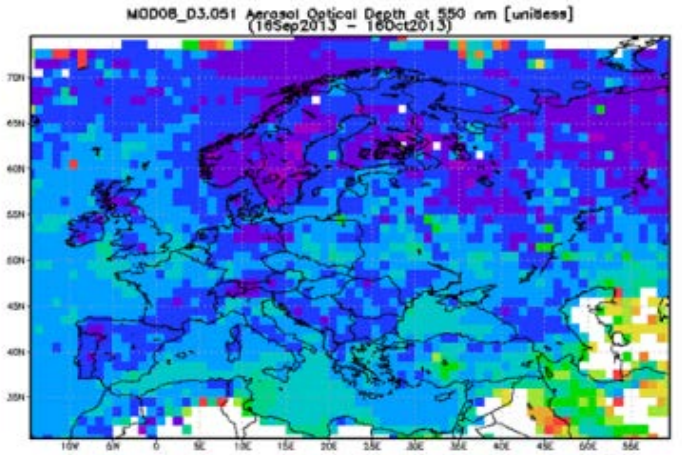
Spring



traffic & industry

Saharan dust

Fall



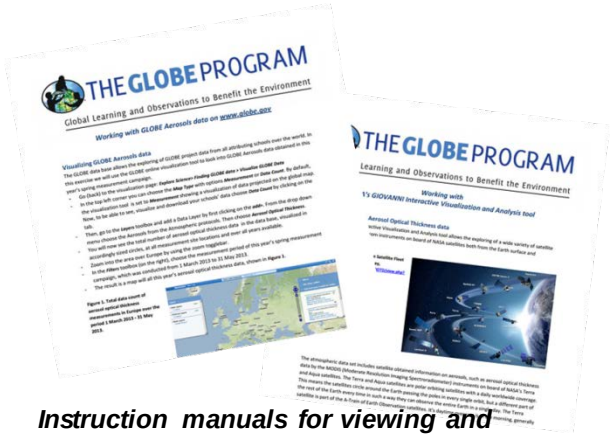
GLOBE Aerosols research; what do *you* see?

View and download AOT derived from your observations *and* of other GLOBE researchers with the *globe.gov* online visualization tool.

globe.gov visualisation tool (http://vis.globe.gov/GLOBE/)

Easy analysis of downloaded data with MS Excel or Libre Office Calc

Read how to get started in this instruction manual



Instruction manuals for viewing and downloading AOT observations from globe.gov database (I)

Conduct your own research – what do you see?

Example research questions:

1. How does AOD vary during a week, month, season in your area? Take sunphotometer measurements at the same time every day (or multiple times in one day, evenly spread over the day – if possible) and consecutive clear sky days throughout the measurement period.
2. How does AOD vary in a single day? In spring? in fall? Take multiple sunphotometer measurements in a single day (if possible at moments evenly spread over the day).
3. How does AOD vary throughout the Netherlands, Europe, and elsewhere? Compare observations done at the same (local) times but different locations.
4. What do you 'see', and what does a satellite 'see'? Compare your observations with AOD from for example the MODIS satellite instrument. Read here how to view and download MODIS AOD data ith the NASA's Giovanni tool.

Share your research results with others, on the GLOBE Aerosols European campaign page

Panoramafoto's vanaf de KNMI meetlocatie (het dak) start meetcampagne 2014

Manual for the visualization of MODISAOD Giovanni (r)

Crowd sourcing of aerosols information: iSPEX

8 July 2013:
National iSPEX
observation day
in the Netherlands

5 september 2013
2nd iSPEX observation day

1st national iSPEX observation day

iSPEX

See http://ispex.nl

See http://www.knmi.nl/globe/meetcampagne_ispex.html

Netherlands, Belgium, and United Kingdom from International Space Station ISS, 3 May 2011 (source: NASA/Astronaut Ron Garan)

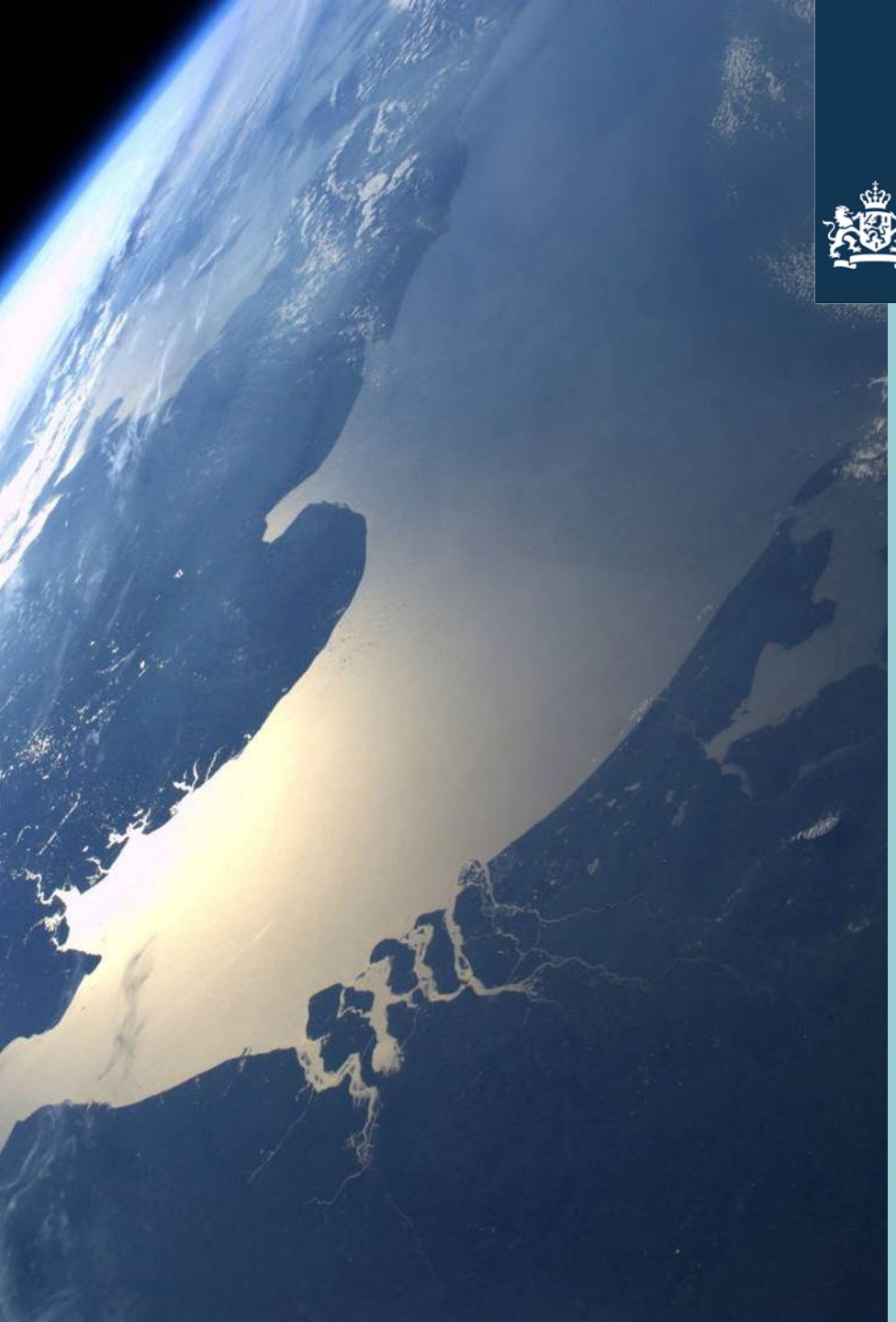
Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

Thank you!

More information:

www.knmi.nl/globe/aerosolen.html

www.globe.gov/web/europe-aerosols-campaign/overview



Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu

Extra:
How to add GLOBE Aerosols data into the globe.gov database

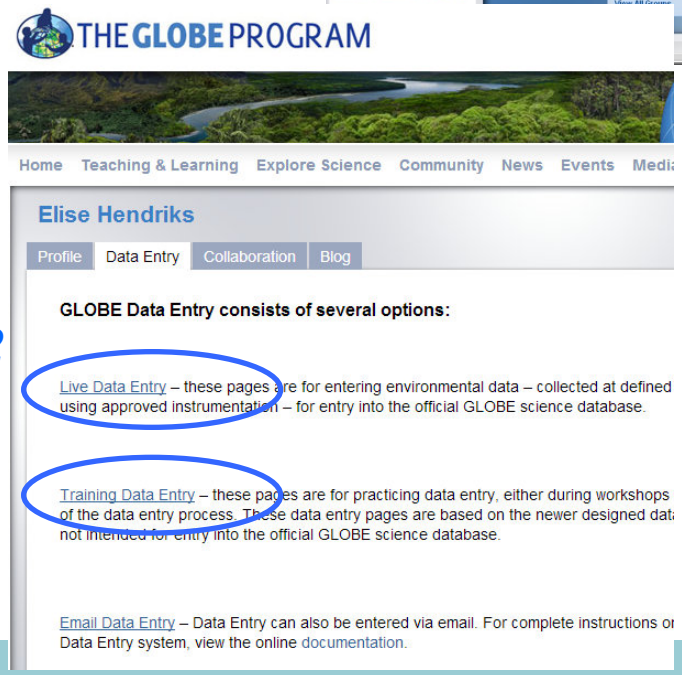
Globe.gov database

Add your measurements to the GLOBE database through *globe.gov*

This is how:

1. Go to *globe.gov* and login into the website
2. Go to ***Live Data Entry*** or ***Training Data Entry*** (choose the latter option to try it out)

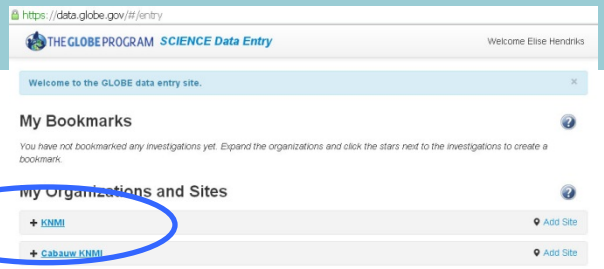
Your personal (live or training) data entry window appears...

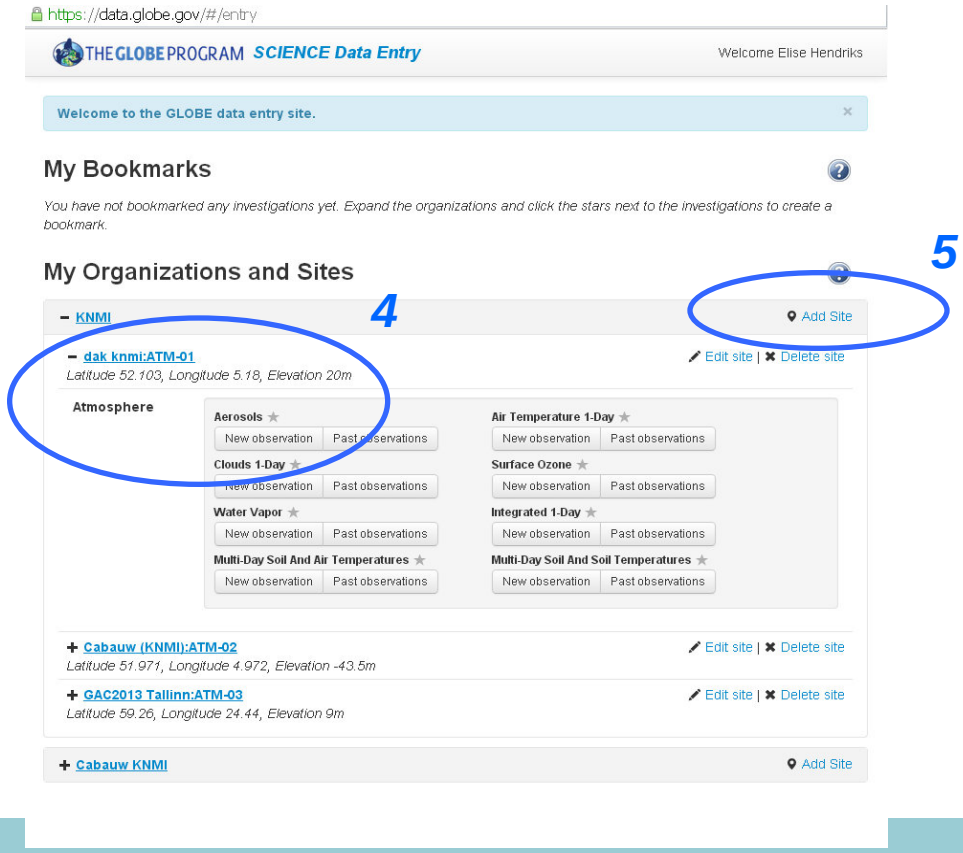


Globe.gov database

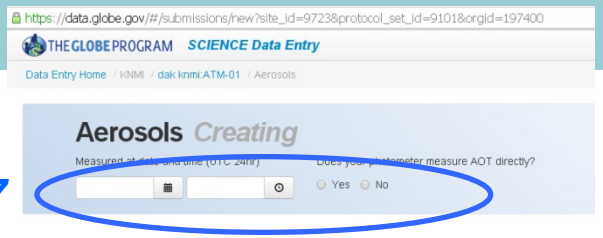
In *data entry at* globe.gov:

3. Open the site map of your your *school* by clicking on the click on the '+' in preceding your school name, to see your *observation sites* and *data*
4. No observation site defined yet? click on *add site* and follow the instructions given
5. Go to *New Observations* in *Atmosphere > Aerosols to* open the data entry page for the Aerosols protocol





Globe.gov database



Adding aerosols observations:

6. Enter the observation date, time and AOT measurement method. New data entries will then appear
7. Add sky observations color and clarity, according to protocol definitions
8. Add sun photometer measurements
9. Add other atmospheric data: contrail information, air temperature,..
10. *Check all entries* , then click on 'Submit' to add your observations

Your observations will be visible within one day (visualization tool)