



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

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

The screenshot shows the GLOBE Program website. At the top, there is a logo for 'THE GLOBE PROGRAM' with a globe icon. Below the logo is a navigation bar with links: Home, Teaching & Learning, Explore Science, Community, News, and Event. The main content area is titled 'Europe Aerosols Campaign' and has a sub-navigation bar with 'Overview', 'Members', 'Discussions', and 'Documents'. On the left side, there is a list of links: 'Aerosols investigations', 'Observe and Measure', 'Upload the data', 'Analyze the data', 'Connect to an aerosol scientist', 'Learning activities', and 'Instruments'. On the right side, there is a profile for a 'GLOBE Aerosols Scientist' named Elise Hendriks. Her profile includes a photo, a greeting, and a short bio: 'Hi, I am Elise Hendriks GLOBE aerosol scientist from the Netherlands. I am very interested in the behavior of aerosols, environment. My research involves using your G of their influence on climate change and air qual'. Below the bio is a link to 'Watch the introduction movie'. At the bottom of the screenshot, there is a text line: 'Globe Europe Aerosols Campaign at globe.gov'.



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!



The GLOBE Program

GLOBE Europe Aerosols Campaign

The main objective is to **inspire teachers and students to bring their local project to an international level by sharing their data with other schools, by using satellite data and by receiving scientific feedback.**

> Pilot phase 2013
Consisted of a 2 months **spring campaign** and a single month **fall campaign**. In this period first **schools throughout Europe and Eurasia joined** by carrying out their measurements. **A platform was set up** in order to show basic measurement instructions and to share general feedback afterward on measurement campaign. This platform is **available on the globe website: www.globe.gov/web/europe-aerosols-campaign**
Regional Office: europe@globe.gov

> Resources
Sun photometers are used to measure the Aerosol Optical Thickness (AOT):

1. GLOBE sun photometer
2. Calitoo sun photometer

> Schedule 2014
Spring campaign: 9 Mar – 9 May
Fall campaign: 15 Sep – 17 Oct

Under Alert Campaign: possibility to study special aerosol events such as forest-fire events, volcanic eruptions, dust storm, and so on.

> Use of data
Aside from the educational value, the student campaign data can provide very useful information to aerosol science and monitoring in relation to climate change and air quality.

Logos: O&M, Institut National de l'Environnement Industriel et des Risques, CNES

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](#)*

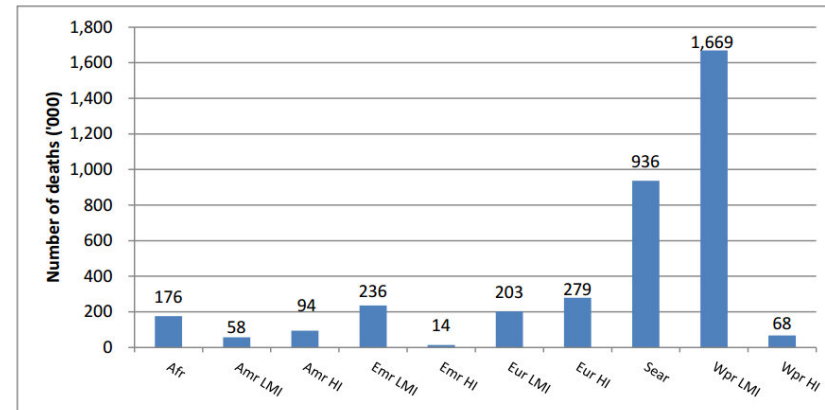


Air pollution and health

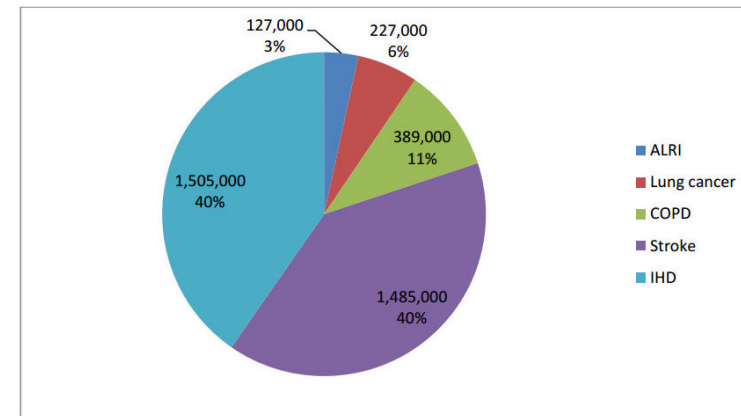
World Health Organisation
(WHO), March 2014:

“... 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 (NO_x), sulphur oxides (SO_x), ozone (O₃), methane (CH₄), ..
- *aerosols*

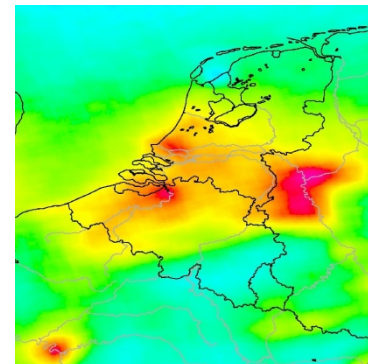
Climate change: *aerosols*, methane, and ozone



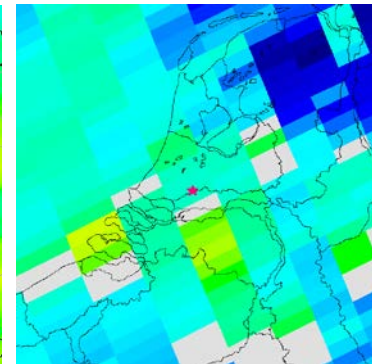
Traffic exhaust



Moscow smog in 2010 (source: wikipedia)



OMI nitrogen dioxide



OMI aerosol optical thickness



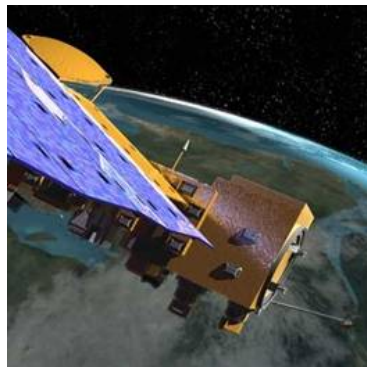
Observations of air pollution

- 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 balloon, KNMI



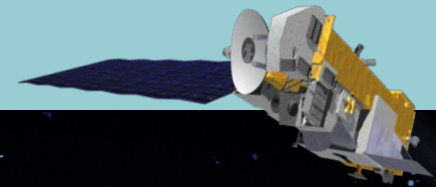
NO2 profiling over Cabauw



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](#))



EOS-AURA with o.a. OMI

Earth Observation for air pollution

Satellite instruments for monitoring and scientific research of air pollution:

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

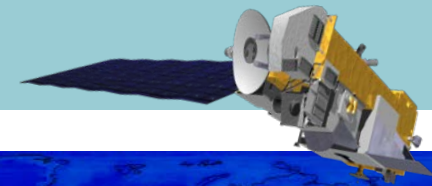
Successor of OMI: *TROPospheric Monitoring Instrument, TROPOMI* (2016-) aboard ESA Sentinel 5-P

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



Sentinel 5-P with TROPOMI

Visualisation of TROPOMI (source: Astrium – Airbus Group)

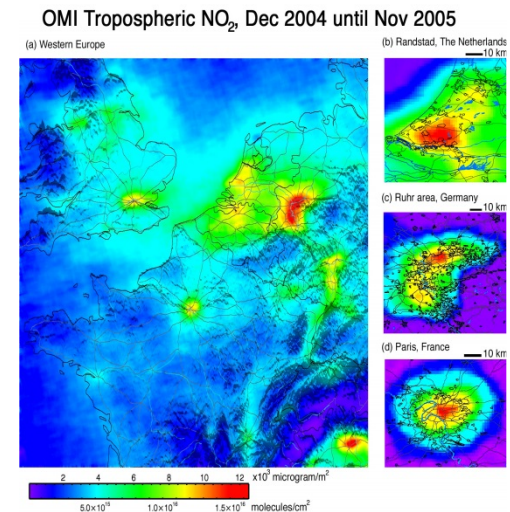
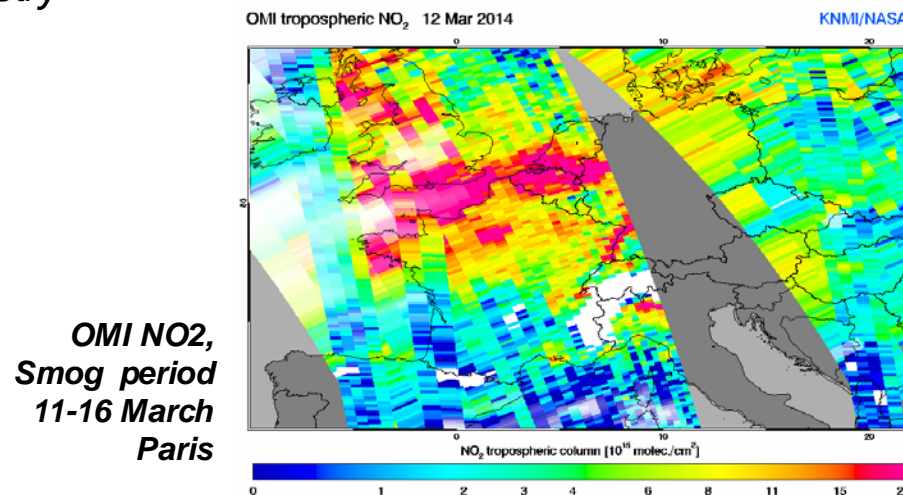
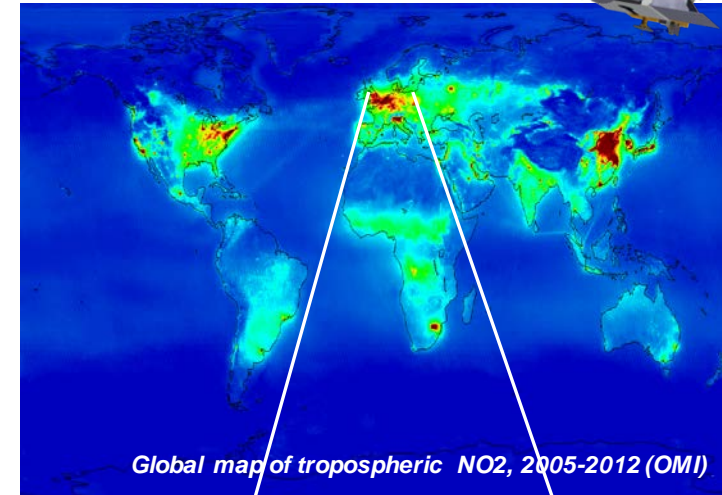


Satellite observations of air pollution

Example:

OMI nitrogen dioxide (NO_2)

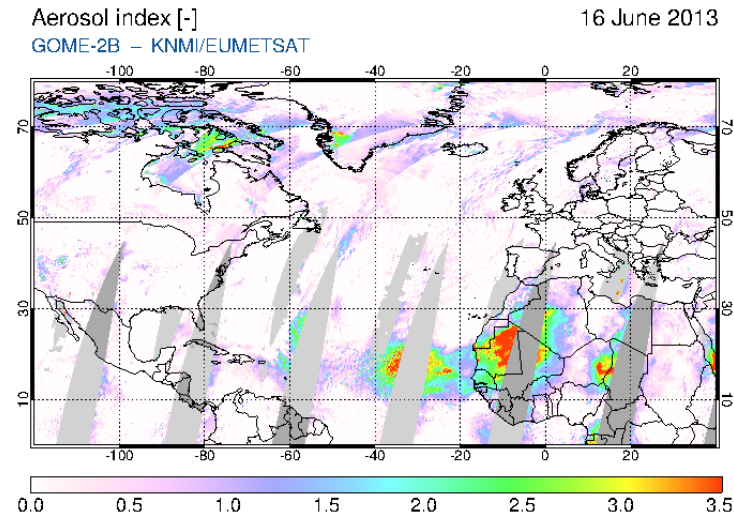
NO_x emissions are partly closely related to aerosol emissions: traffic, ships, industry



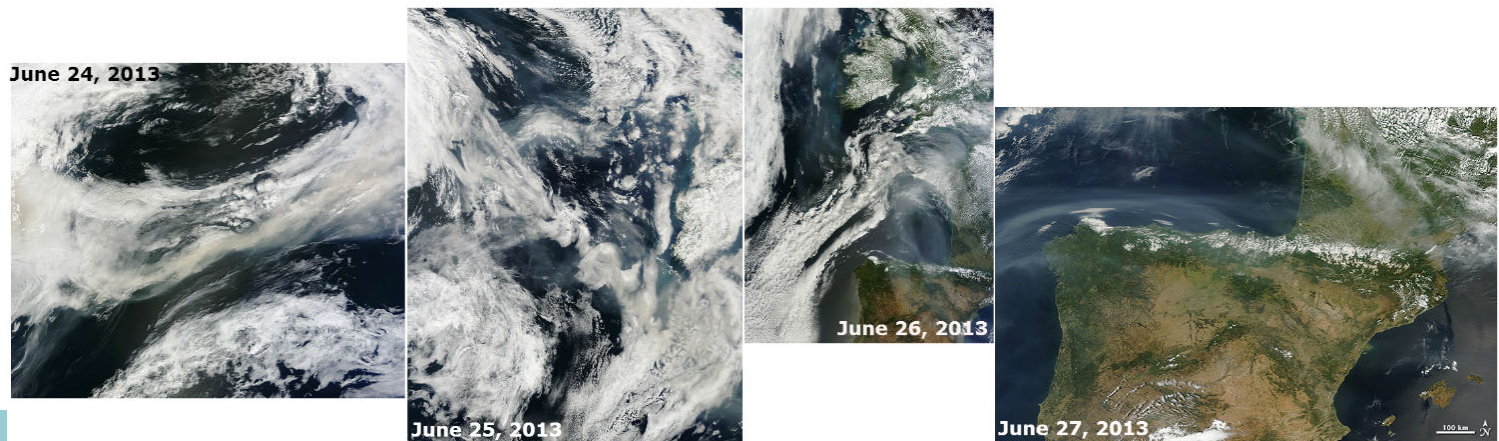


Satellite observations of aerosols

Example:
Canadian forest fire
smoke plumes reach
Europe
June-July 2013



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



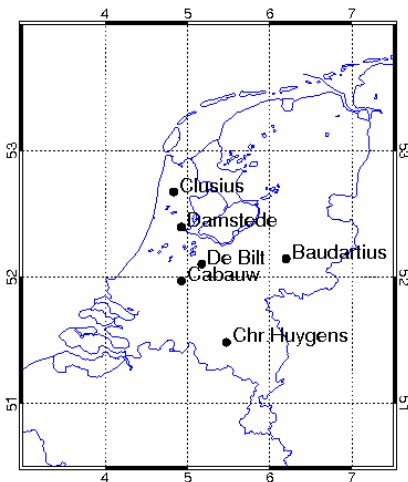


GLOBE Aerosols Campaign in 2013

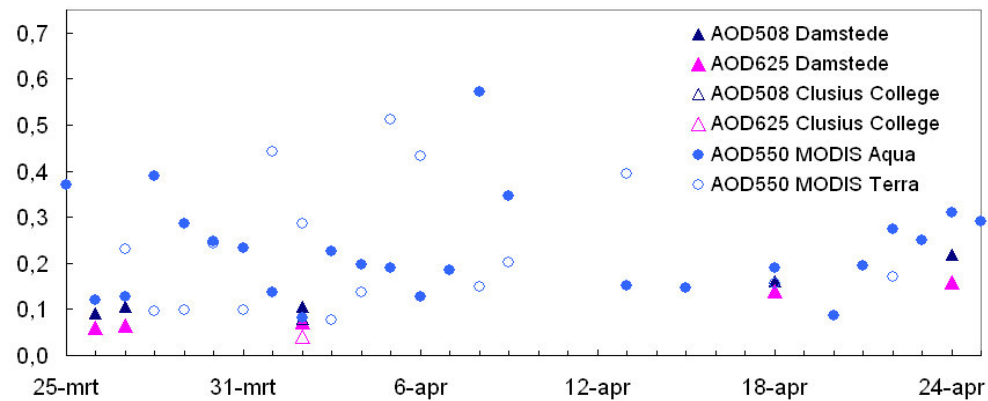
Spring campaign – *separate campaigns in NL, France, ..*

Fall campaign – *pilot European campaign*

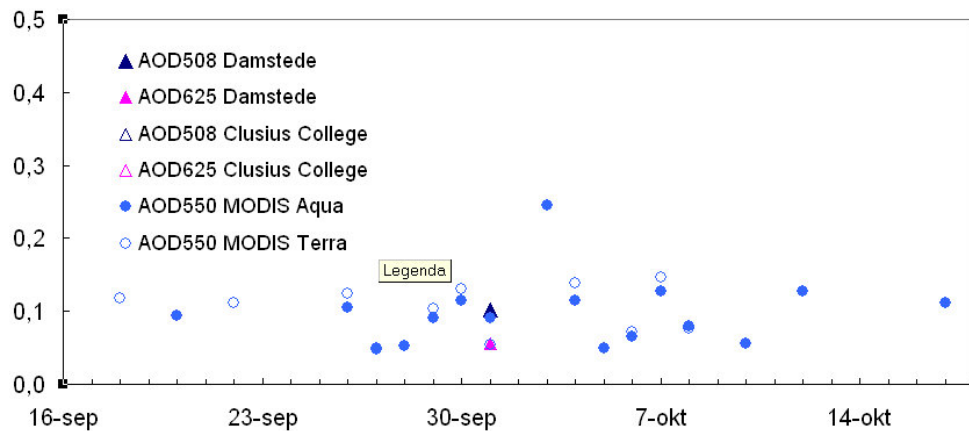
GLOBE and MODIS AOT
Amsterdam area



AOT, Amsterdam, 25 March - 25 April 2013



AOT Amsterdam, fall 2013





GLOBE European Aerosols Campaign in 2013

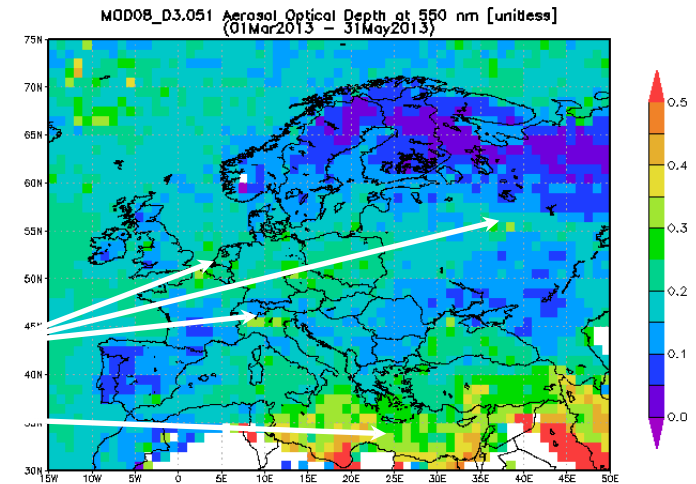
MODIS Terra over Europe, spring versus fall period:

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

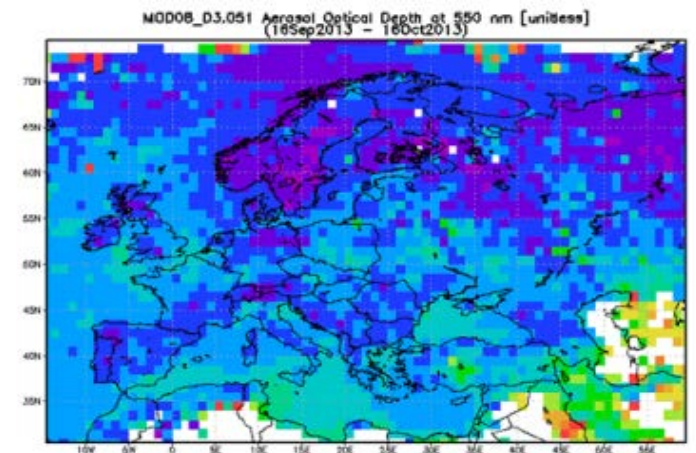
Spring

traffic & industry

Saharan dust



Fall



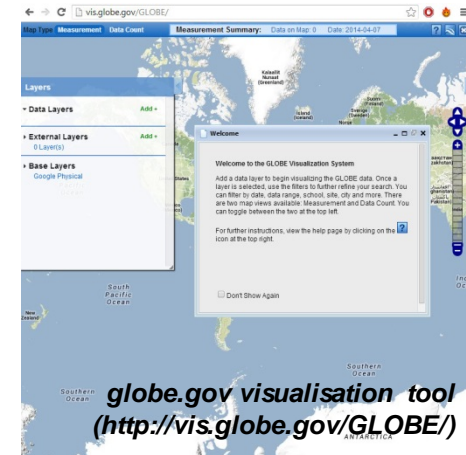


GLOBE Aerosols research; what do you see?

View and download AOT derived from your observations *and* of other GLOBE researchers with the [globe.gov](http://vis.globe.gov) online visualization tool.

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

Read how to get started in [this](#) instruction manual



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



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 with the [NASA's Giovanni tool](#).



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



Manual for the visualization of MODISAOD Giovanni (r)

Share your research results with others, on the [GLOBE Aerosols European campaign page](#)



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



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

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



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

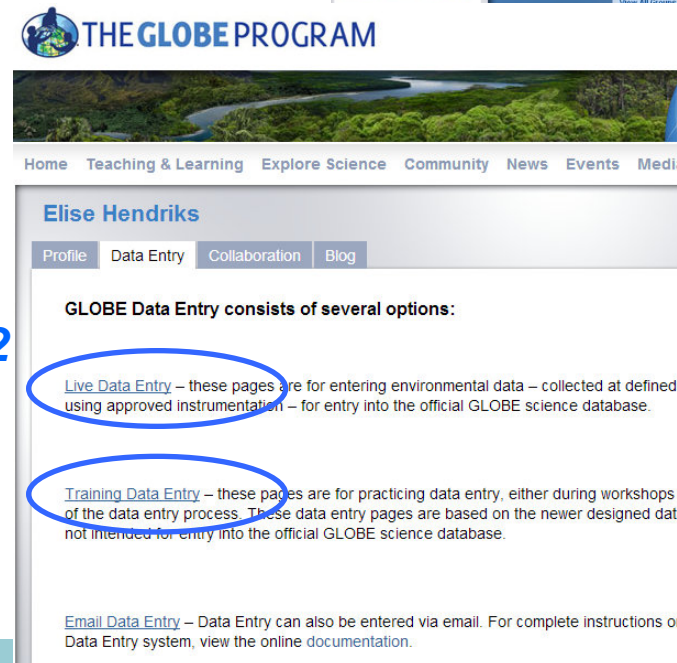
This is how:

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...



2





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

https://data.globe.gov/#/entry

THE GLOBE PROGRAM SCIENCE Data Entry

Welcome Elise Hendriks

Welcome to the GLOBE data entry site.

My Bookmarks

You have not bookmarked any investigations yet. Expand the organizations and click the stars next to the investigations to create a bookmark.

My Organizations and Sites

- + KNMI Add Site
- + Cabauw KNMI Add Site

https://data.globe.gov/#/entry

THE GLOBE PROGRAM SCIENCE Data Entry

Welcome Elise Hendriks

Welcome to the GLOBE data entry site.

My Bookmarks

You have not bookmarked any investigations yet. Expand the organizations and click the stars next to the investigations to create a bookmark.

My Organizations and Sites

- KNMI Add Site
- dak knmi:ATM-01 Latitude 52.103, Longitude 5.18, Elevation 20m Edit site | Delete site
- + Cabauw (KNMI):ATM-02 Latitude 51.971, Longitude 4.972, Elevation -43.5m Edit site | Delete site
- + GAC2013 Tallinn:ATM-03 Latitude 59.26, Longitude 24.44, Elevation 9m Edit site | Delete site
- + Cabauw KNMI Add Site

Atmosphere

Aerosols ★

New observation Past observations

Clouds 1-Day ★

New observation Past observations

Water Vapor ★

New observation Past observations

Multi-Day Soil And Air Temperatures ★

New observation Past observations

Air Temperature 1-Day ★

New observation Past observations

Surface Ozone ★

New observation Past observations

Integrated 1-Day ★

New observation Past observations

Multi-Day Soil And Soil Temperatures ★

New observation Past observations



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](#))

