

OpenEarthTools =  
Open source management of  
Data, Models and Tools for  
marine & coastal  
science & technology

[www.OpenEarth.eu](http://www.OpenEarth.eu)

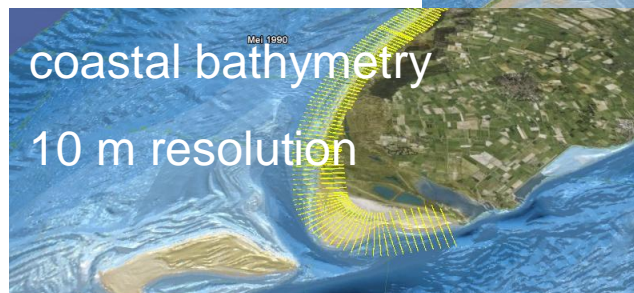
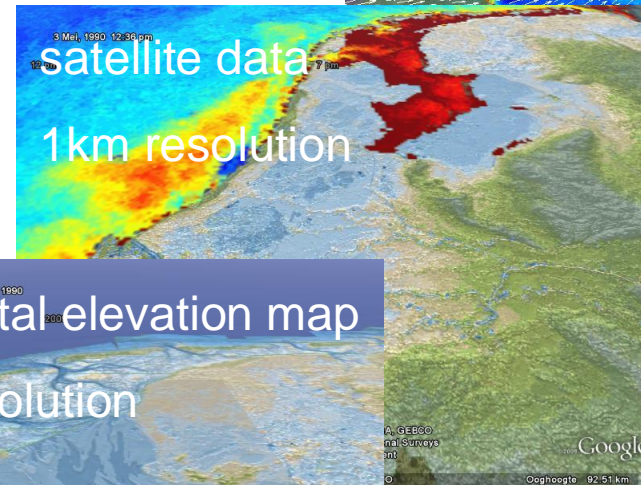
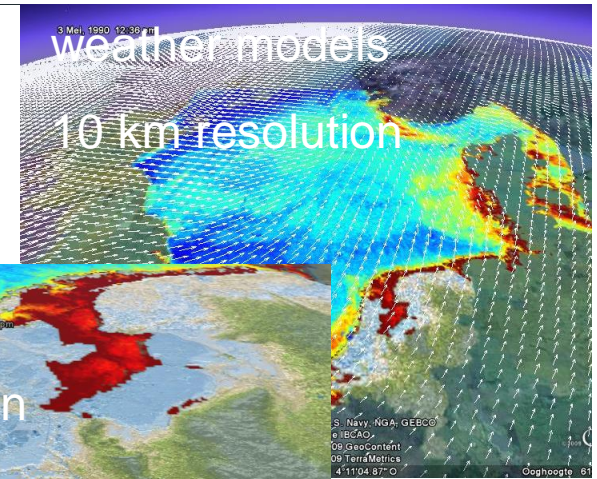


*.. and what about*

**YOU?**

# Open<sup>1</sup>Earth<sup>2</sup>

- Open<sup>1</sup>-access Google-Earth<sup>2</sup>-alike of
- all environmental data products covering
- any range of physical scales located
- anywhere on the world
- under rigorous version control

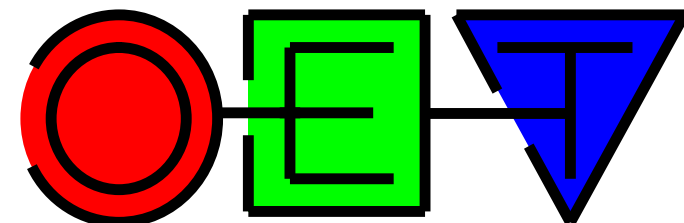


Process scale: km/yr

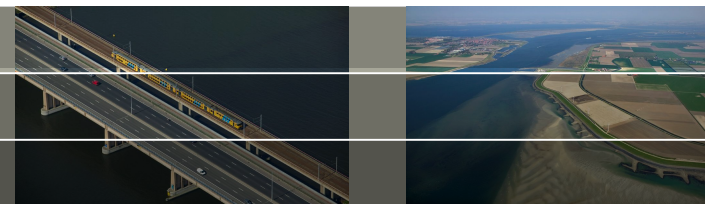


after De Vriend

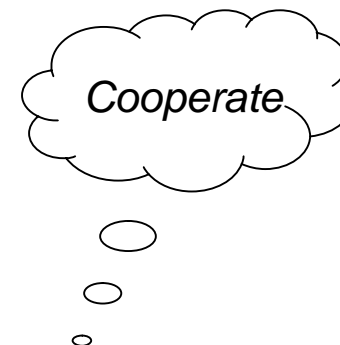
scale of interest: km/yr

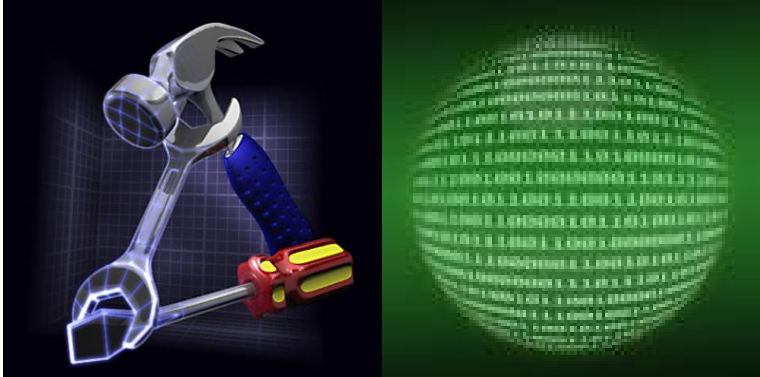
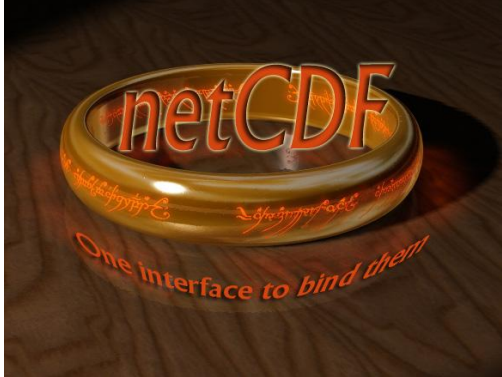
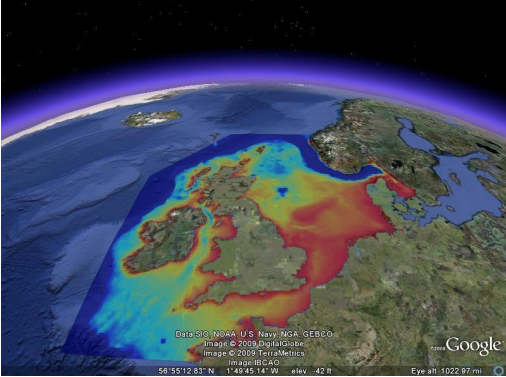





# Contents

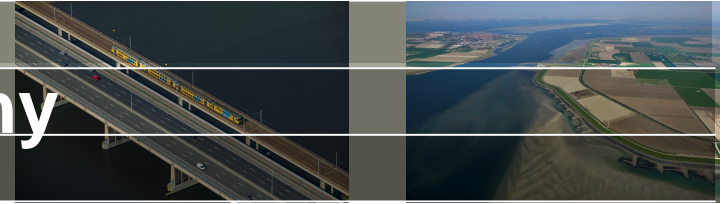


0. The power of collaboration
1. Google Earth: web service for images
2. OPeNDAP/netCDF: web service for data
3. Subversion: web service for version control

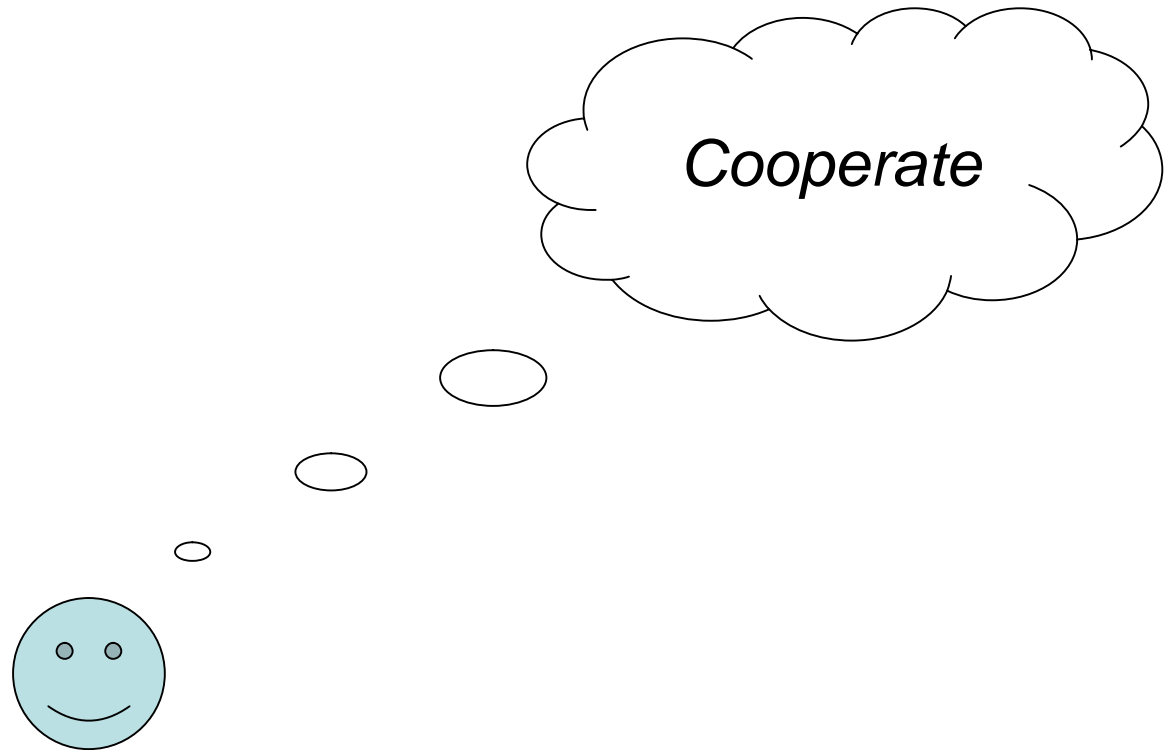


① Version control and backup	② Web access to datasets	③ Straightforward visualisation
tools      data & scripts	from pluriform to standard format!	open source software
		
		

# What is OpenEarth: philosophy



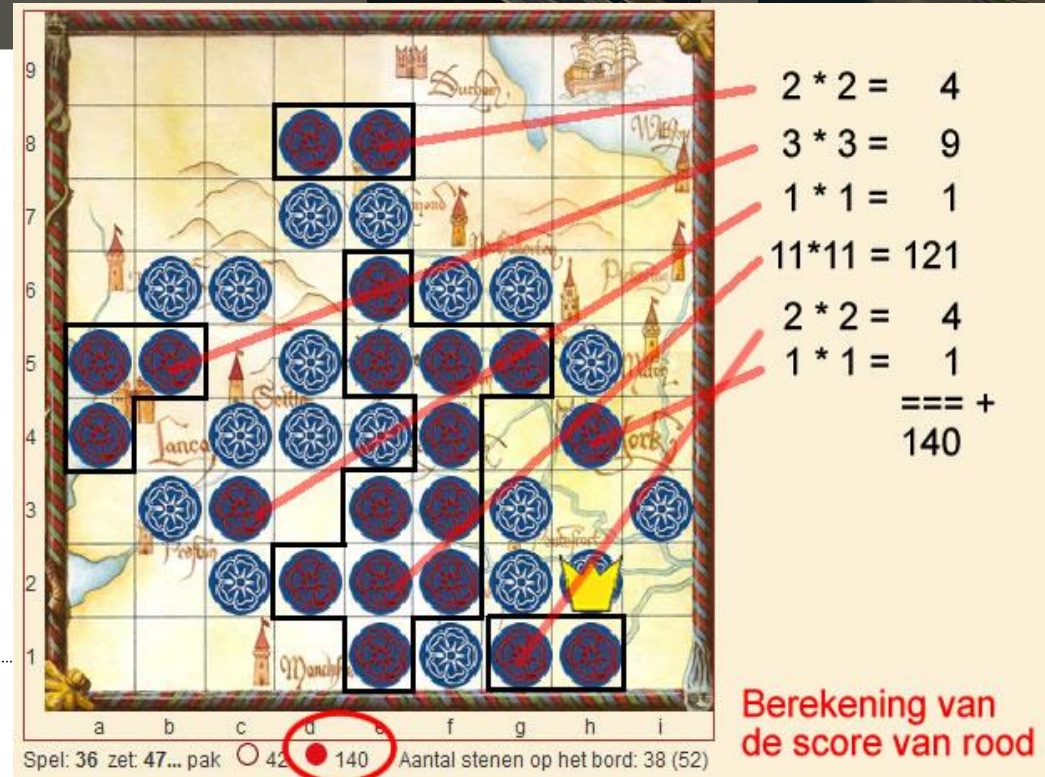
1. philosophy
2. community
3. repository
4. delivery



When you work on complex matters you soon discover that some things are too big to handle on your own. That you constantly reinvent the wheel. That others seem to reinvent your wheels. That some important wheels never get invented because they are too big to handle for a single project. The solution is to collaborate across the artificial boundaries of projects.

# What is OpenEarth: community

- Prisoners dilemma
- Tragedy of the commons
- OpenEarth accepts some asymmetry in sharing: it is the player that keeps the sharing going



Journal of Personality and Social Psychology  
2009, Vol. 96, No. 1, 83–103

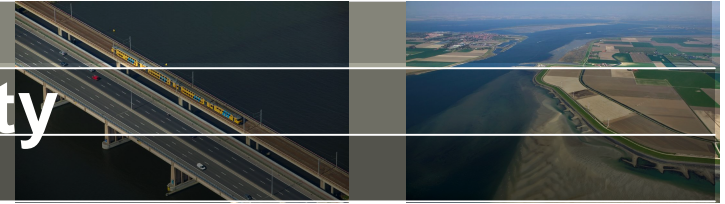
## Promoting Cooperation and Trust in “Noisy” Situations: The Power of Generosity

Anthon Klapwijk  
VU University Amsterdam

Paul A. M. Van Lange  
VU University Amsterdam and Leiden University

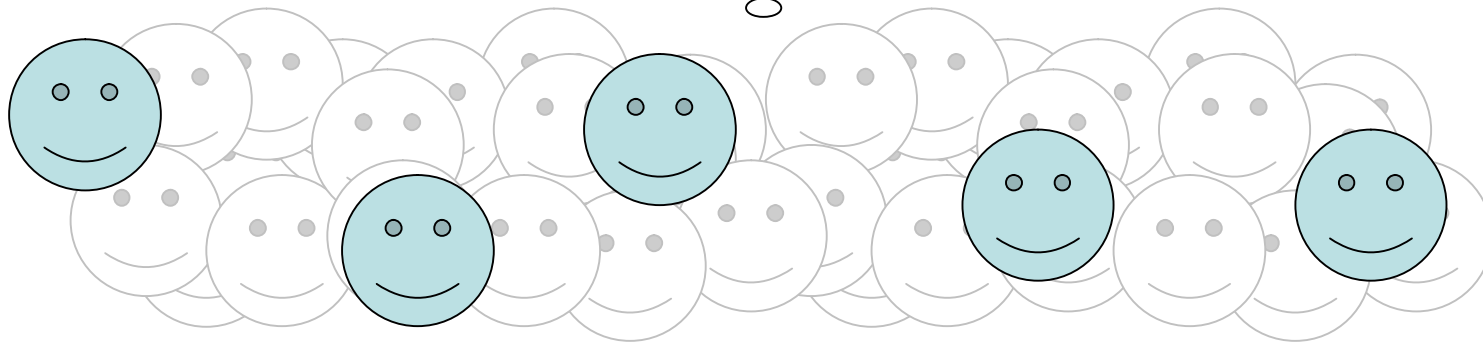
The authors present an interdependence theoretical framework and advance the argument that generosity serves the important purpose of communicating trust, which is assumed to be of utmost importance to coping with incidents of negative noise (i.e., when the other every now and then behaves less cooperatively than intended). Using a new social dilemma task (the parcel delivery paradigm), it was

# What is OpenEarth: community



1. philosophy
2. **community**
3. repository
4. delivery

*Cooperate*

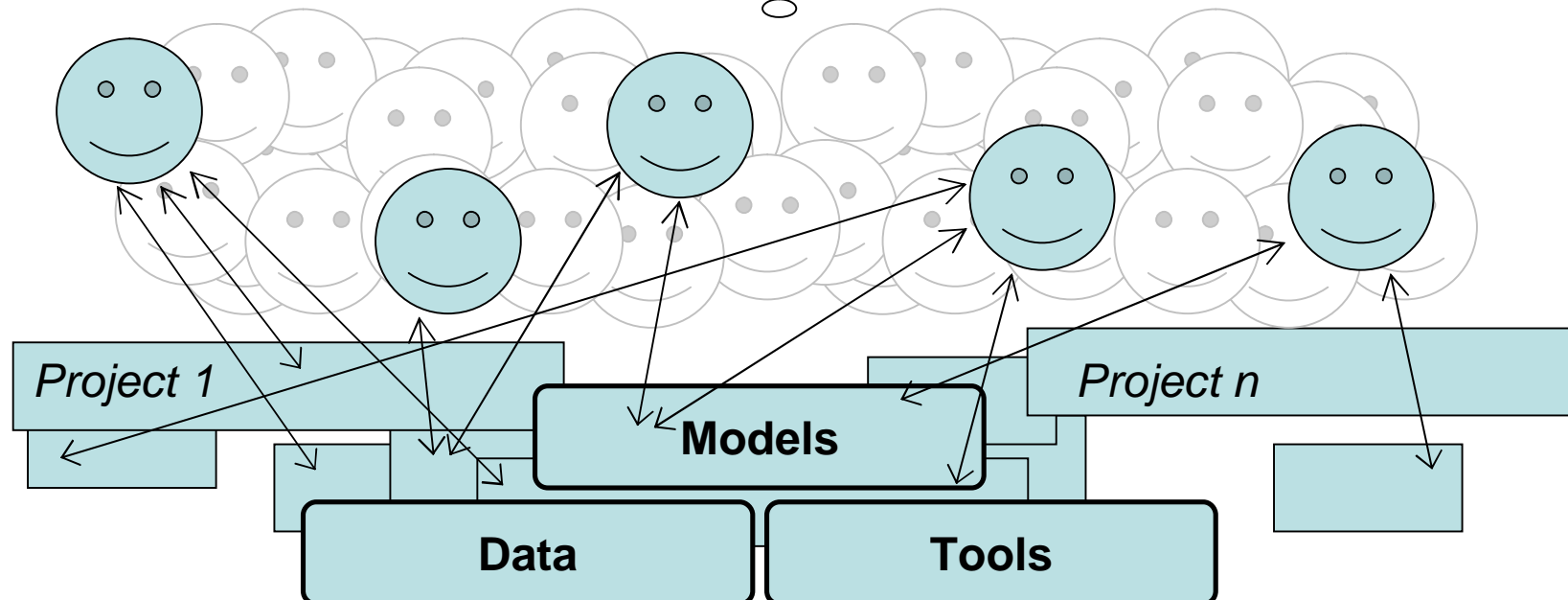


Fortunately there are usually more people than you think who are prepared to team up in related topics. So share the wheels you invented, never invent a wheel again, and embark a mission to invent those very big wheels we all need. You can split the required investment over different projects that afford the money otherwise needed for reinvention of wheels. Like this, OpenEarthTools made an advanced Google plot toolbox, a coordinate conversion toolbox, etc.

# What is OpenEarth: community needs structure

- all collaborating is not enough
- chaos
- coordination needed
- but no overall boss
- like wikipedia

*Cooperate*



# What is OpenEarth: community needs structure

- oh oh, ik heb een oude versie gebruikt!
- euh, wat/waar is de meest recente versie eigenlijk?
- o nee, maken we weer dezelfde fout!
- hmm, wat is hier eigenlijk gemeten?
- tja, waar is dit eigenlijk gemeten?
- oops, welke tijdzone is dit gemeten?
- aarghh, wie weet nog wat hier precies is gedaan?
- #\*\$!, is die data weggegooid?!?
- ja hoor, weer een nieuw data formaat!!!
- zucht, dit probleem moet iemand al eens eerder hebben opgelost!

- QA/QC = SOMETHING<sup>1</sup> ADHERES TO<sup>2</sup> SOME CRITERIA<sup>3</sup>

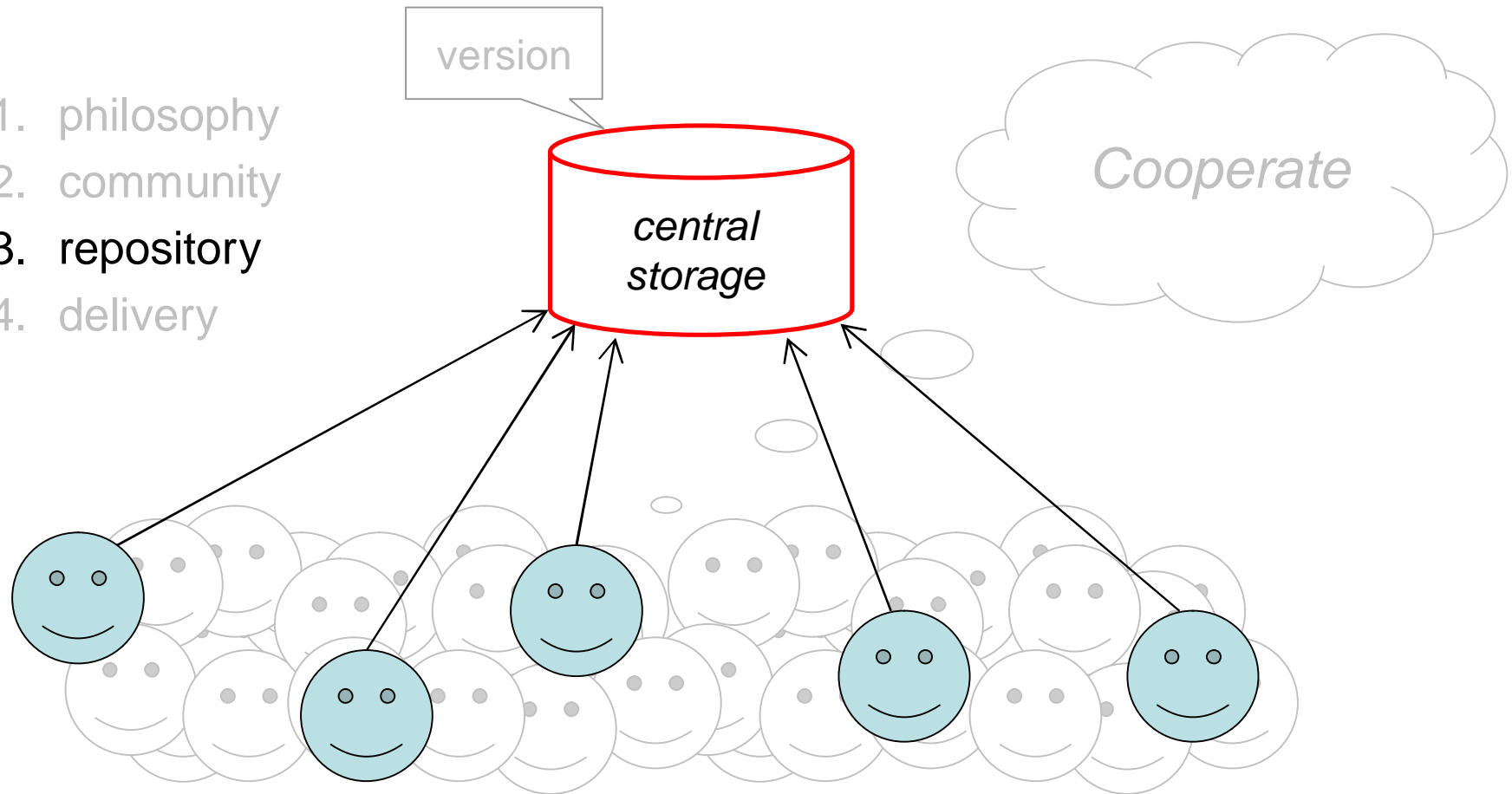
1. version control
  - no version control = no quality
2. a community using it and improving it on the spot
  - no users = no quality
3. the cumulative opinion and philosophy of all users
  - no opinion in quality = no quality





# What is OpenEarth: repository

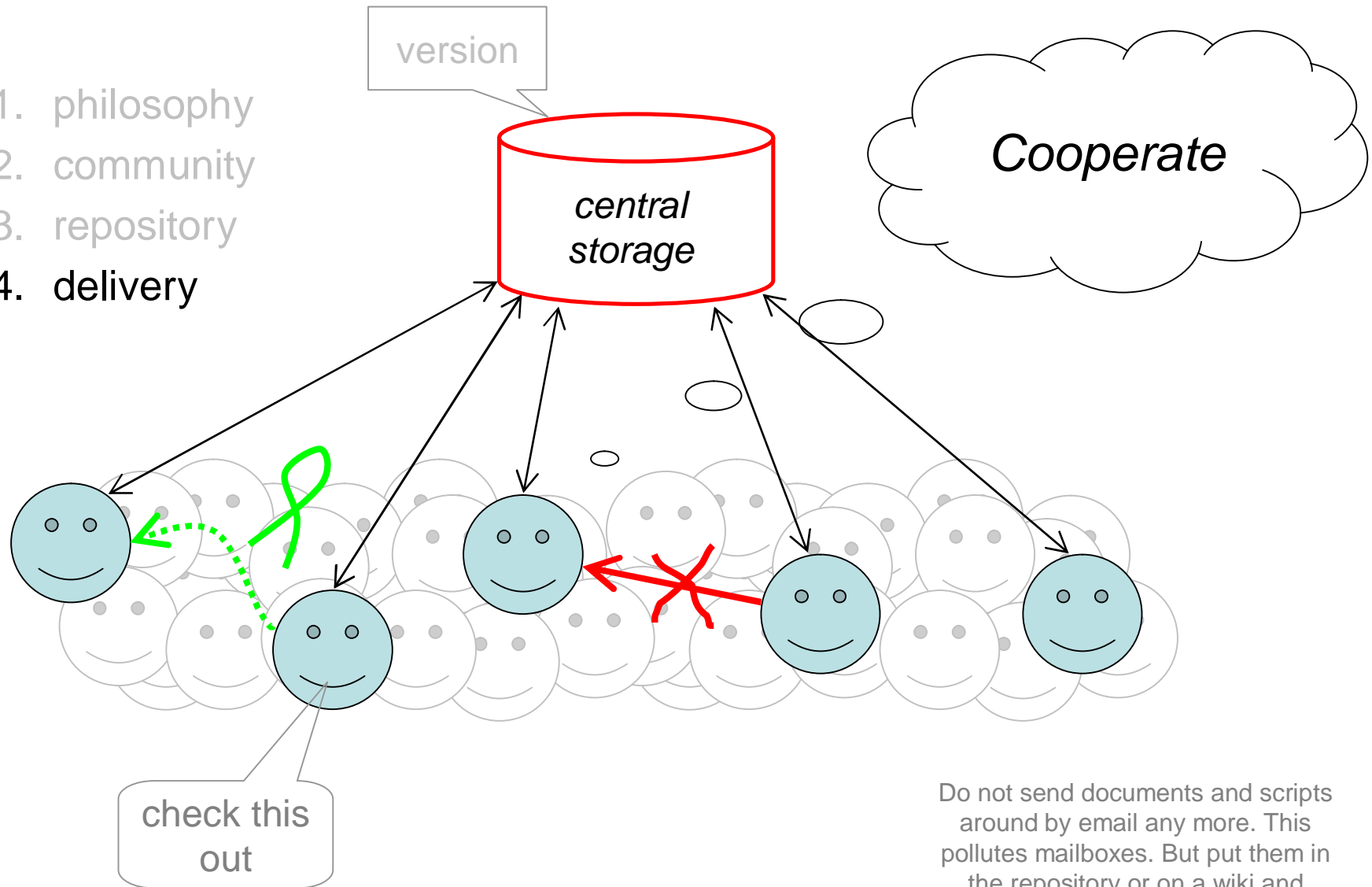
1. philosophy
2. community
3. repository
4. delivery



When working with a team, it is important to keep good track of the latest version of a tool/document. When working in pairs of 2 it is easy: either you work on it or the other person. In groups of 3 and bigger a formal system is required. Especially when more than 1 person is working on it at the same time. A repository allows more persons to work on it simultaneously, and it takes care of the essential merging process.

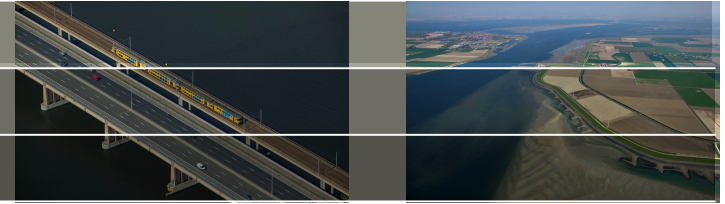
# What is OpenEarth: web services

1. philosophy
2. community
3. repository
4. delivery



Do not send documents and scripts around by email any more. This pollutes mailboxes. But put them in the repository or on a wiki and inform colleagues where to get the latest version.

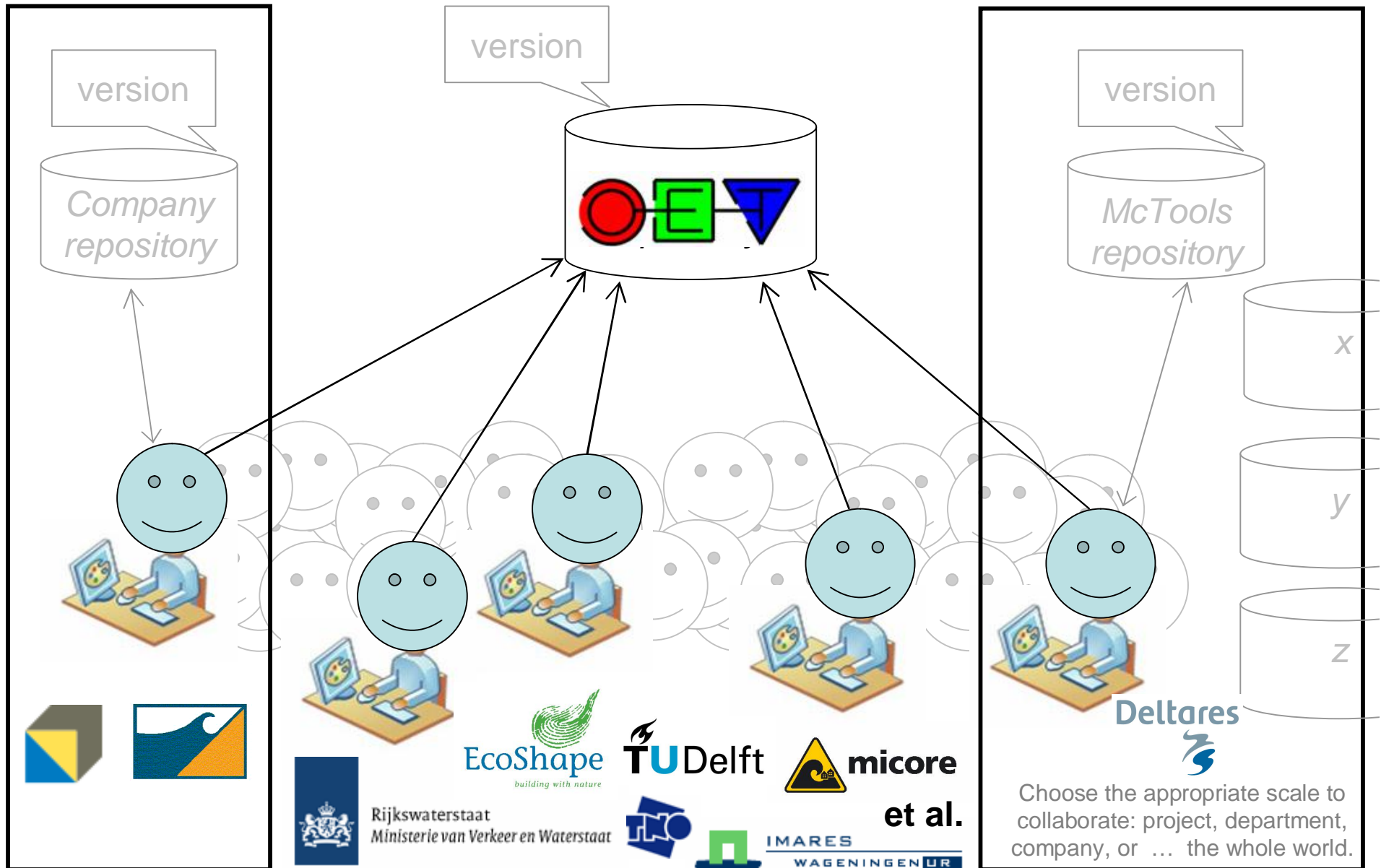
# What is OpenEarth: example



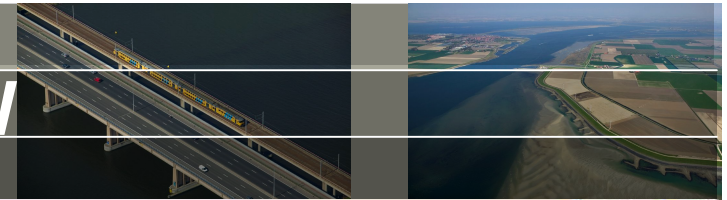
1. General Mapping Toolbox: only \*.eps on linux
2. arcGIS: \$
3. matlab mapping toolbox: \$
4. PCTTRANS marine: powerful, but much ado with external files (grids)
5. PROJ 4: powerfull but requires it skill to link it
6. matlab CTRANS DV: Rijksdriehoek, UTM, LonLat
  - Zitman > Verploeg > Bonekamp > Elias > de Boer > ?
7. **OpenEarth** SuperTrans convert coordinates
  - Maarten van Ormondt (Deltares) & Thijs Damsma
  - GUI & matlab command line
  - ~ 3000 EPSG transfomations
  - free if you join OpenEarthTools

```
>> [x,y]=ConvertCoordinates(5,52,'WGS 84','geo','WGS 84 / UTM zone 31N','xy',...)
```

# What is OpenEarth: uniform open and closed access



# Linked data: RAW DATA NOW



Tim Berners-Lee on the next Web | Video on TED.com - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.ted.com/talks/tim\_berners\_lee\_on\_the\_next\_web.html

Tim Berners-Lee on the next ...

[Sign In](#) | [Register](#)

**TED** Ideas worth spreading

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## Talks Tim Berners-Lee on the next Web

Filmed Feb 2009; Posted Mar 2009



**About this talk** [Open interactive transcript »](#)

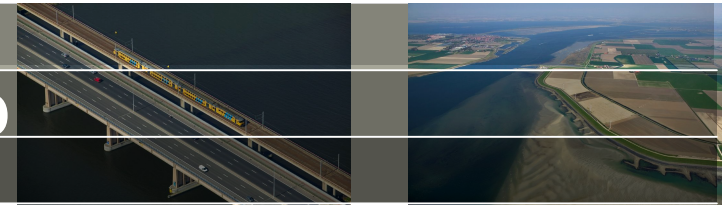
20 years ago, Tim Berners-Lee invented the World Wide Web. For his next project, he's building a web for open, linked data that could do for numbers what the Web did for words, pictures, video: unlock our data and reframe the way we use it together.

### About Tim Berners-Lee

Tim Berners-Lee invented the World Wide Web. He leads the World Wide Web Consortium, overseeing the Web's standards and development. [Full bio and more links](#)

### About our sponsor

# UK gov't: all data will open up



Unlocking innovation | data.gov.uk - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://data.gov.uk/

Unlocking innovation | data.gov.uk

HM Government data.gov.uk

Home Blog Data SPARQL Apps Ideas Forum Wiki Resources About

Unlocking innovation  
Working with UK Public  
Sector information and data

Subscribe by RSS

Community  
Log in / Sign up

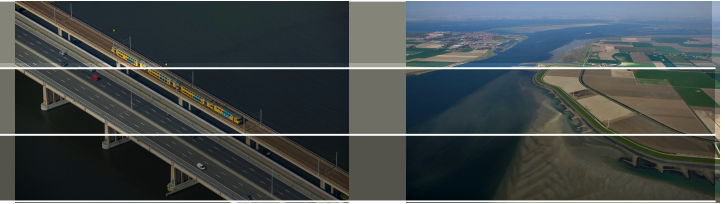
Local Data Panel

What is the Semantic Web?  
Combining different data sources has never been easy but the Semantic Web will

**Latest datasets**

- 18 June** Estimated government workforce including consultants
- 14 June** More COINS public spending data: now covers 2005 to 2010
- 10 June** Lists of all Special Advisers and Cabinet Office staff
- 4 June** The COINS database of public spending

# What does OpenEarth



## 1. Stimulate collaboration

- spread the message

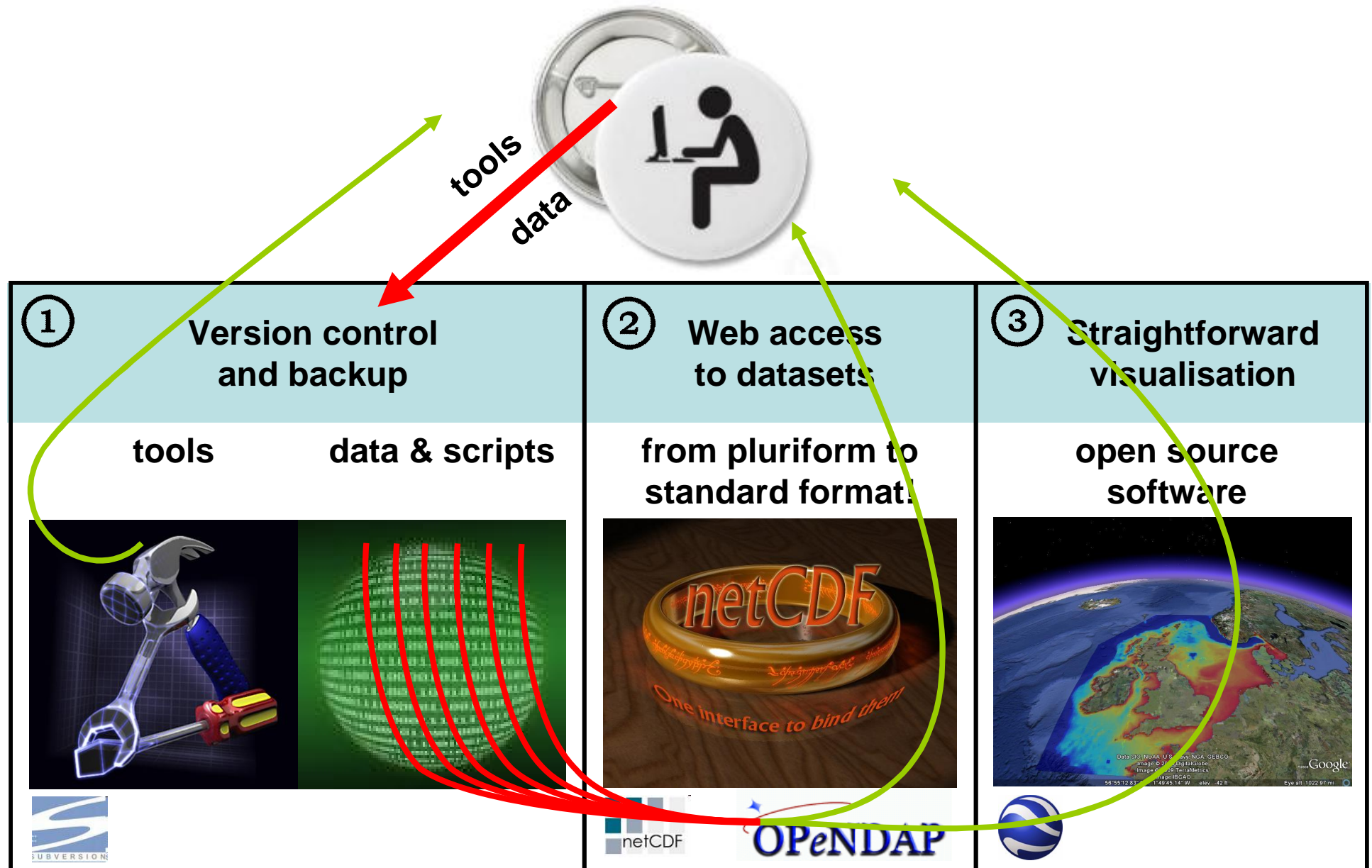
## 2. Organise collaboration

- design open source components IT infrastructure:
  - operational: proof-of-concept: ready for 'test-drive'
- clones to spread approach (pilot > operational):
  - McTools, TU Delft library, Van Oord, Alkyon, MATROOS
  - on linux server: pilot takes ICT half a day

## 3. Training and minimizing divergence

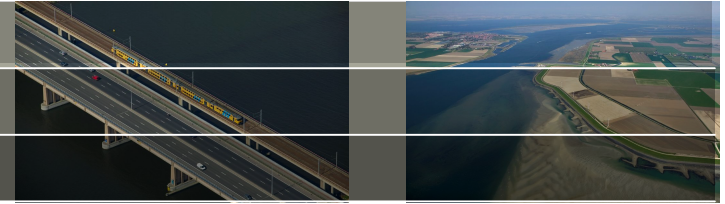
- [http:// openEarth.eu](http://openEarth.eu)

# How does OpenEarth do that: WORKFLOW





# OpenEarth infrastructure



① [repos.deltares.nl](http://repos.deltares.nl)

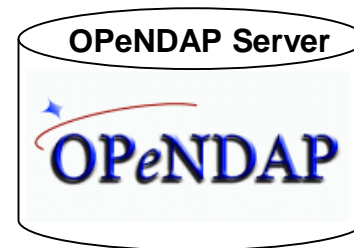


**tools**



**raw data**

② [opendap.deltares.nl](http://opendap.deltares.nl)



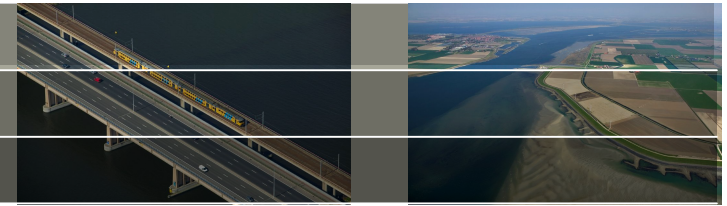
**netCDF data**

③ [kml.deltares.nl](http://kml.deltares.nl) (soon)



**Google Earth data**

# OpenEarth infrastructure



Web service for images (OGC)

- Visualizations of geo-data: 3D
- Interface to other visualizations
- Interface to data on OPeNDAP server

① [repos.deltares.nl](https://repos.deltares.nl)

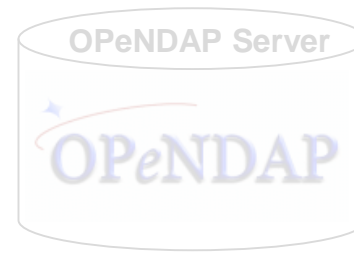


tools



raw data

② [opendap.deltares.nl](https://opendap.deltares.nl)



netCDF data

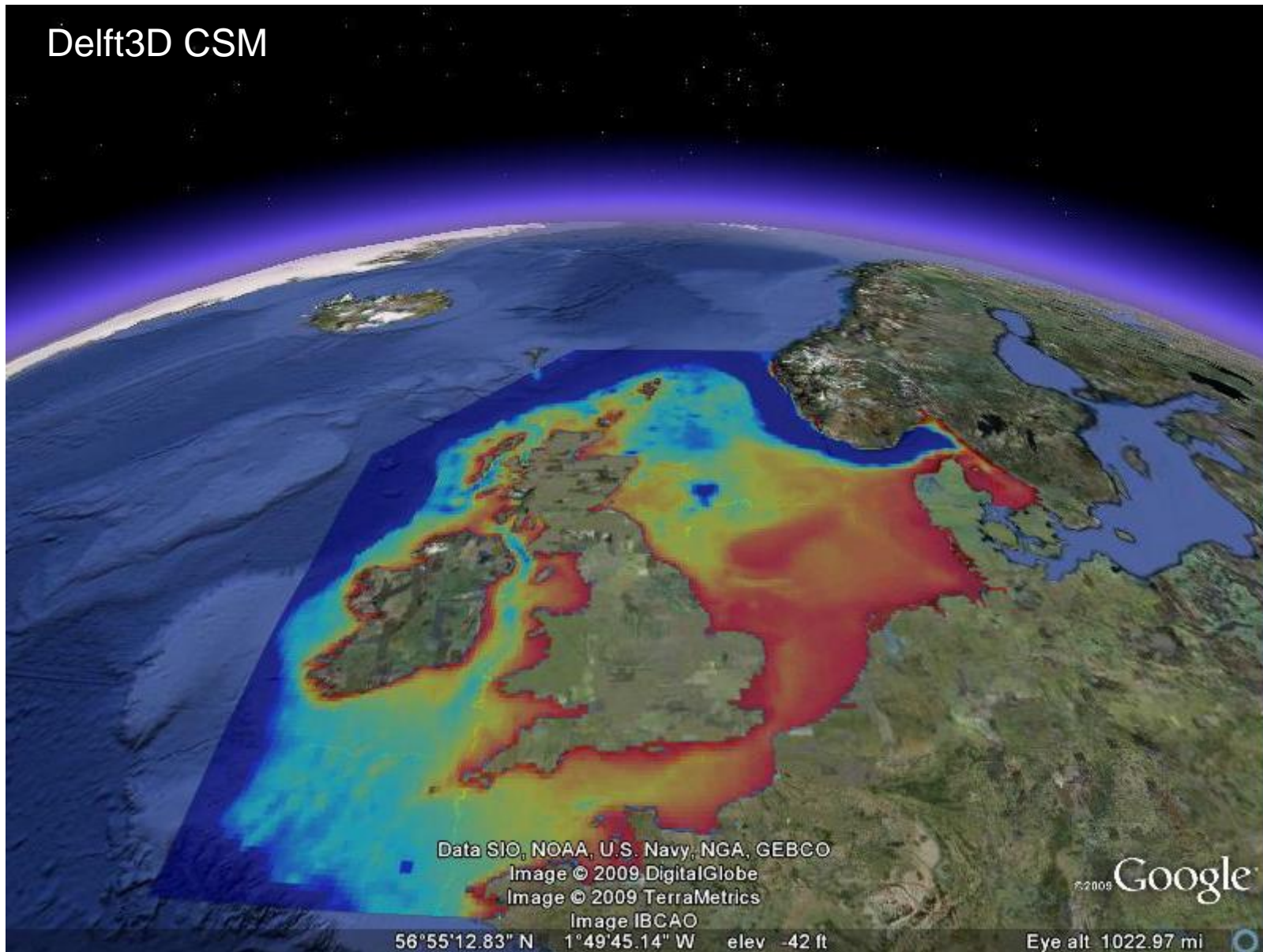
③ [kml.deltares.nl](https://kml.deltares.nl) (soon)



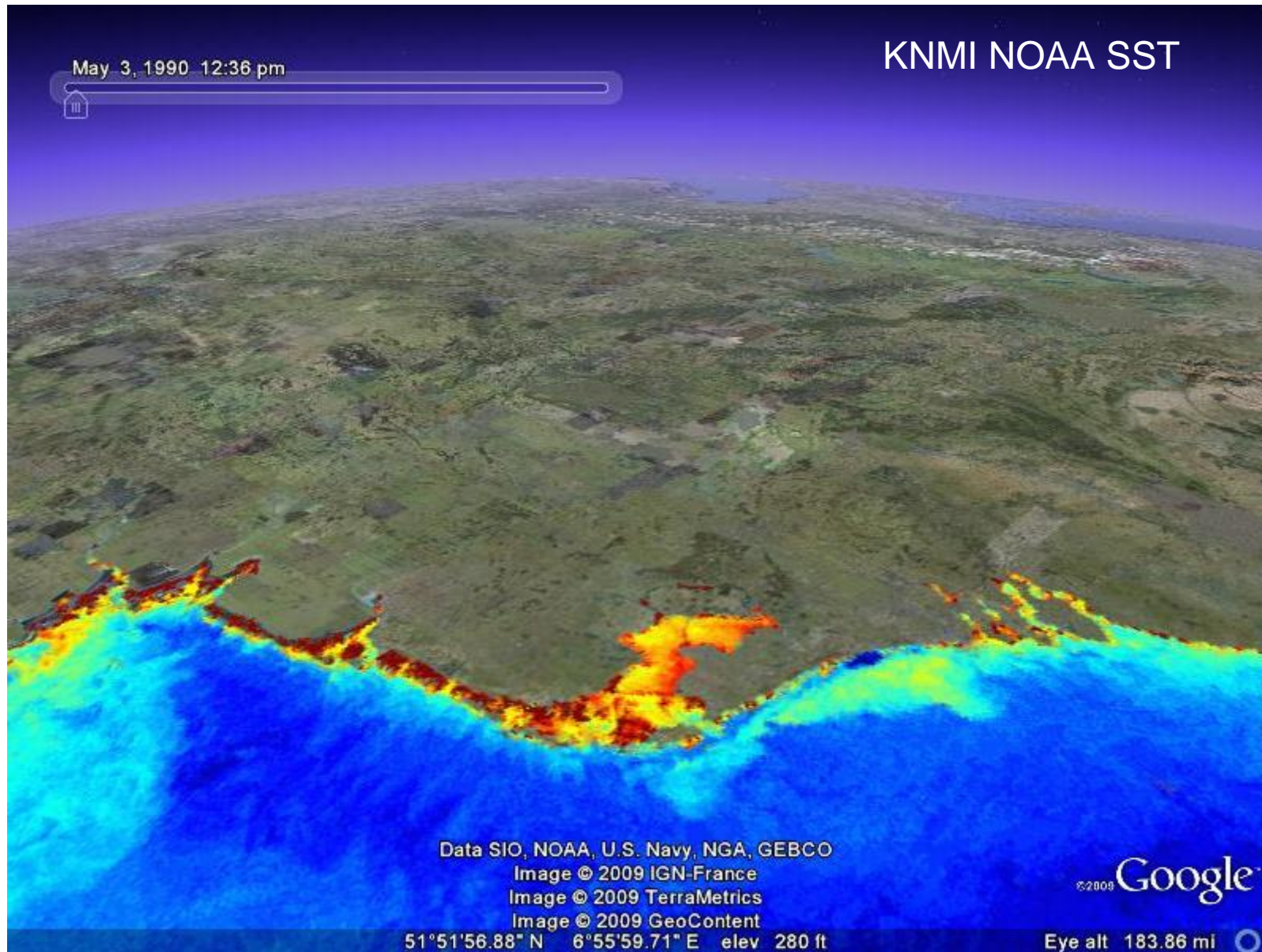
Google Earth

# netCDF enables Google Earth visualizations

Delft3D CSM

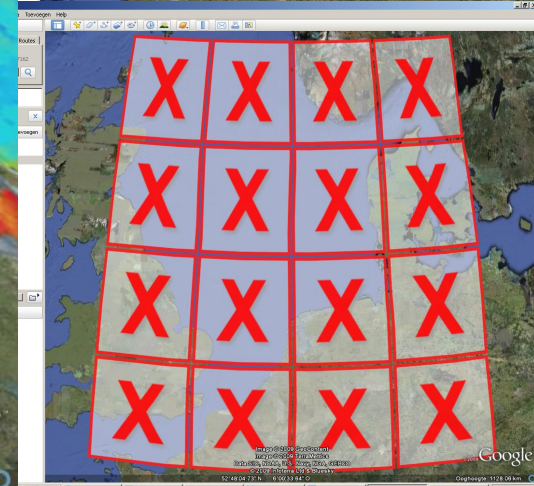
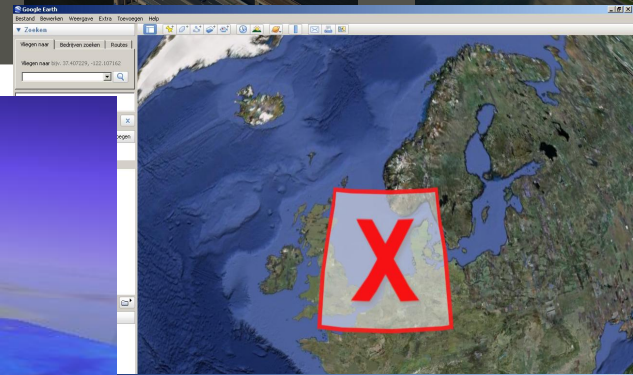
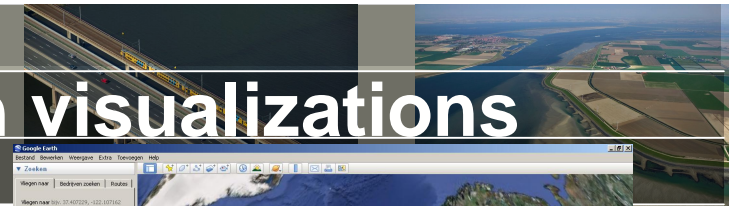
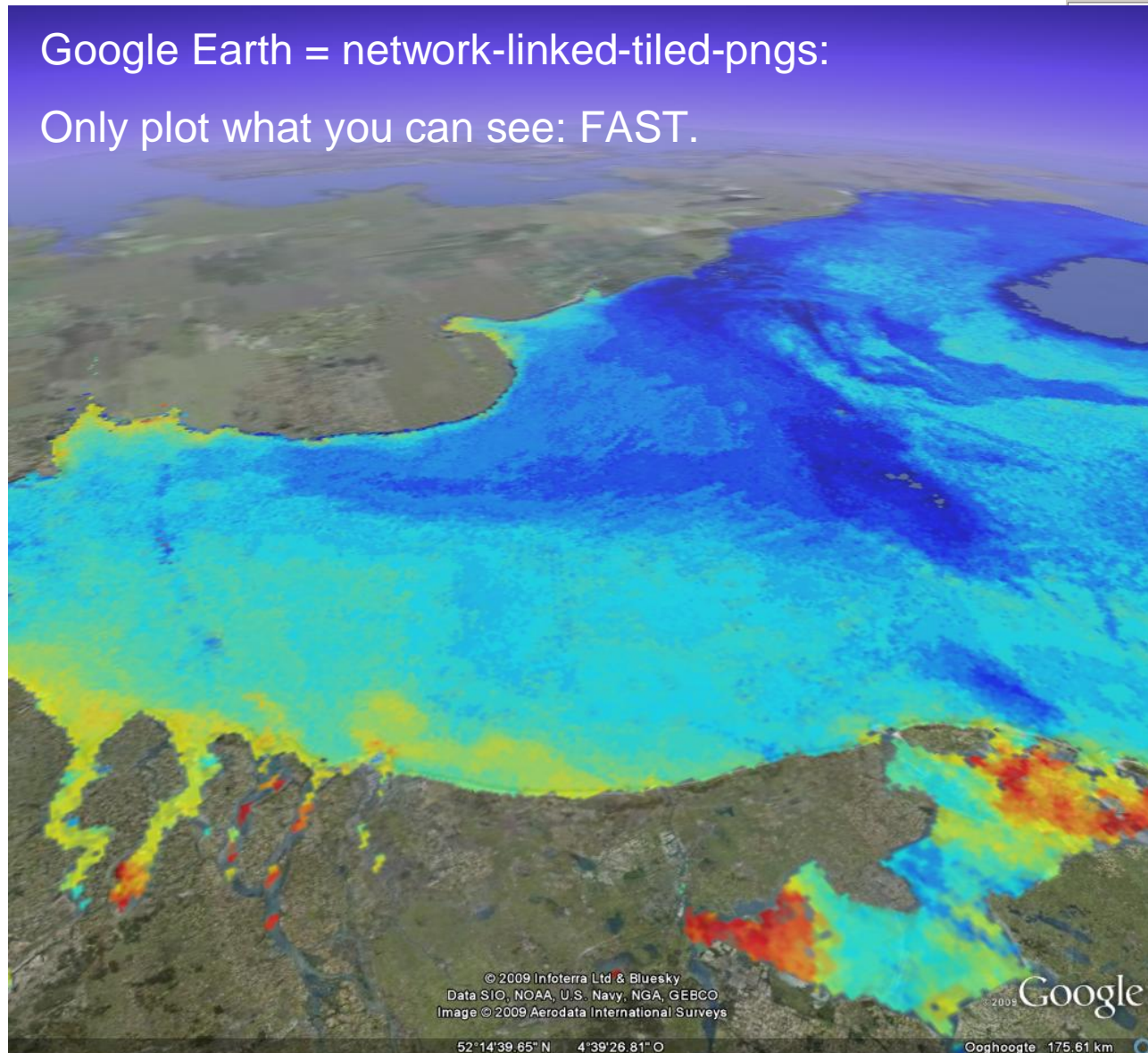


# netCDF enables Google Earth visualizations



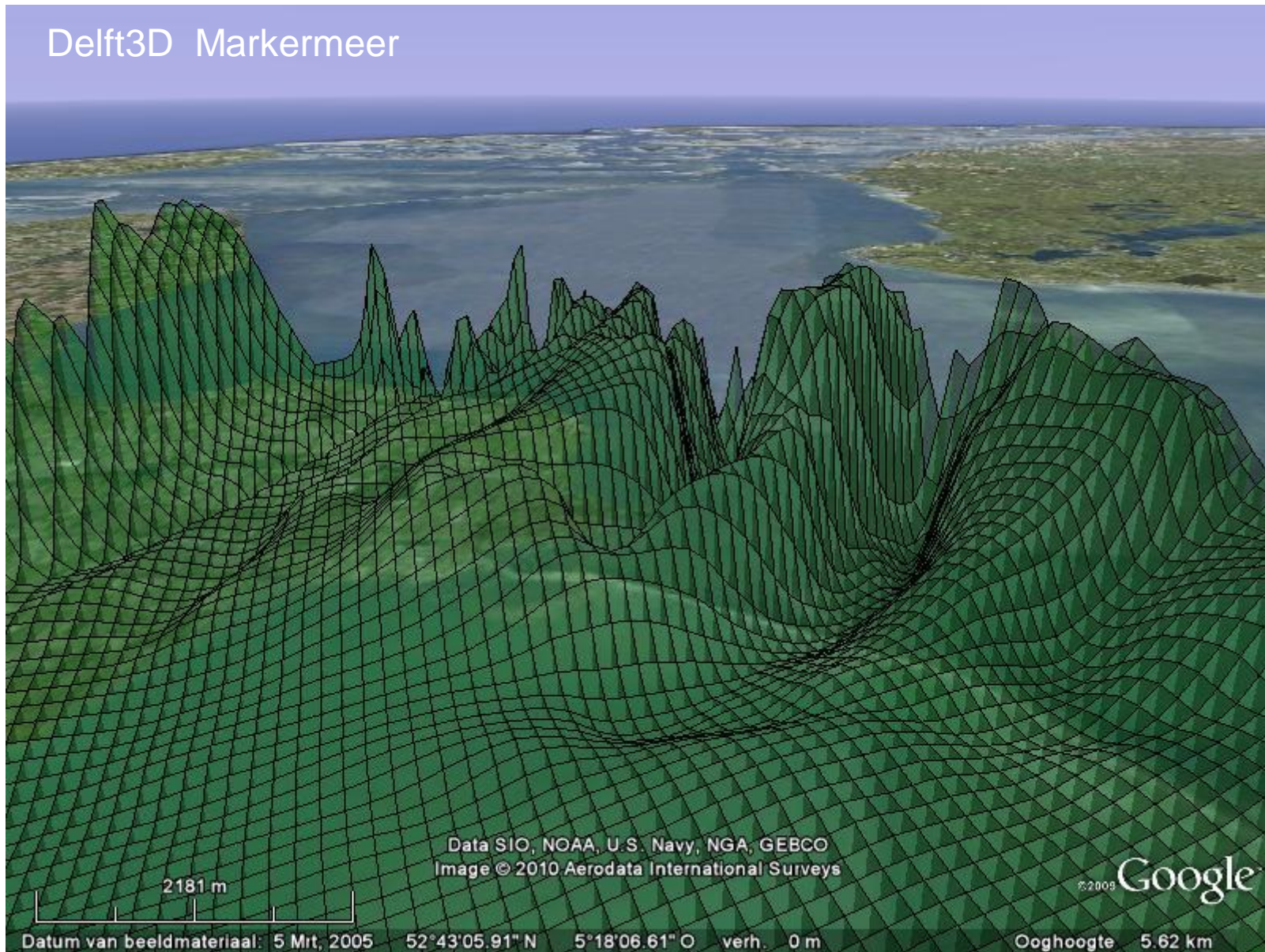
# netCDF enables Google Earth visualizations

Google Earth = network-linked-tiled-pngs:  
Only plot what you can see: FAST.

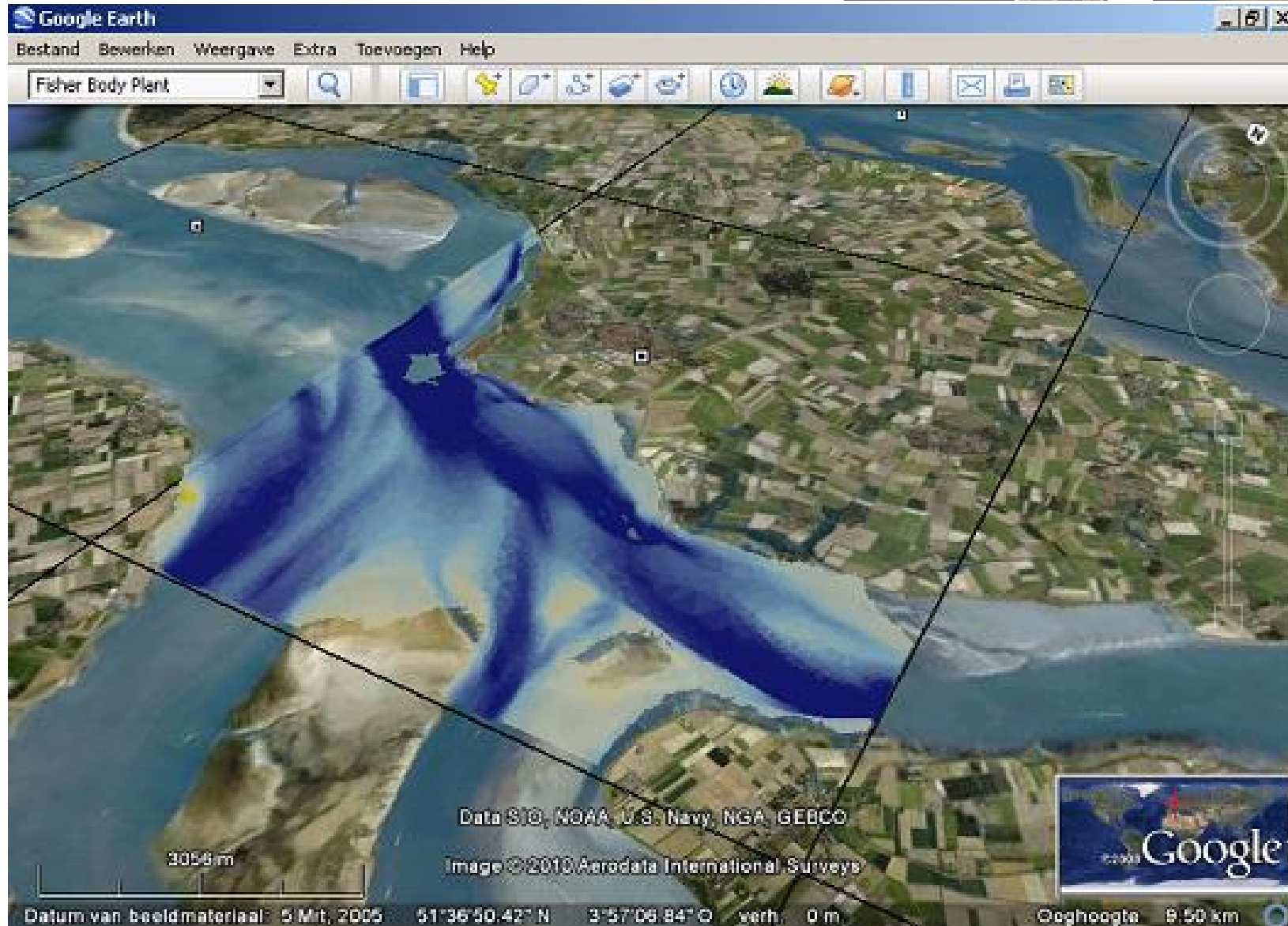


# netCDF enables Google Earth visualizations

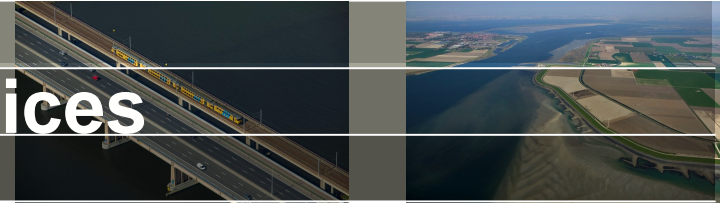
Delft3D Markermeer



# Google Earth can deeplink to other visualizations



# KML and other OGC web services

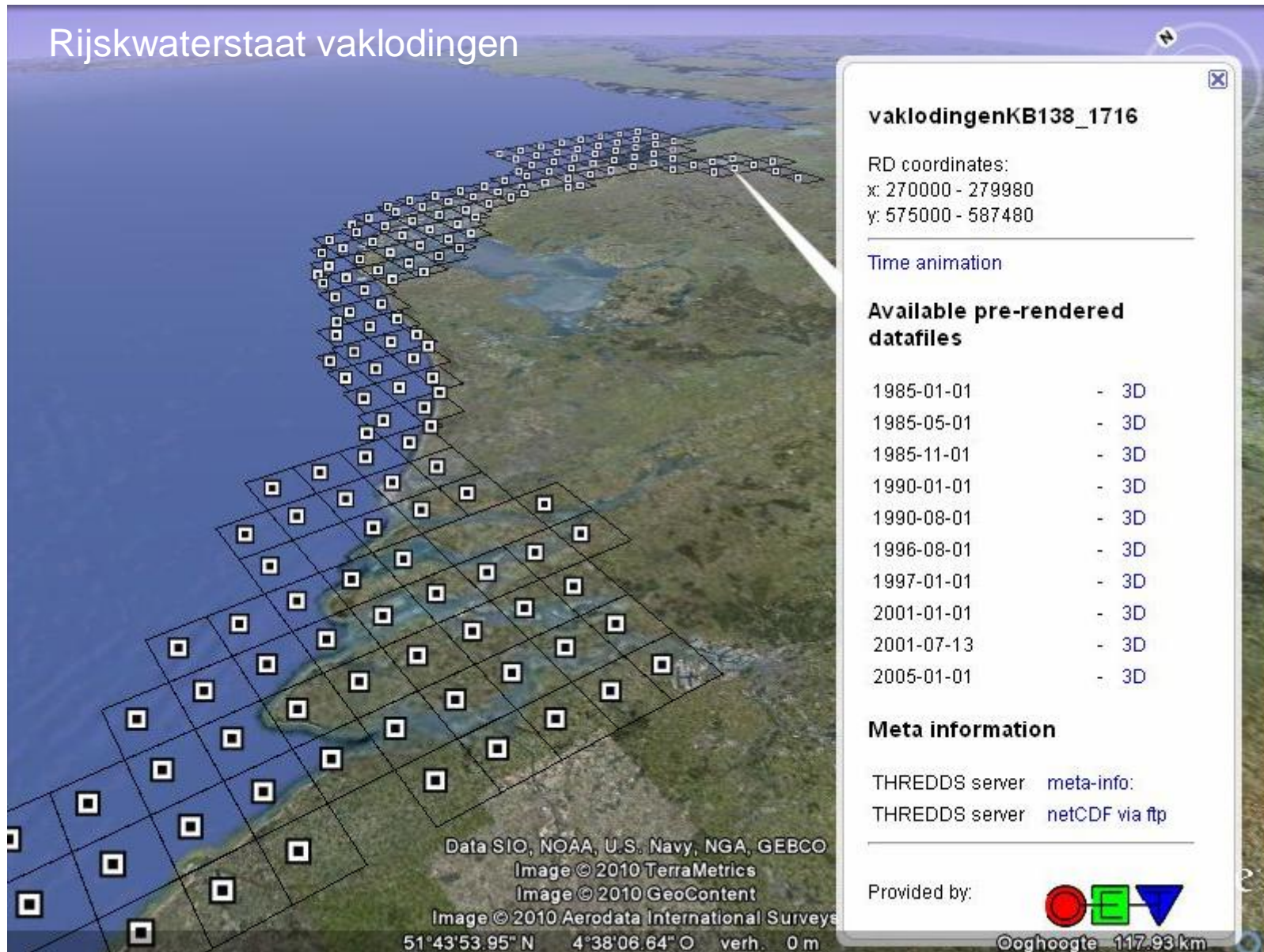


- OGC WxS: upcoming standard for web services for visualizations
  - WMS: grid images
  - WFS: polygons (shapefiles)
  - WCS: grid matrices
    - > no free viewer yet, so we just wait
    - > no simple server yet, so we just wait
    - > limited creativity: experts needed to set-up portal
    - > 2D (why is it that GIS people keep denying Galileo ...)
- OGC KML (Keyhole Markup Language, bought by Google)
  - > free viewer already ... with all aerial pictures as bonus
  - > simple file server, hardly expert needed
  - > ample creativity: simple syntax & description pop-ups: html+
  - > 3D (Google Earth only deals a round world, in globally accepted wgs84 roundishness)



# Google Earth can deeplink to data

Rijkswaterstaat vaklodingen



**vaklodingenKB138\_1716**

RD coordinates:  
x: 270000 - 279980  
y: 575000 - 587480


Time animation

**Available pre-rendered datafiles**

1985-01-01	- 3D
1985-05-01	- 3D
1985-11-01	- 3D
1990-01-01	- 3D
1990-08-01	- 3D
1996-08-01	- 3D
1997-01-01	- 3D
2001-01-01	- 3D
2001-07-13	- 3D
2005-01-01	- 3D

**Meta information**

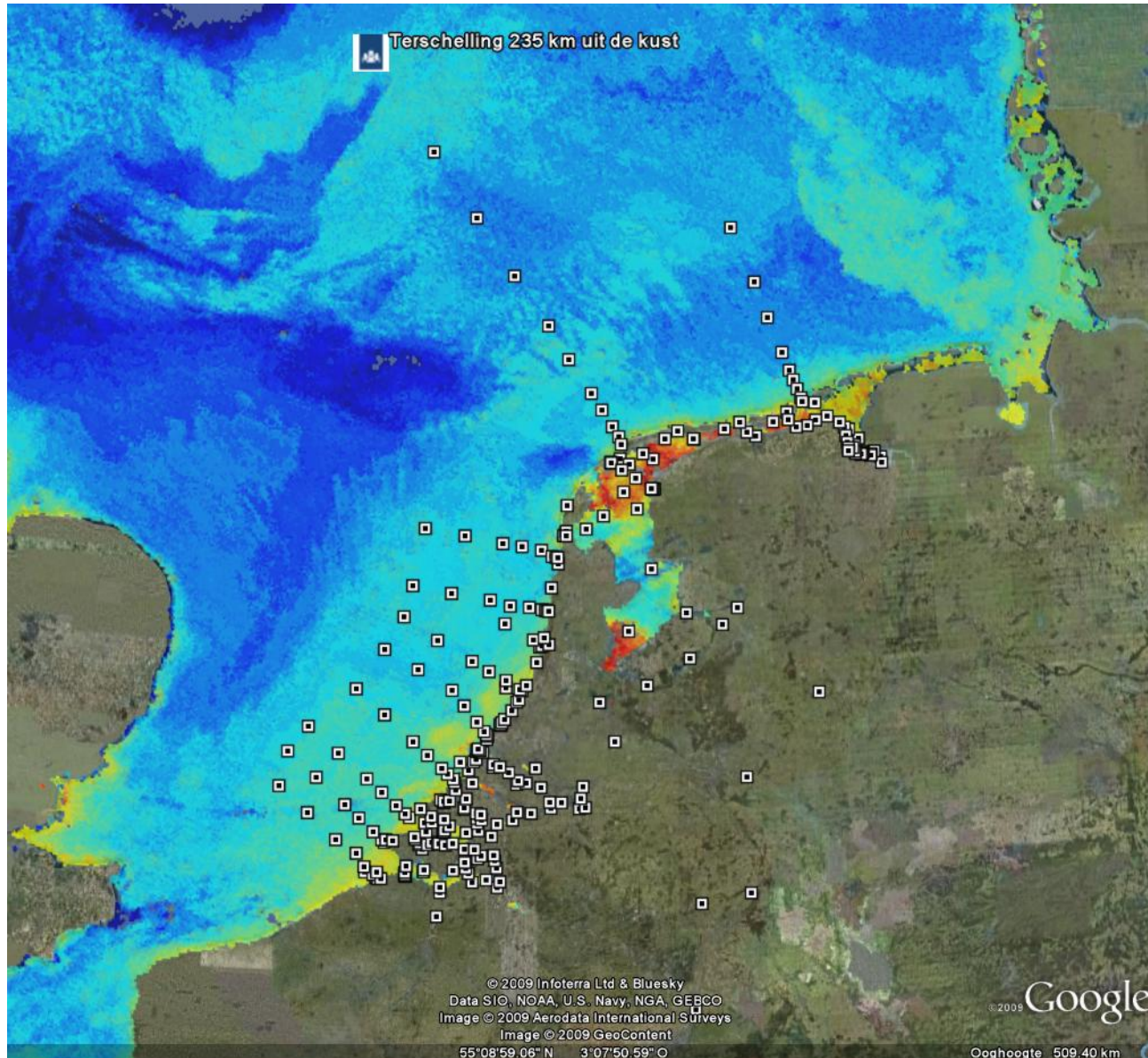
THREDDS server meta-info:  
THREDDS server netCDF via ftp

Provided by: 

©ooghoogte 117.93 km

Data SIO, NOAA, U.S. Navy, NGA, GEBCO  
Image © 2010 TerraMetrics  
Image © 2010 GeoContent  
Image © 2010 Aerodata International Surveys  
51°43'53.95" N 4°38'06.64" O verh. 0 m

# Google Earth can deeplink to visualizations & data

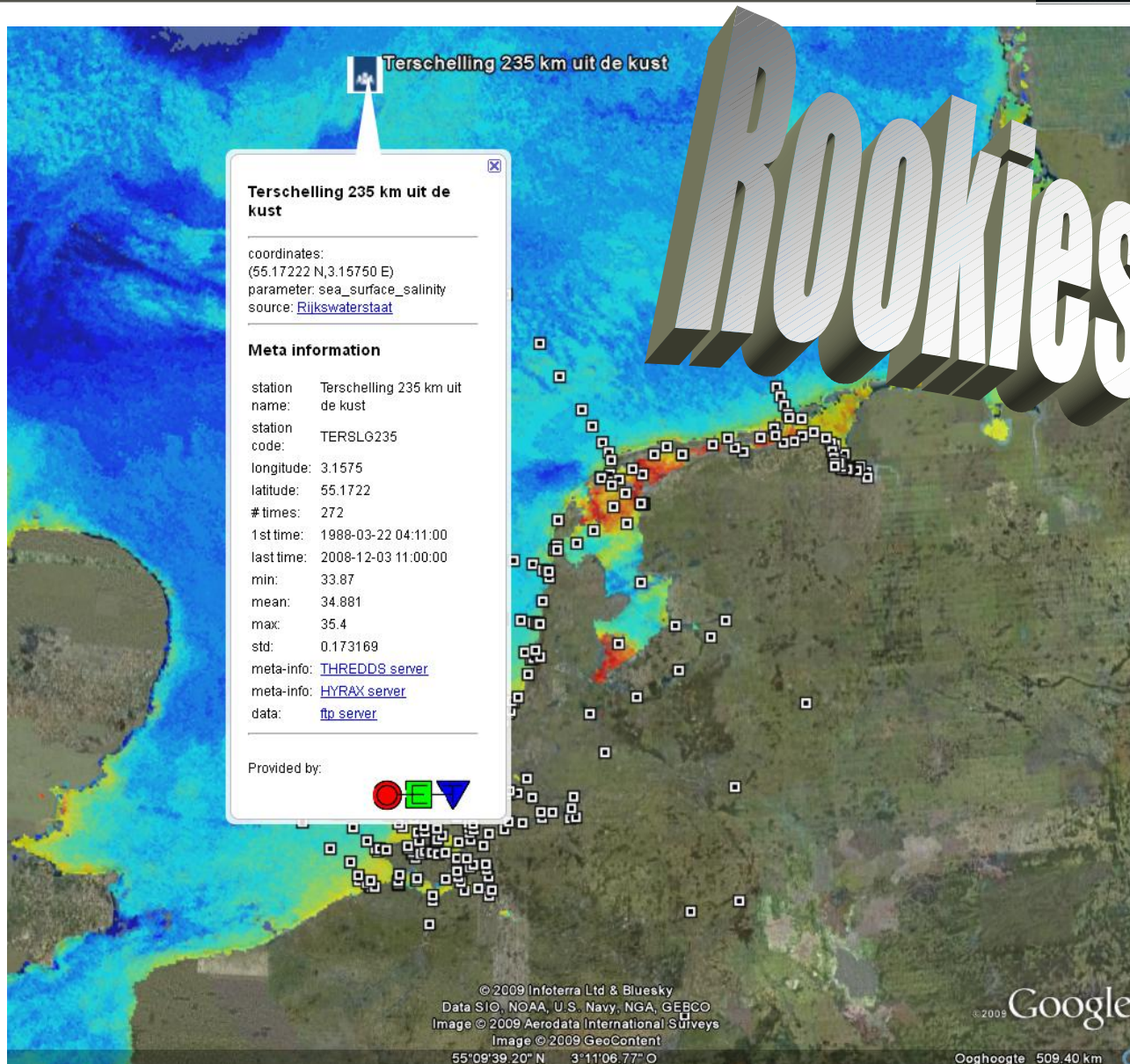


Instead of adapting viewers to data, adapt data to viewers.

World's best viewer is free, and has an open interface definition (kml) on how to put your own data in.

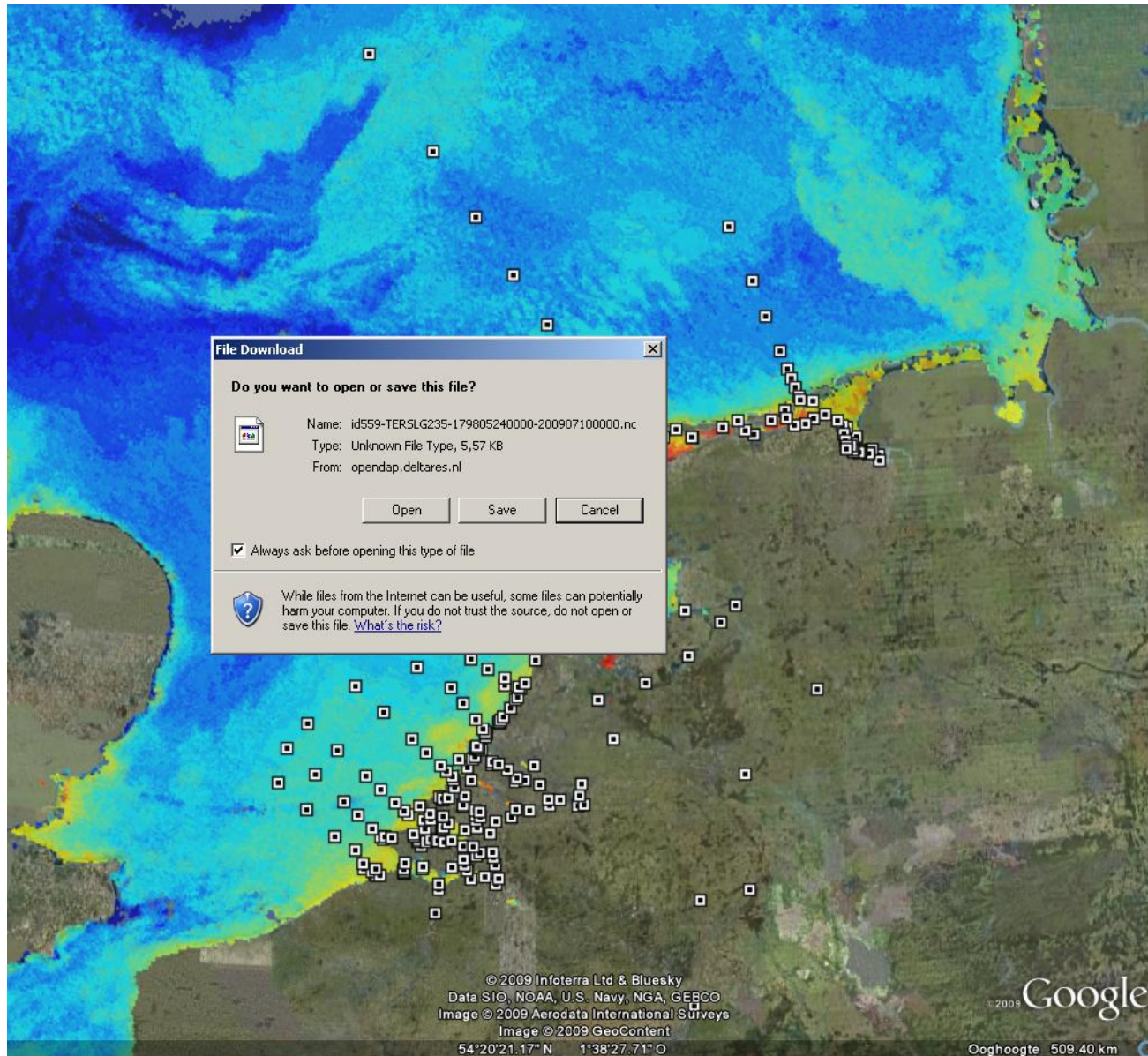
Put your effort in making dedicated kml files, instead of building ever more expensive viewers.

# Google Earth can deeplink to visualizations & data



Rookies can do this

# Google Earth can deeplink to visualizations & data



Google

The  
[Data URL](#)  
can be  
used  
in various  
clients

The screenshot shows a web browser window displaying a Google Map of the North Sea region. The map is overlaid with a color-coded salinity distribution, ranging from blue (low salinity) to red (high salinity). Numerous small white squares representing data points are scattered across the map. The browser's address bar shows the URL: `http://opendap.deltares.nl:8080/thredds/dodsC/opendap/rijkswaterstaat/waterbase/sea_surface_salinity/id559-TERSLG235-179805240000-200907100000.nc.html`. Below the map is the 'OPeNDAP Dataset Access Form'. The form includes an 'Action:' section with buttons for 'Get ASCII', 'Get Binary', and 'Show Help'. The 'Data URL:' field is circled in red, and a large red arrow points to it. The 'Global Attributes:' section displays metadata for the dataset, including title, institution, source, history, and version. The 'Variables:' section shows a checkbox for 'station\_id' and a text input field for 'locations'.

OPeNDAP Dataset Access Form

Tested on Netscape 4.61 and Internet Explorer 5.00.

**Action:** Get ASCII Get Binary Show Help

**Data URL:** `http://opendap.deltares.nl:8080/thredds/dodsC/opendap/rijkswaterstaat/w`

**Global Attributes:**

```
title: ""
institution: "Rijkswaterstaat"
source: "surface observation"
history: "Original filename: id559-TERSLG235-179805240000-200907100000, version:, filedate:11-jul-2009 13:11:02, tranformation"
```

**Variables:**  station\_id: Array of Strings [locations = 0..0]

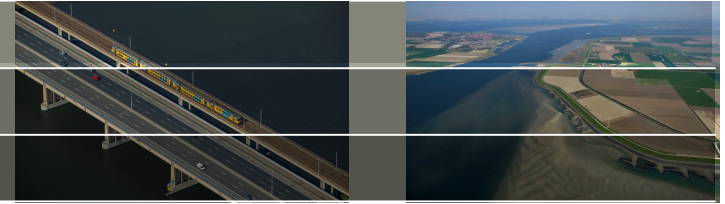
locations:

long\_name: "station identification code"

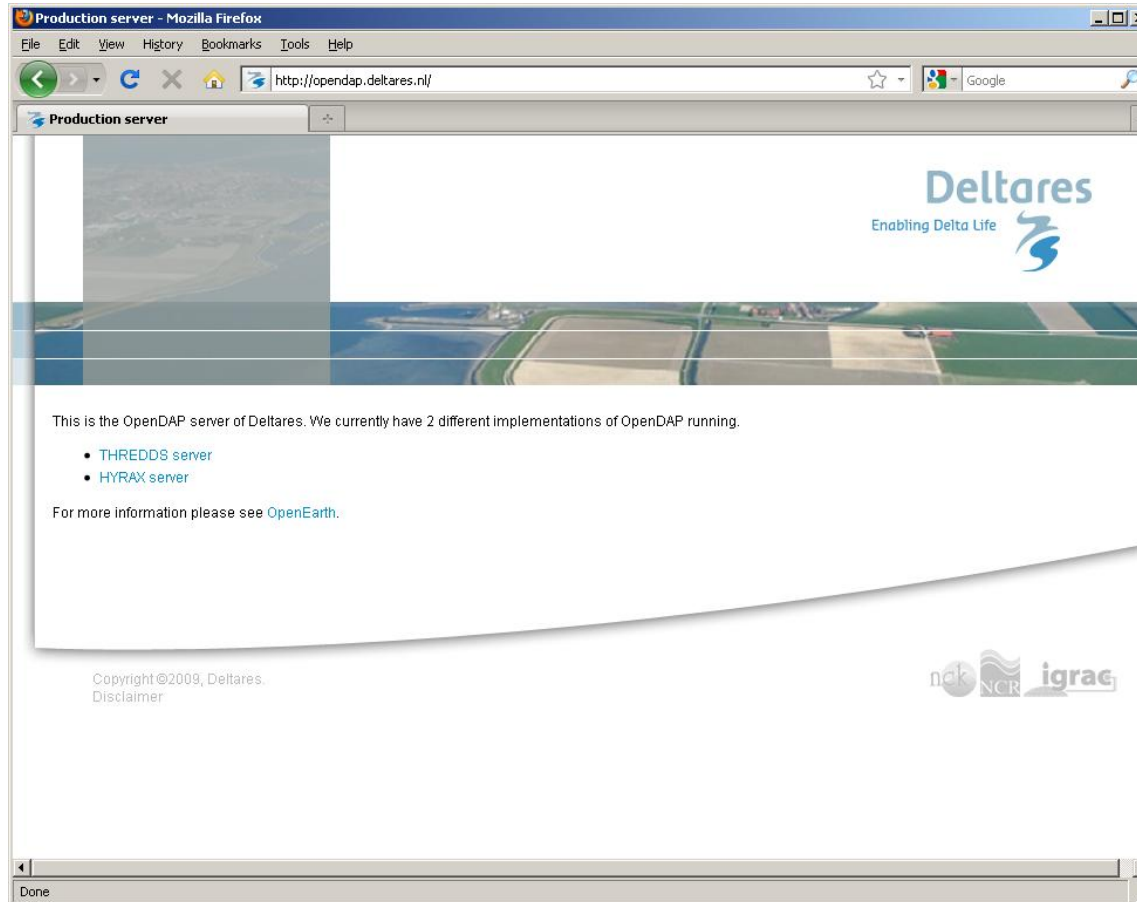
standard\_name: "station\_id"

OPeNDAP Dataset Query Form

# NCP example

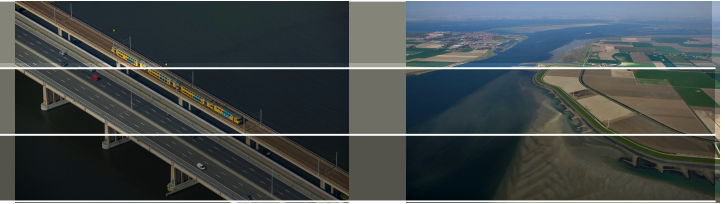


You can also obtain the this [Data URL](http://opendap.deltares.nl) by scrolling down an OPeNDAP server.



e.g. [opendap.deltares.nl](http://opendap.deltares.nl)

# NCP example



The OPeNDAP server hosts an underlying directory structure, just click.

The image shows a sequence of browser windows illustrating the directory structure of an OPeNDAP server. The windows are stacked, showing the path from the root catalog to the specific dataset file.

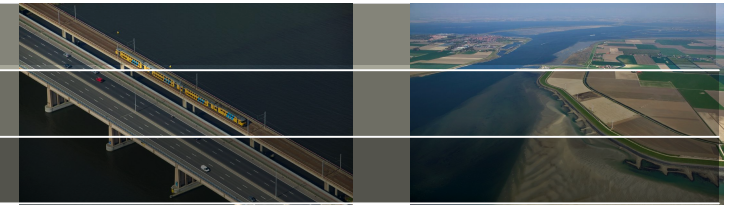
- Window 1:** `http://opendap.deltares.nl/thredds/catalog.html`. Shows a "Dataset" list with "OpenDAP/" circled in red.
- Window 2:** `http://opendap.deltares.nl/thredds/catalog/opendap/catalog.html`. Shows a "Dataset" list with "tno/" circled in red.
- Window 3:** `http://opendap.deltares.nl/thredds/catalog/opendap/tno/catalog.html`. Shows a "Dataset" list with "ncp/" circled in red.
- Window 4:** `http://opendap.deltares.nl/thredds/catalog/opendap/tno/ncp/catalog.html`. Shows a "Dataset" list with "dz50\_jul12007.nc" circled in red.

Red arrows indicate the navigation path from the root catalog to the specific dataset file.

Dataset	Size
ncp	
<a href="#">slib_jul12007.nc</a>	
<a href="#">dz10_jul12007.nc</a>	
<a href="#">dz90_jul12007.nc</a>	
<a href="#">grind_fbr2007.nc</a>	
<a href="#">dz50_jul12007.nc</a>	

Initial Installation at My Group  
THREDDS Data Server [Version 4.0.17 - 20090611.0429] [Documentation](#)

# NCP example: download



Once you hit an \*.nc file, you can either old-fashionedly fully download it, or ...

The screenshot shows a Mozilla Firefox browser window with the address bar containing `http://opendap.deltares.nl/thredds/catalog/opendap/tno/ncp/catalog.html?dataset=varopendap/tno/nc`. The page content includes:

- Initial Install
- Initial Installation
- THREDDS Data Server
- Catalog /thredds/catalog/opendap/tno/ncp/catalog.html
- Dataset: ncp/dz50\_juli2007.nc
  - Data type: GRID
  - ID: varopendap/tno/ncp/dz50\_juli2007.nc
- Access:
  - OPENDAP: /thredds/dodsC/opendap/tno/ncp/dz50\_juli2007.nc
  - Download: /thredds/fileServer/opendap/tno/ncp/dz50\_juli2007.nc
- Dates:
  - 2010-06-07 14:02:28Z (modified)
- Viewers:
  - Integrated Data Viewer (IDV) (webstart)
  - NetCDF-Java ToolsUI (webstart)

A dialog box titled "Opening dz50\_juli2007.nc" is overlaid on the page. It contains the following text and options:

You have chosen to open  
**dz50\_juli2007.nc**  
which is a: NC file  
from: http://opendap.deltares.nl

What should Firefox do with this file?

- Open with LaunchAnywhere (default)
- Save File
- Do this automatically for files like this from now on.

Buttons for "OK" and "Cancel" are at the bottom of the dialog. A red arrow in the browser window points from the "Download" link to the dialog box.



# NCP example

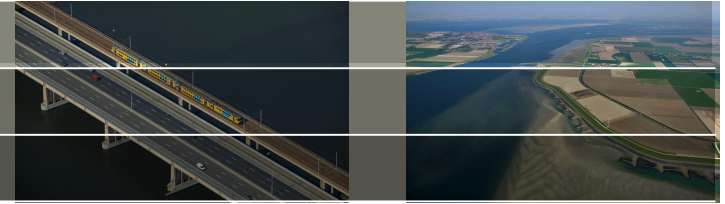
.. or you can query it's meta-info, or subset it, with the OPeNDAP protocol and...

The image shows two browser windows. The left window displays the THREDDS Data Server catalog page for the dataset 'ncp/dz50\_juli2007.nc'. The right window shows the OPeNDAP Dataset Access Form for the same dataset, which includes fields for Action, Data URL, Global Attributes, and Variables.

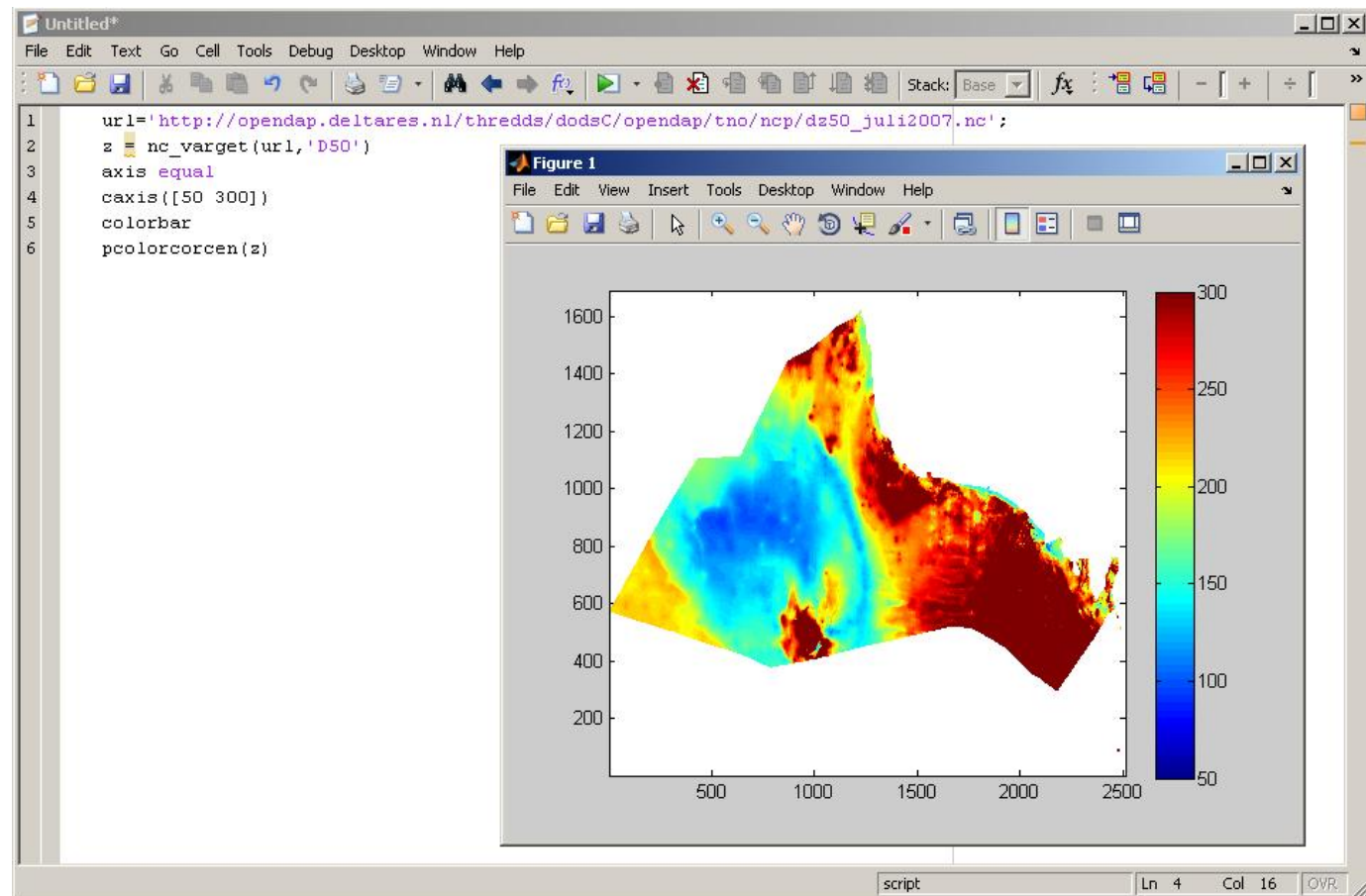
**Catalog Services - Mozilla Firefox**  
http://opendap.deltares.nl/thredds/catalog/opendap/tno/ncp/catalog.html?dataset=varopendap/tno/ncp  
Catalog Services  
Initial Install  
Initial Installation  
THREDDS Data Server  
Catalog /thredds/catalog/opendap/tno/ncp/  
Dataset: ncp/dz50\_juli2007.nc  
• Data type: GRID  
• ID: varopendap/tno/ncp/dz50\_juli2007.nc  
Access:  
1. **OPeNDAP:** /thredds/dodsC/opendap/tno/ncp/dz50\_juli2007.nc  
2. Download: /thredds/fileServer/opendap/tno/ncp/dz50\_juli2007.nc  
Dates:  
• 2010-06-07 14:02:28Z (modified)  
Viewers:  
• Integrated Data Viewer (IDV) (webstart)  
• NetCDF-Java ToolsUI (webstart)

**OPeNDAP Dataset Query Form - Mozilla Firefox**  
http://opendap.deltares.nl/thredds/dodsC/opendap/tno/ncp/dz50\_juli2007.nc.html  
OPeNDAP Dataset Access Form  
Tested on Netscape 4.61 and Internet Explorer 5.00.  
Action: Get ASCII Get Binary Show Help  
Data URL: http://opendap.deltares.nl/thredds/dodsC/opendap/tno/ncp/dz50\_juli2007.r  
Global Attributes:  
title: "sediment grain size D50 in upper seabed of Dutch continental shelf part of North Sea"  
institution: "TNO Bouw en Ondergrond"  
source: ""  
history: "\$HeadURL: https://repos.deltares.nl/repos/OpenEarthRawData/trunk/tno/ncp/scripts/ncp2nc.m \$"  
Variables:  
 x: Array of 32 bit Integers [x = 0..1689]  
x:  
long\_name: "x-coordinate in Cartesian system"  
units: "m"  
standard\_name: "projection\_x\_coordinate"  
actual\_range: 408000.0, 745800.0  
epsg: 23031.0  
 y: Array of 32 bit Integers [y = 0..2511]  
y:  
long\_name: "y-coordinate in Cartesian system"  
units: "m"  
standard\_name: "projection\_y\_coordinate"  
actual\_range: 5680000.0, 6182200.0

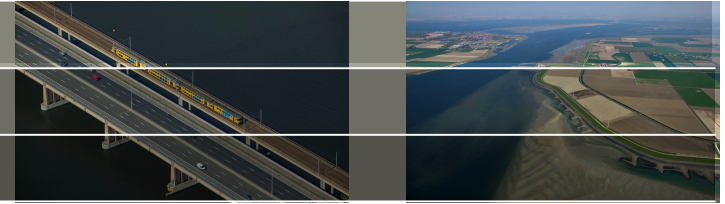
# NCP example



.. use the [Data URL](#) in OPeNDAP-enabled netCDF tools  
(recompilation is only change needed, software stays identical.).

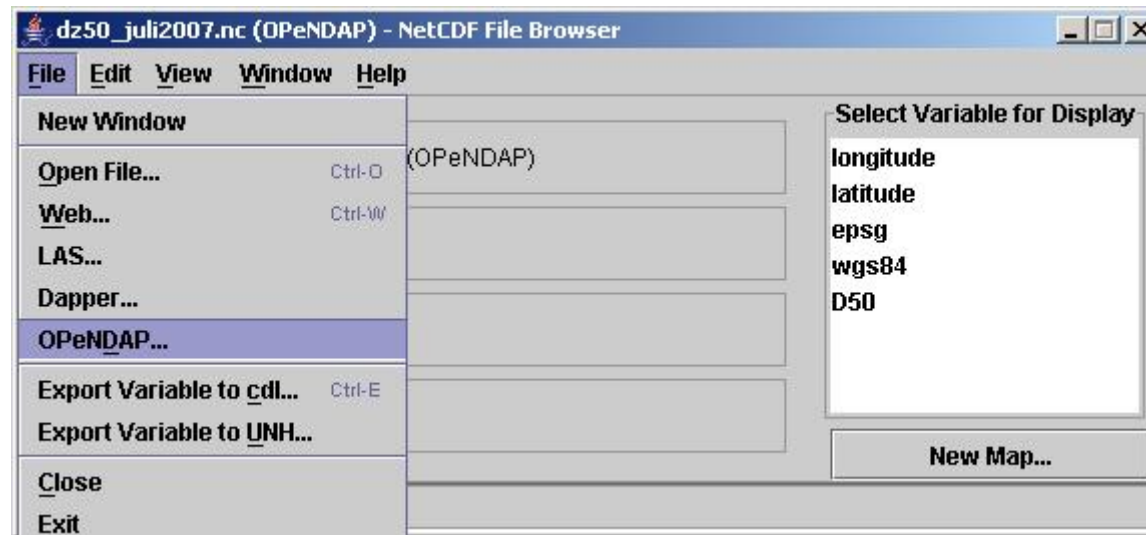


# NCP example

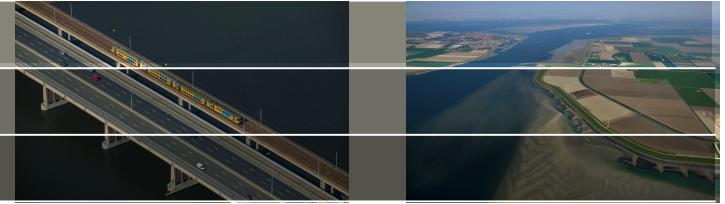


.. use the [Data URL](#) in OPeNDAP-enabled netCDF tools

(recompilation is only change needed, software stays identical.).



# NCP example



D50 from dz50\_juli2007.nc (Domain Selector)

```
float D50(x, y);
:long_name = "D50 sediment grain size diameter in upper seabed";
:units = "micrometer";
:_FillValue = NaN; // java.lang.Float
:actual_range = 92.96479797363281, 1798.989990234375; // java.lang.Double
:coordinates = "latitude longitude";
:grid_mapping = "epsg";
```

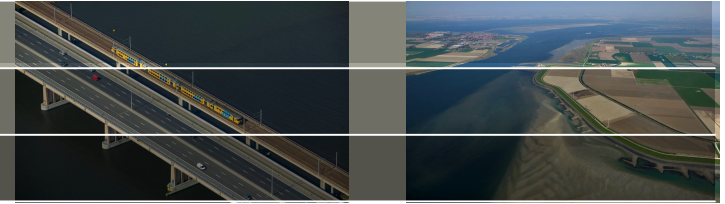
**Axes**

Name	Units	Dependent Variable		Reverse	Start	End
		x	y			
x	m	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	408000	745800
y	m	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	6182200	5680000

Graph Variable    Close

Alas, data is too biog in ncBrowse, better use Matlab, python, R, ...

# OpenEarth infrastructure



Web service for data (huge)

① [repos.deltares.nl](https://repos.deltares.nl)

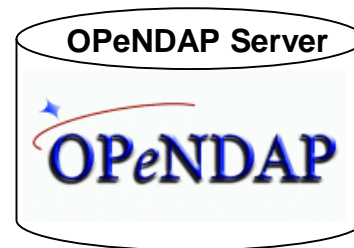


tools



raw data

② [opendap.deltares.nl](https://opendap.deltares.nl) ③ [kml.deltares.nl](https://kml.deltares.nl) (soon)



netCDF data

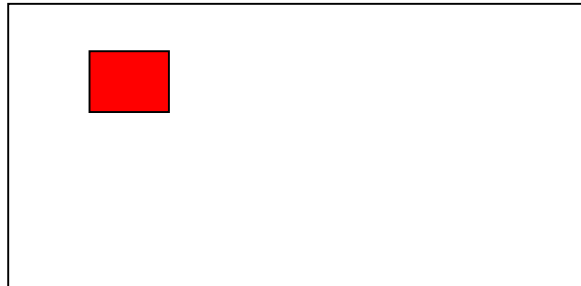


Google Earth

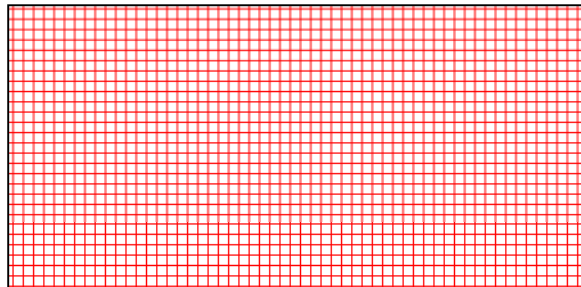
# Unprecedented: all data at your fingertips

- Google Earth
  - web with all the worlds **aerial images** on a just-what-you-need basis
- OPeNDAP
  - web with all the worlds **data** on a just-what-you-need basis

> sub-region



> sub-resolution

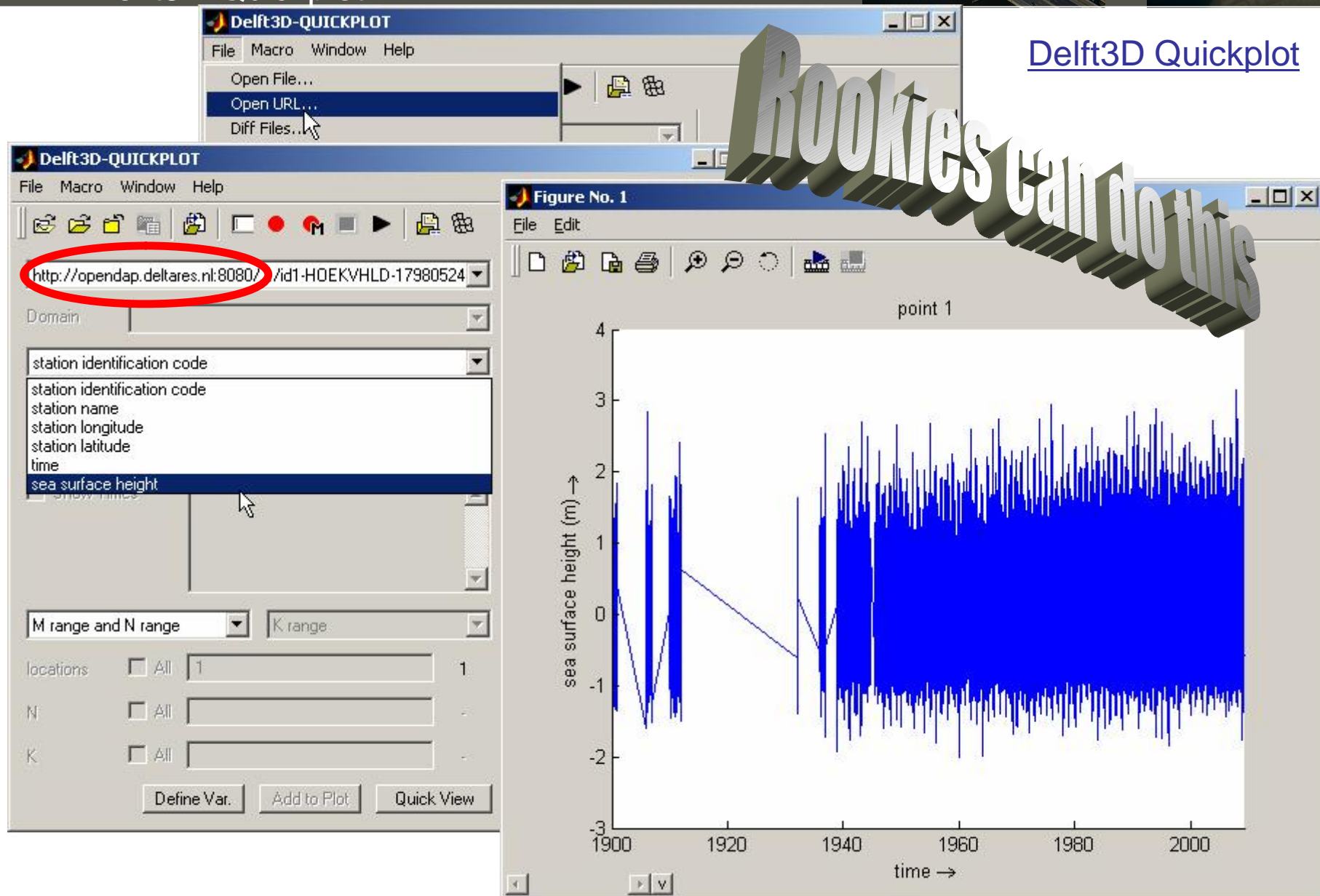


# Use of data directly from OPeNDAP server

## Delft3D-Quickplot

[Delft3D Quickplot](#)

**Rookies can do this**



# Use of data directly from OPeNDAP server

Matlab

The image shows a Matlab script in the editor window. The script is as follows:

```
1 oetsettings
2 %% load data
3 F = fopen('http://opendap.delta.knmi.nl:8080/thredds/dodsC/opendap/rijkswaterstaat/sedimentatlas_waddenzee/korrel.nc');
4 D.lon = nc_varget(F,'lon');
5 D.lat = nc_varget(F,'lat');
6 D.cumphi = nc_varget(F,'cumphi');
7 D.diameter = nc_varget(F,'diameter');
8 [D.x,D.y] = convertcoordinates(D.lon,D.lat,'CS1.code',4326,'CS2.code',28992); % wgs84 to RD
9 %% plot data
10 caxis ([0 100])
11 plotc (D.x,D.y,D.cumphi(:,10),'.')
12 colorbarwithtitle(['D < ',num2str(D.diameter(10)), ' \mu m [%]'])
13 tickmap ('xy')
14 axis equal
15 axis tight
16 %% plot in Google Earth
17 KMLscatter(D.lat ,D.lon ,D.cumphi(:,10),'fileName',['sedimentatlas_waddenzee.kml']);
```

The script is executed, and the results are shown in two windows:

- Google Earth:** A 3D map of the Wadden Sea area with a color-coded overlay representing the percentage of sediment particles smaller than 177 micrometers. The color scale ranges from 0% (blue) to 100% (red).
- Figure 1:** A 2D scatter plot of the same data. The x-axis represents longitude (100 to 250) and the y-axis represents cumulative phi (550 to 630). The plot shows a dense distribution of points colored according to the percentage of sediment particles smaller than 177 micrometers. A color bar on the right indicates the scale from 0 to 100%.

The status bar at the bottom of the Matlab window shows the current position: "Datum van beeldmateriaal: 5 Mrt, 2005 53°11'52.48" N 5°48'49.81" O verh. 0 m Ooghoogte 173". The bottom right corner of the window shows "script Ln 5 Col 23 OVR".



# Use of data directly from OPeNDAP server

ncBrowse

The image displays a NetCDF File Browser interface. The main window shows the file 'N19900503T123600\_SST.nc (OPeNDAP)' with attributes: 24. The 'Select Variable for Display' list includes 'polar\_stereographic', 'longitude\_cen', 'latitude\_cen', and 'SST'. An 'OPeNDAP Connection Dialog' is open, showing the 'Data File URL' as 'http://opendap.deltares.nl:8080/hredds/dodsC/opendap/knmi/NOAA/mom/1990\_'. A red circle highlights the URL. Below the dialog, a 3D-style text graphic reads 'Rookies can do this'. The main window also displays a 'Graphic Display from N19900503T123600\_SST.nc' showing a sea surface temperature map of the North Atlantic. The map is titled 'N19900503T123600\_SST.nc sea surface temperature' and shows a color-coded temperature distribution. The x-axis is labeled 'x\_cen (km)' and ranges from 0 to 800. The y-axis is labeled 'y\_cen (km)' and ranges from 0 to 600. A color scale at the bottom indicates temperatures from 8.0 to 16.0, with a legend for 'SST [time=1990-05-03 12:36:00 GMT, y\_cen=\*, x\_cen=\*]'.

[ncBrowse](http://www.epic.noaa.gov/java/ncBrowse/) is free:

[www.epic.noaa.gov/java/ncBrowse/](http://www.epic.noaa.gov/java/ncBrowse/)



# Use of data directly from OPeNDAP server


EDC for arcGIS 9.2+

EDC - Mozilla Firefox


File Edit View History Bookmarks Tools Help

http://www.pfeg.noaa.gov/products/EDC/

EDC



**EDC** Environmental Data Connector  
an extension for connecting ArcGIS to Thredds/OPeNDAP



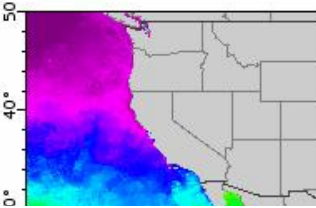
Created by [Applied Science Associates, Inc](#) under contract to NOAA using funds from the NOAA satellite R&O (research & operations) project

**NEW!** EDC is now compatible with ArcGIS 9.3

[EDC Registration Form](#)

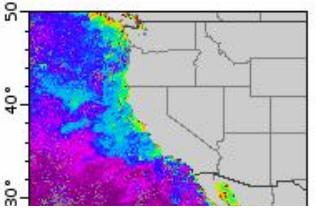
It is not necessary to register in order to download and use the EDC. However registering and documenting users will help secure funds for future enhancements and if there are improvements made to the EDC, we will notify those who have registered.

The latest SST, Blended (Experimental) (8 Day Composite) from ERDDAP  
[larger](#) [largest](#) [edit image/download data](#)



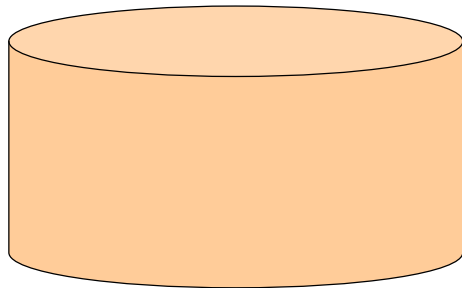
Download EDC [ArcGIS 9.2 and 9.3]  
Updated 01/09/09

Chlorophyll-a, Aqua MODIS, NPP (8 Day Composite) from ERDDAP  
[larger](#) [largest](#) [edit image/download data](#)

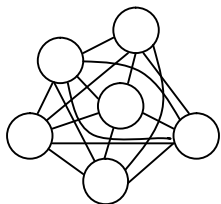


# OPeNDAP vs RDBMS: no fight, use both

- Relational Database  
RDBMS / SQL

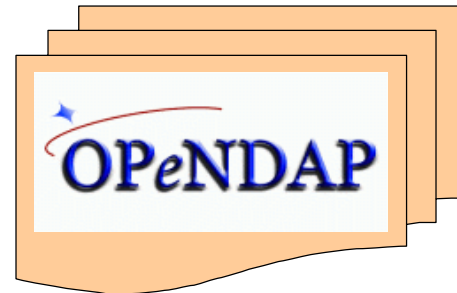


- lots of relations
- not web-based
- central filling
- central access point

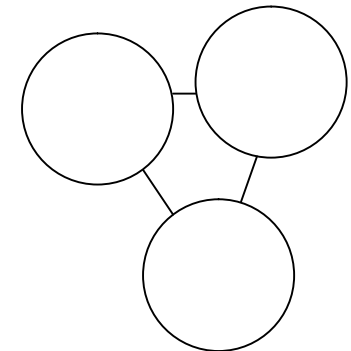


?

- OPeNDAP  
netCDF collection



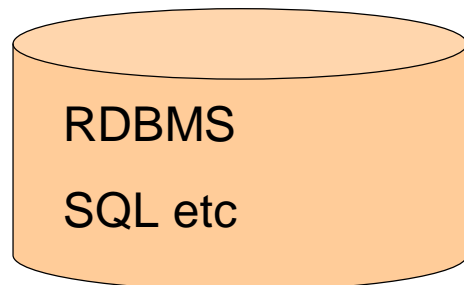
- few relations
- web-based
- decentralized filling
- distributed access



# OPeNDAP vs RDBMS: RDBMS is basis

Many (e.g. FEWS, MATROOS) use RDBMS as central database

- Clean-up strategy keeps RDBMS limited in size
- Increasing demand for keeping full archive for calibration/validation
- Limitations of RDBMS with huge data sizes (grids) (TBs)
- Performance conflicts with completeness

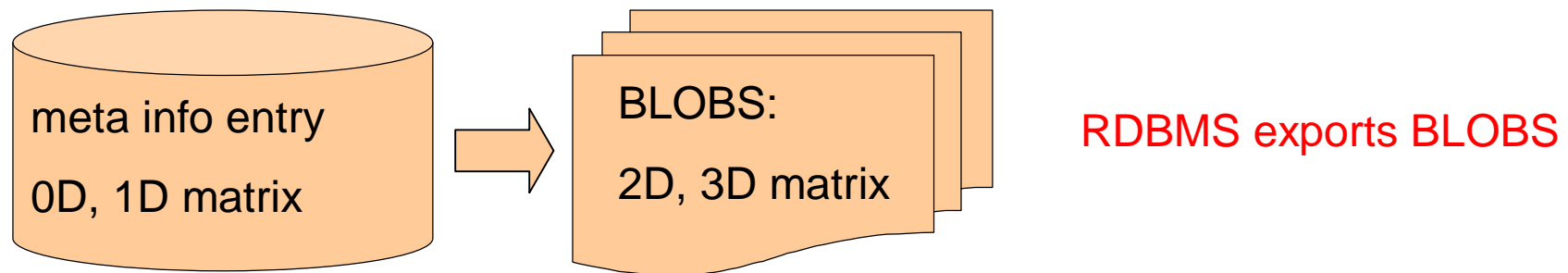


**RDBMS contains BLOBS**

# OPeNDAP vs RDBMS: export BLOBS

Hybrid solution: archive large data:

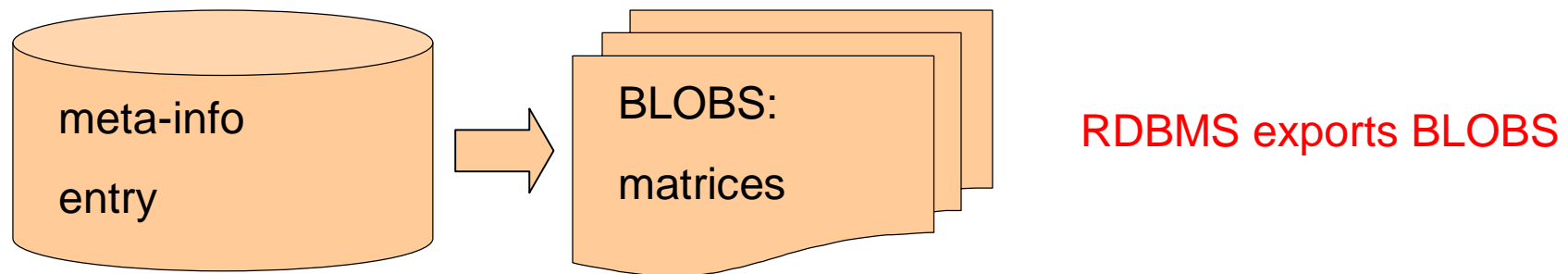
- export BLOBS from RDBMS to file server
- BLOB = Binary Large Object, e.g. 2D or 3D matrix
- keep entry in RDBMS for fast query
- BLOB server for all separate BLOBS
- light-weight RDBMS remains
- Basic architecture of RWS-MATROOS
- Possibilities explored for FEWS (talked with NOAA-NWS)



# OPeNDAP vs RDBMS: export BLOBS

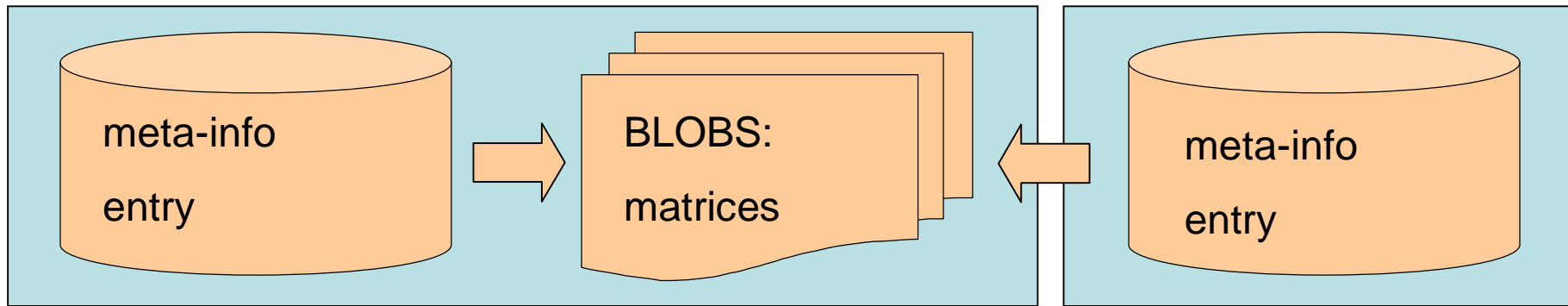
OPeNDAP BLOB server: difference with e.g. ftp BLOB server

- standardized BLOBS: netCDF (NASA standard)
- aggregate BLOBS to one virtual big BLOB (slices > sausage)
  - make from 2D (x,y) grid time series a 3D (x,y,t) grid
- subset BLOBS and only requests what you need
  - a la Google Earth: only get what you need (FEWS in Africa...)
  - a slice or stick from a 3D model grid
  - a patch from a big 2D grid (NL from European weather model)

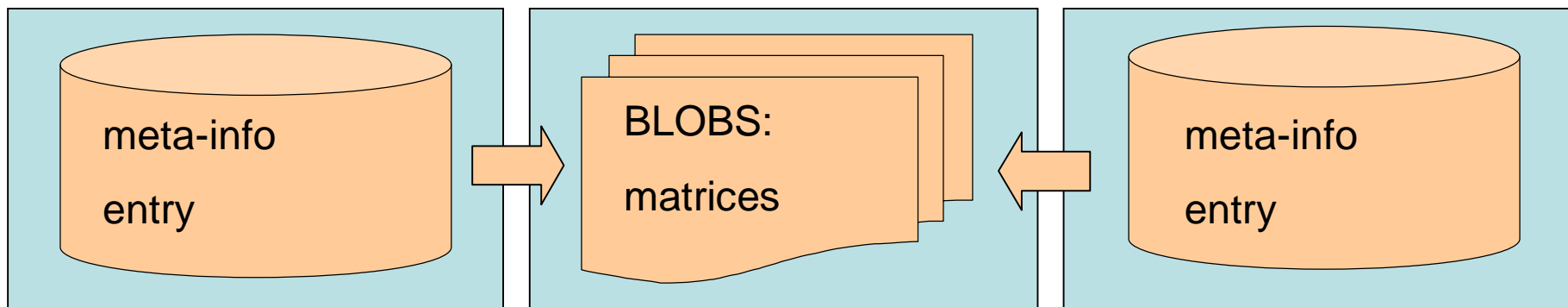


# OPeNDAP vs RDBMS: fast vs. complete

a light-weight installation co-using another ones BLOB archive server.



a central BLOB archive server hosted for for multiple light-weight installations

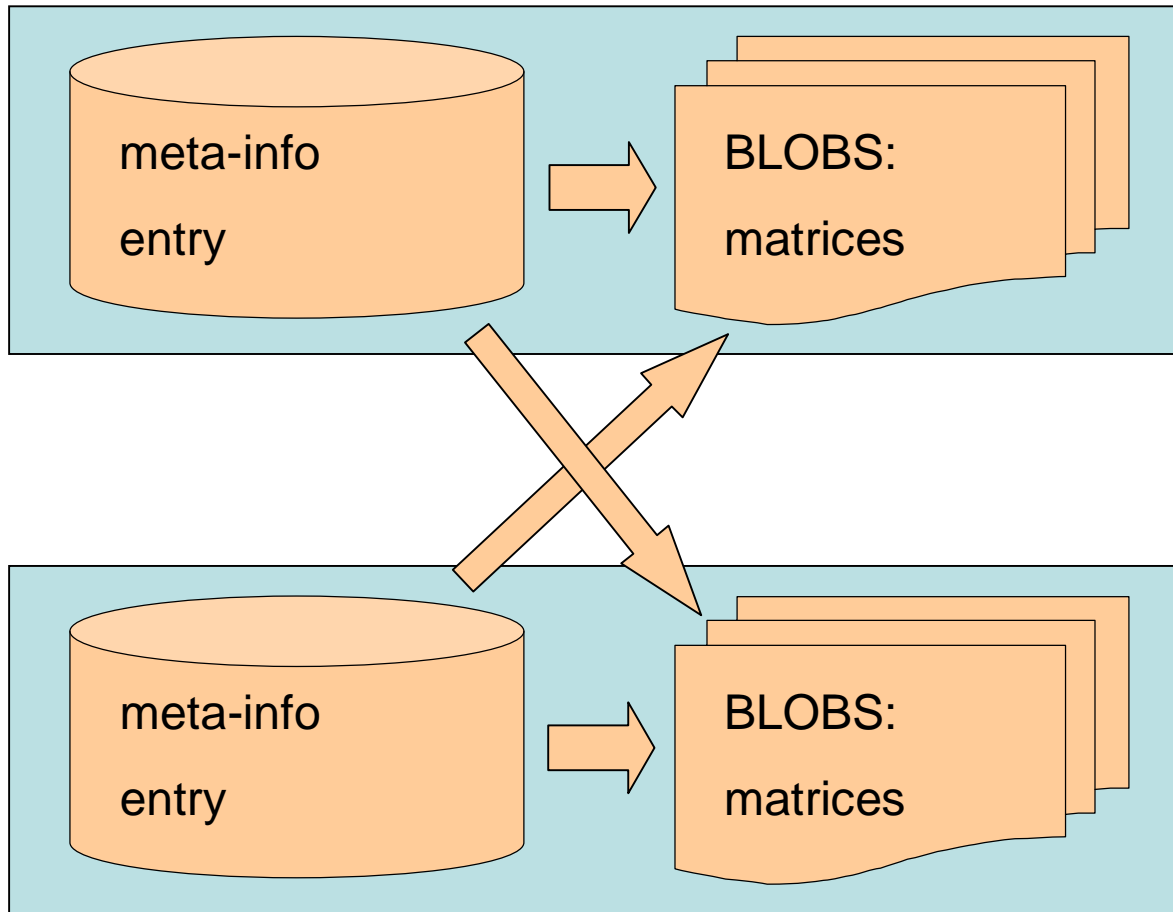




# OPeNDAP vs RDBMS: fast vs. complete

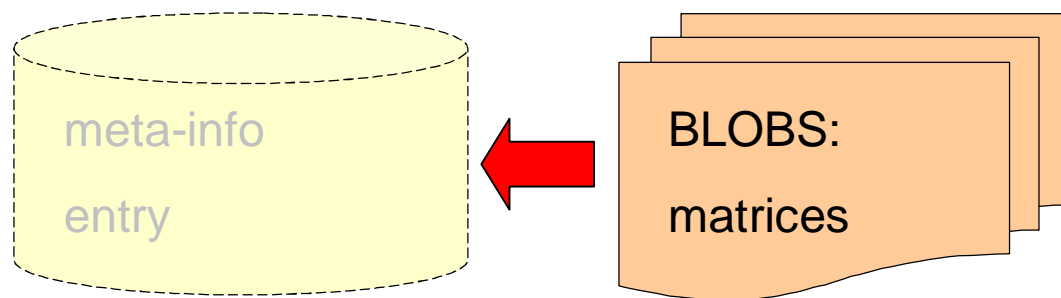


mirror use of heavy BLOB archive servers (> 10 TB): redundancy



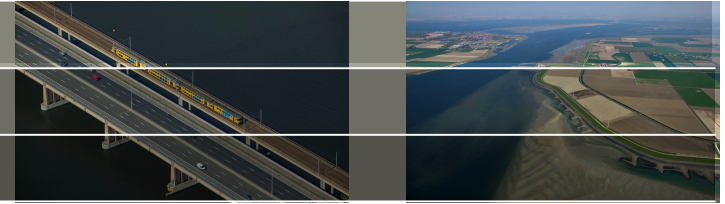
# OPeNDAP vs RDBMS: index BLOBS into SQL

- RDBMS: difficult when data is very pluriform as in:
- [www.OpenEarth.nl](http://www.OpenEarth.nl)
  - RWS historische tijdseries waterbase
  - KNMI historische tijdseries wind en meteo
  - RWS historische grids lodingen
  - KNMI historische satelliet beelden
  - AHN100
  - TNO NCP data
  - ...



RDBMS imports meta-info:  
cache results of  
harvesting scripts into  
RDBMS

# OpenEarth infrastructure



1. Web service for tools, raw data and model schematizations:
  - provides paramount QA/QC for:
  - write access for everyone with moderators
2. webservice for data: netCDF
  - editorial board only
3. webservice for graphics: Google Earth
  - editorial board only

① [repos.deltares.nl](https://repos.deltares.nl)

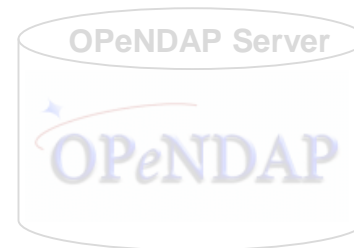


**tools**



**raw data**

② [opendap.deltares.nl](https://opendap.deltares.nl) ③ [kml.deltares.nl](https://kml.deltares.nl) (soon)



**netCDF data**



**Google Earth**

# Every peanut butter jar has: date + factory batch no.



food-info.net

- date x
- batch no. x
- ingredients x
- calories x
- e gram x

```
KB125_1918_20030416.asc - Notepad
File Edit Format View Help
ncols 500 nrows 625 xllcorner 140000 byllcc
-271 -265 -255 -249 -249 -235 -22
18 -112 -108 -104 -100 0 -99 -97
-294 -285 -271 -251 -231 -202 -
-321 -286 -268 -257 -249 -227 0 -2
07 -106 0 -106 -106 -106 -104 -103
4 -70 -76 -82 -88 -95 -102
-227 -226 -224 0 -111 -113 -115 -
-203 -199 -196 -190 -184 -180 -17
79 -76 -73 -74 -72 0 -70 -69
-224 -223 -213 -207 -199 -194 -
-158 -160 -161 -153 -150 -151 0 -1
02 -99 0 -101 -101 -102 -101 -100
```

- date x
- svn no. x
- parameters x
- coordinates x
- dimensions ✓

# Every peanut butter jar has: date + factory batch no.

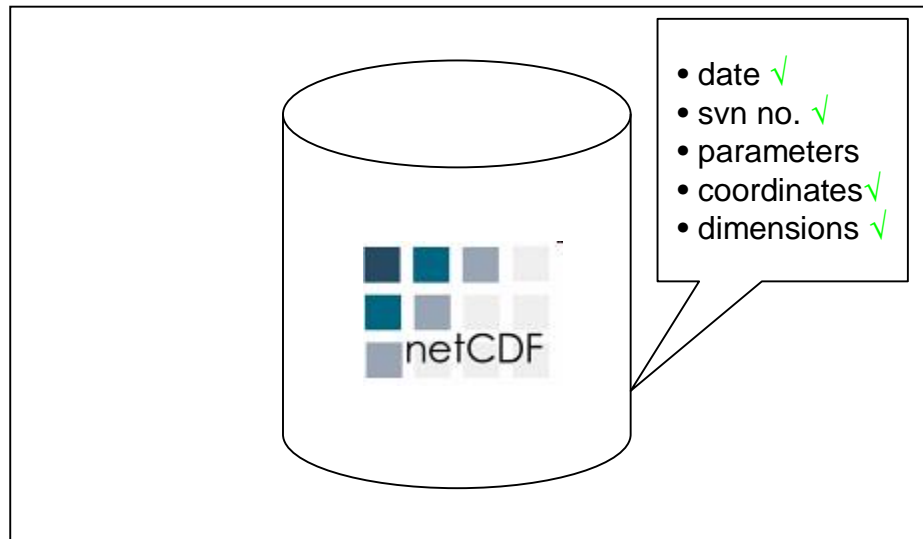


food-info.net

```
KB125_1918_20030416.asc - Notepad
File Edit Format View Help
ncols 500 nrows 625 xllcorner 140000 byllcorner
-271 -265 -255 -249 -249 -235 -227
18 -112 -108 -104 -100 0 -99 -97
-294 -285 -271 -251 -231 -202 -
-321 -286 -268 -257 -249 -227 0 -2
07 -106 0 -106 -106 -106 -104 -103
4 -70 -76 -82 -88 -95 -102
-227 -226 -224 0 -111 -113 -115 -
-203 -199 -196 -190 -184 -180 -17
79 -76 -73 -74 -72 0 -70 -69
-224 -223 -213 -207 -199 -194 -
-158 -160 -161 -153 -150 -151 0 -1
02 -99 0 -101 -101 -102 -101 -100
```



iloapp.gibodriehoek.be



# 1<sup>st</sup> principle: data = raw data + processing

*NASA satellite data with open source SeaDas processing toolkit (in IDL)*

- *L0: dump of recorded voltages, only averaged over 16 pixels*
- *L1: voltages + satellite track*
- *L2 ~ physical quantities*
- *L3 ~ binned in space (1 grid instead of zillions of warped photos)*
- *L4 ~ binned in time (climatology)*

DATA =

**RAW DATA (volts)**

History will never  
change!

one parameter at  
one place at  
one time

+

**PROCESSING**

Interpretation does  
change!

e.g. instrument  
deterioration,  
recalibration

# 1<sup>st</sup> principle: data = raw data + processing

DATA: SeaWiFS L2 ocean color data product

=

TOOL: version number  
of open SeaDAS  
IDL toolbox

+

VOLTS: name of raw  
L1 input datafile

The screenshot shows the HDFView application window. The title bar reads "HDFView". The menu bar includes "File", "Window", "Tools", and "Help". The toolbar contains icons for file operations. The "File/URL" field shows the path "D:\SeaWiFS\L2\1999\81999087112603.L2\_HDUN\_ZUNO.hdf". The left pane displays a tree view of the data structure, with "Geophysical Data" selected. The main pane shows the following metadata:

```
S1999087112603.L2_HDUN_ZUNO.hdf (0, 0)
Group size = 6
Number of attributes = 65
Title = SeaWiFS Level-2 Data
Sensor Name = SeaWiFS
Product Name = S1999087112603.L2_HDUN_ZUNO
Software Name = MSI12
Software Version = SeaDAS Version 4.0p3, MSI 2 2.0 (with MUMM turbid water extension 2.0), SunOS 5.6
Replacement Flag = ORIGINAL
Data Center = University of Dundee
Station Name = NERC Satellite Receiving Station
Station Latitude = 56.46
Station Longitude = -2.98
Processing Time = 2004082191710000
Processing Control = /app-soft/sun-sparc/solaris2.6/app/seadas4.0/bin/mumm-msi12 par=T.parT
Input Parameters = IFILE = //sunfish.users/homes/boer_g/POSTBOX/seawifs/1999/S1999087112603.L1A_HDUN_ZUNO
```

A purple text label "version number" is overlaid on the "Software Version" field. Arrows from the text on the left point to the "Software Version" field and the "Input Parameters" field.

# OpenEarth principles: data with meta-data

- ASCII file means nothing
- we need meta-information
- ... standardized
- at very least
  - quantity
  - units
- et voila, netCDF
  - allows for unlimited meta-information
  - offers machine-readable standards
  - vocabulary of quantity and units
  - can be loaded in any language/program
  - is open
  - designed for huge datasets
  - robust yet simple (NASA standard)

Remember high school ?

$$F_1 = 3 N$$

$$3 N$$

$$F_1 = 3$$

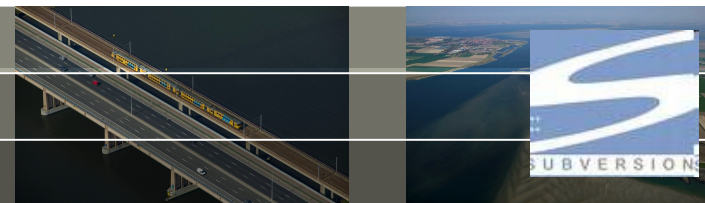
$$3$$

and what does our arcGIS  
'standard' look like 20 years  
later ?

```
mv250.asc - Notepad
File Edit Format View Help
ncols      1121
nrows     1301
xllcorner  -125
yllcorner  299875
cellsize   250
NODATA_value -9999
-9999 -9999 -9999 -9999 -9999 -99
9 -9999 -9999 -9999 -9999 -9999 -
999 -9999 -9999 -9999 -9999 -9999
-9999 -9999 -9999 -9999 -9999 -99
9 -9999 -9999 -9999 -9999 -9999 -
999 -9999 -9999 -9999 -9999 -9999
-9999 -9999 -9999 -9999 -9999 -99
-9999 -9999 -9999 -9999 -9999 -99
9 -9999 -9999 -9999 -9999 -9999 -
```



# Repository username



- Get username and password.
- Why, OpenEarth is open, right? Yes, but not anonymous.

## Every file is logged ...

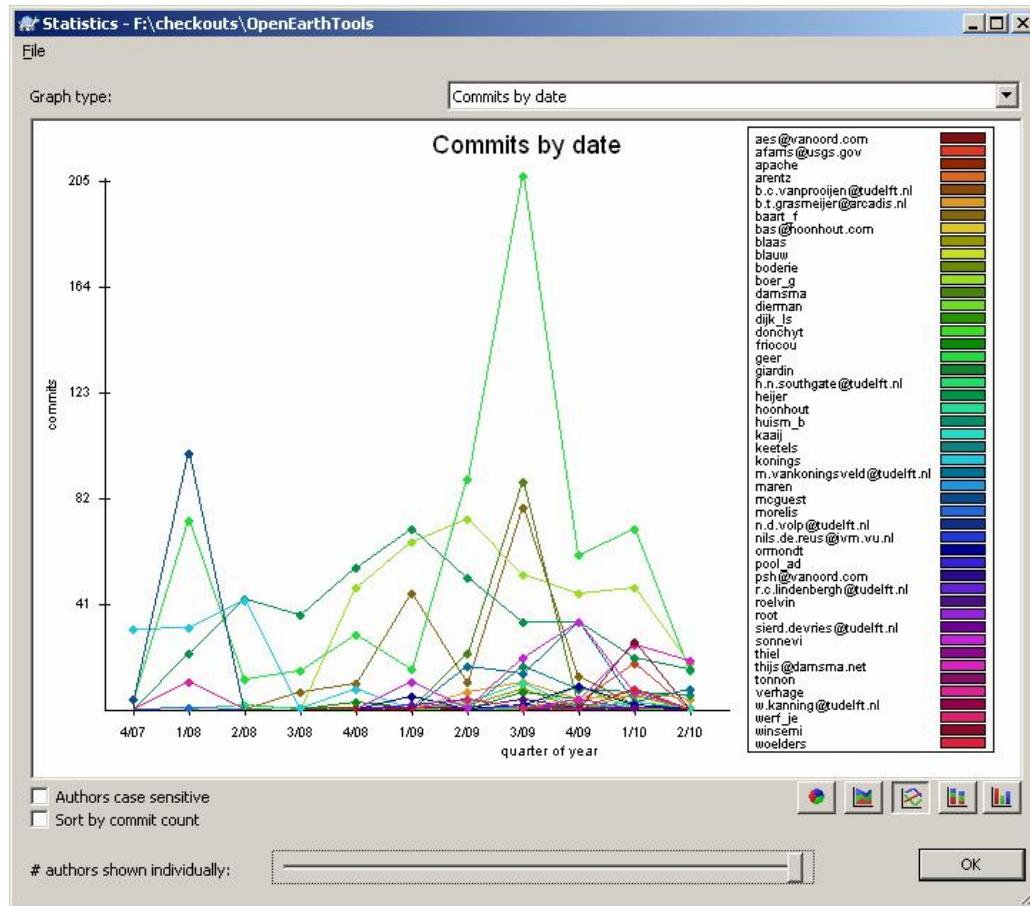
Revision	Actions	Author	Date	Message
304		baart_f	01:55:58, maandag 23 maart 2009	Changes for compatibility with Ualg. Compatibility function for UCIT.
303		boer_g	15:28:45, vrijdag 20 maart 2009	Add more meta-info (lat lon), and test indirect dimension mapping.
302		ormond	13:47:42, vrijdag 20 maart 2009	SuperTrans moved to OpenEarthTools
301		ormond	13:43:11, vrijdag 20 maart 2009	SuperTrans moved to OpenEarthTools
300		ormond	12:35:26, vrijdag 20 maart 2009	findinstruct and findstrinstruct added.
299		ormond	12:27:48, vrijdag 20 maart 2009	Several gui functions added.
298		ormond	12:27:17, vrijdag 20 maart 2009	updated oetnewfun lgpl block (removed postal adress), and added (!)gpl info.
297		boer_g	11:25:07, vrijdag 20 maart 2009	exampleStochastVar.m: option added to deactivate (= set to deterministic) one or more variables
296		heijer	10:44:08, vrijdag 20 maart 2009	Fixed loading of table from INP struct from different directory.
295		boer_g	18:05:45, donderdag 19 maart 2009	

## ... and every line in every file is logged.

Revision	Author	Line
2120	geer	93 %% Initiate variables
975	heijer	94 writemessage('init');
975	heijer	95
1724	geer	96 NoDUROSResult = false;
1307	heijer	97 getdefaults(...
1307	heijer	98 'xInitial', [-250 -24.375 5.625 55.725 230.625 1950]', 1,...

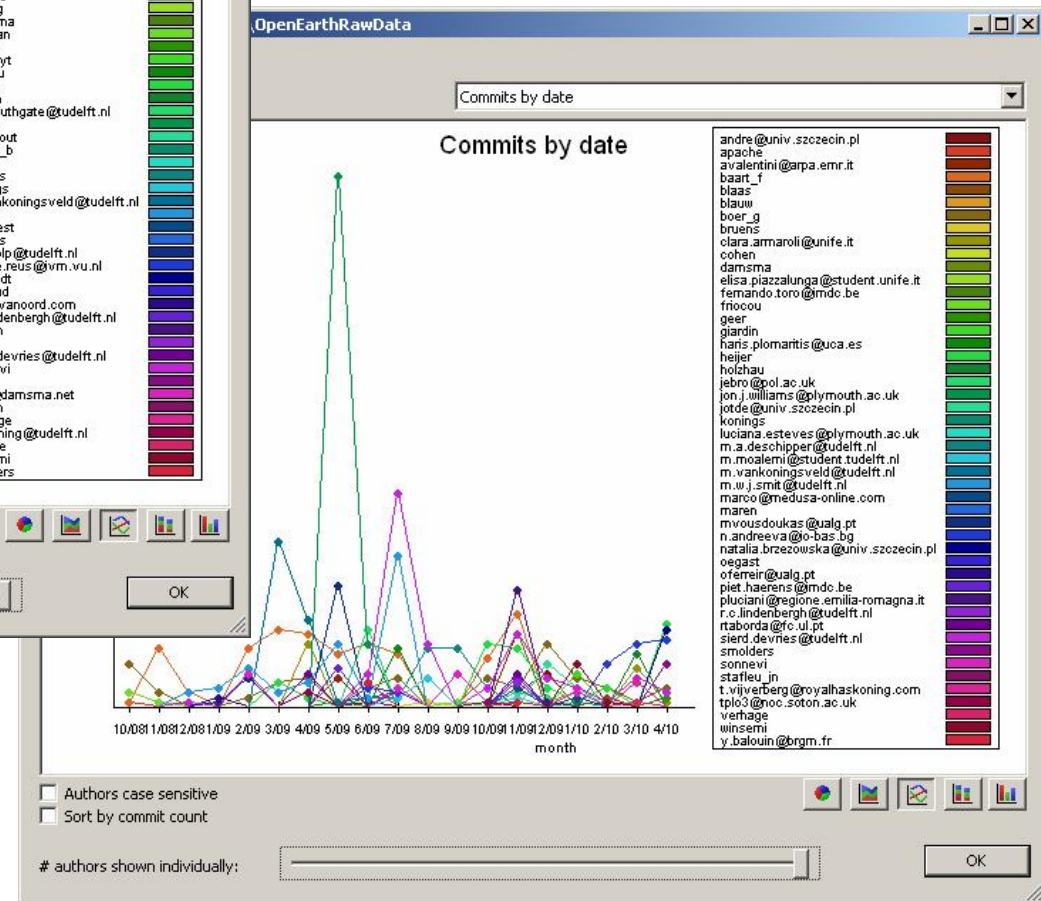
- Everyone has write acces to facilitate lots of micro-improvements.
- This allows anyone can be allowed to join.

# OpenEarth is already truly a community

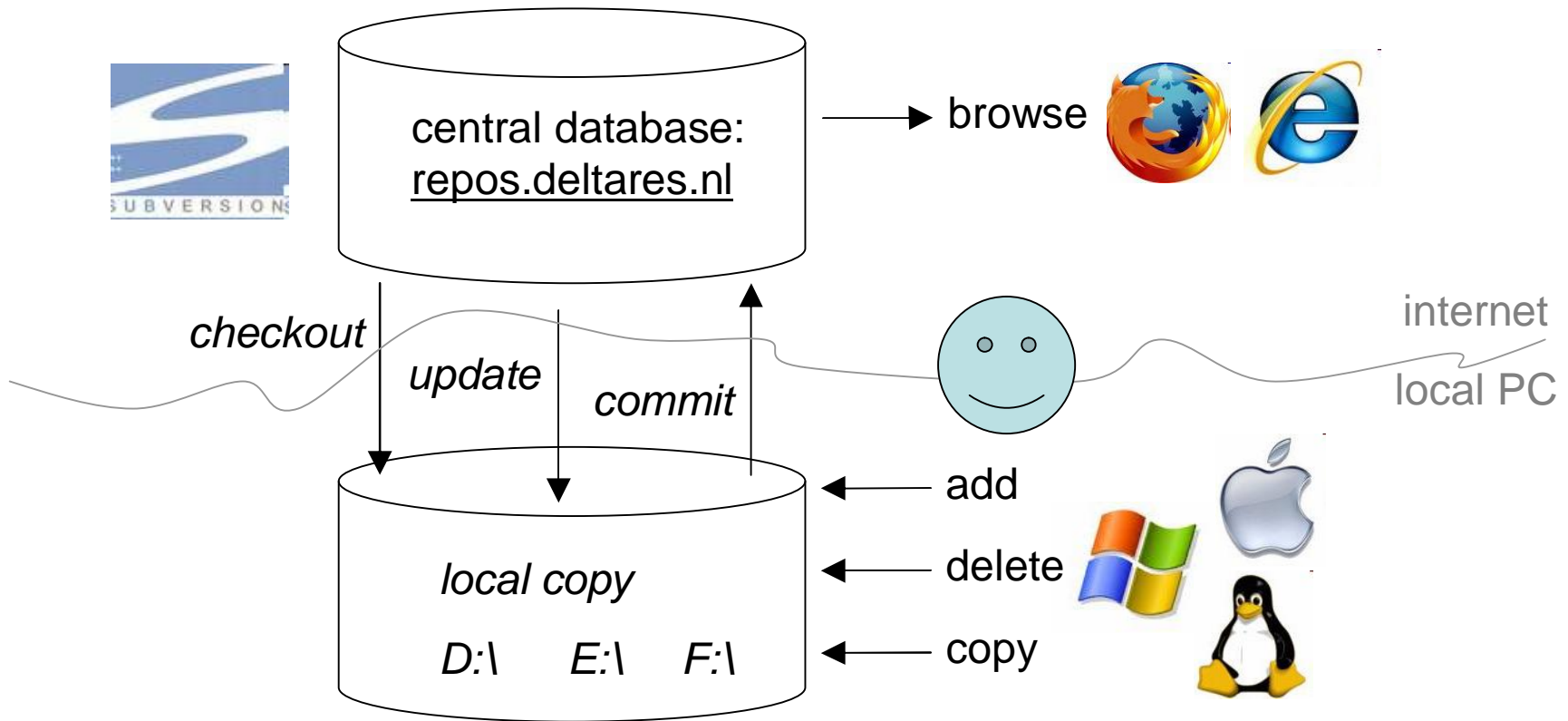
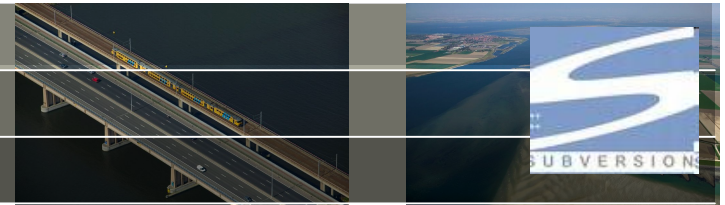


OpenEarthTools

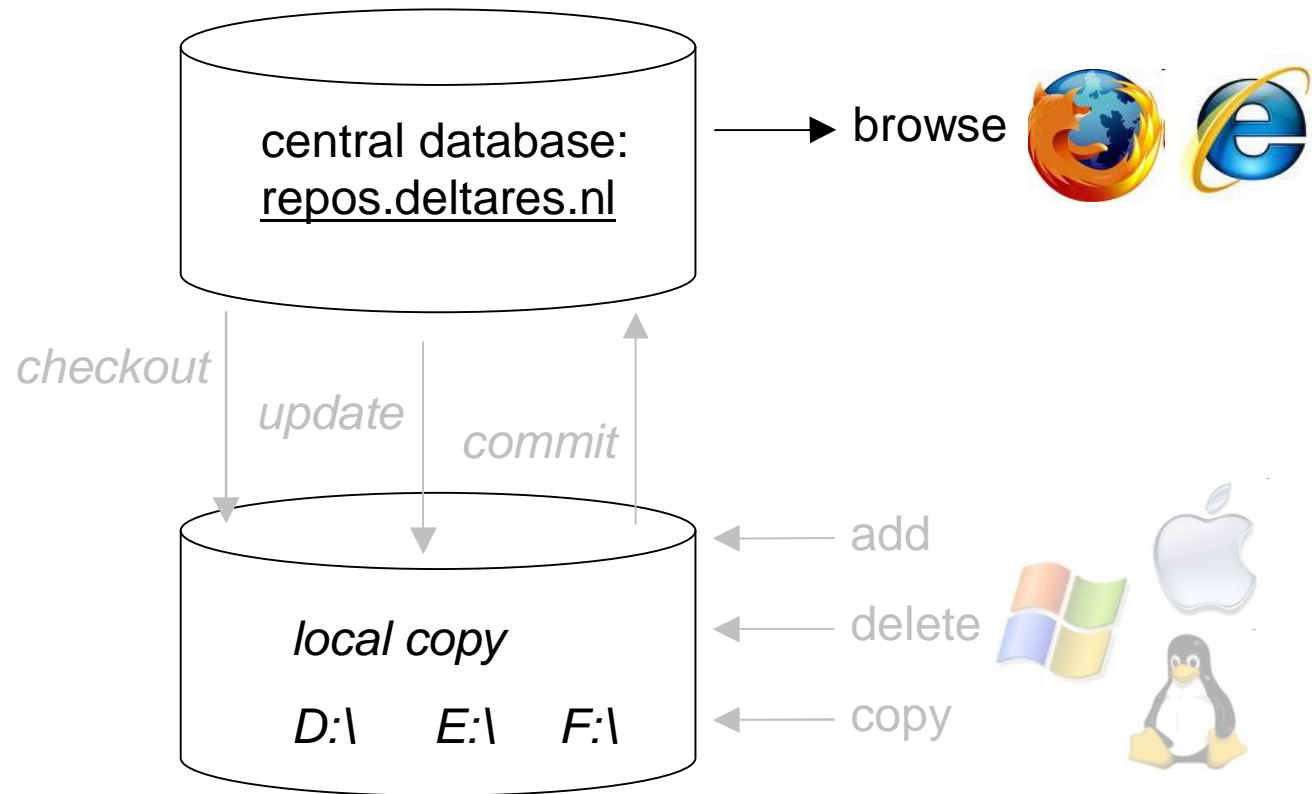
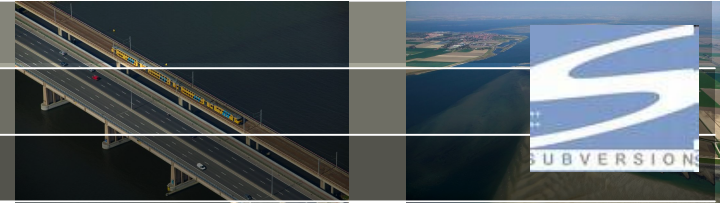
## OpenEarthRawData



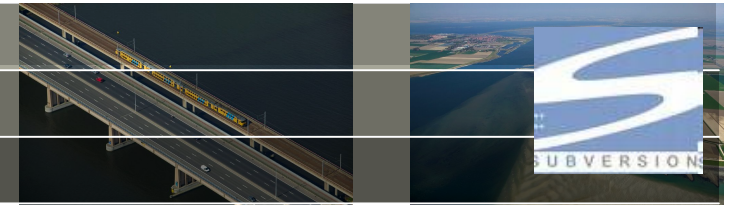
# REPOSITORY *basics*



# REPOSITORY *browse*



# REPOSITORY *browse*



Collection of Repositories - Mozilla Firefox  
https://repos.deltares.nl/repos/

Revision 0  
Collection of Repositories

- Auxilium/
- GWSobek/
- HKV/
- Maconomy/
- MoS2/
- NHI/
- OpenEarthData/
- OpenEarthModels/
- OpenEarthRawData/
- OpenEarthTools/
- RADInstruments/
- Rijn-Maas/
- RtcModule/
- Sobek-RE/
- TKW/
- WVC/
- XBeach/

Done

Powered by [Subversion 1.4.6](#)

Revision 514

branches/  
sandbox/  
tags/  
trunk/ (circled)  
tutorials/

Version (circled)

trunk/matlab - Mozilla Firefox  
https://repos.deltares.nl/repos/OpenEarthTools/trunk/matlab/

Undo  
Cut  
Copy  
Paste  
Delete  
Select All

trunk/matlab

[Parent Directory]

- applications/
- docs/
- general/
- io/
- addpathfast.m
- oetsettings.m (circled)

Mozilla Firefox  
https://repos.deltares.nl/repos/OpenEarthTools/trunk/m

```
function oetsettings(varargin)
%OETSETTINGS enable the OpenEarthTools matlab tools by adding all re:
%
% OpenEarthTools is a collection of open source tools
% intended to be licensed under the GNU (Lesser) Public License
% (<a href="http://www.gnu.org/licenses/licenses.html">http://www.gnu.o
%
% For more information on OpenEarthTools refer to the following source:
%
% * wiki: <a href="http://OpenEarth.deltares.nl"
% * repository: <a href="https://repos.deltares.nl/repos/OpenEarthToo
% * help blocks: See all through the OpenEarthTools directories and new
```

Powered by [Subversion 1.4.6 \(r28521\)](#)

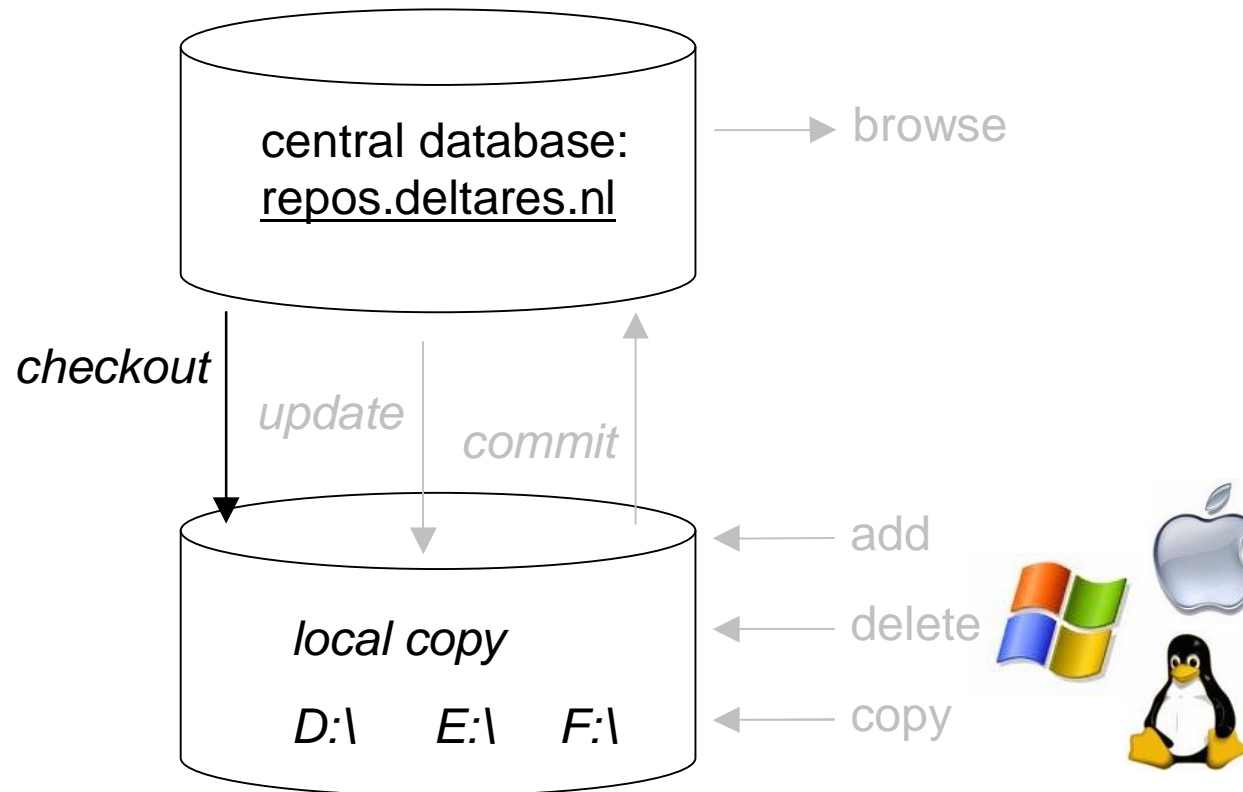
# REPOSITORY



## SVN Checkout...



- It is not handy to get files one by one with a browser: Get them all at once with free Subversion client program.



# Overlay icons show status of local copy



File Explorer window showing the directory `E:\checkouts\OpenEarthTools\matlab\applications`. The address bar shows the path `E:\checkouts\OpenEarthTools\matlab\applications`. The table below lists the contents of this directory.

Name	Size	Type	Date Modified
delft3d		File Folder	12-06-2009 10:03
DUROS		File Folder	12-06-2009 10:03
durosta		File Folder	12-06-2009 10:03
googleearth		File Folder	12-06-2009 10:03
KNMI		File Folder	12-06-2009 10:03
meris		File Folder	12-06-2009 10:03
OceanDataView		File Folder	12-06-2009 10:04
probabilistic		File Folder	12-06-2009 10:03
Rijkswaterstaat		File Folder	12-06-2009 10:03
sobek		File Folder	12-06-2009 10:03
SuperTrans		File Folder	12-06-2009 10:04
SuperTrans2.0		File Folder	12-06-2009 10:03
SWAN		File Folder	12-06-2009 10:04
textpad		File Folder	12-06-2009 10:04
tide		File Folder	12-06-2009 10:03
xbeach		File Folder	12-06-2009 10:03
contents.m	2 KB	M File	12-06-2009 10:04
oet_applications.m	1 KB	M File	12-06-2009 10:04

*up to date*

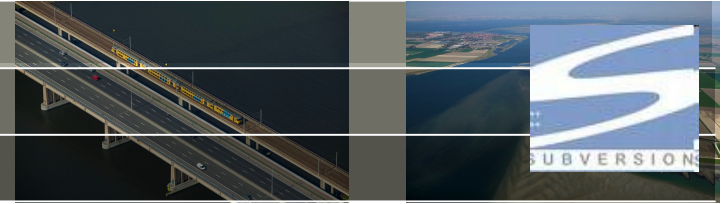
*modified*

File Explorer window showing the directory `E:\checkouts\OpenEarthRawDataSandbox`. The address bar shows the path `E:\checkouts\OpenEarthRawDataSandbox`. The table below lists the contents of this directory.

Name	Size	Type	Date Modified
JoeSmit		File Folder	12-06-2009 11:17

*added*

# Tools protocol (Matlab)



- name space, precursor to Object Oriented
  - vs\_\*
  - swan\_\*
  - delфт3d\_\*
  - nc\_\*
  - ucit\_\*
- \*\_test for unit tests
- \*\_tutorial for tutorials
- h1 line for table of contents
- example for cut-'n-pastable use
- alignment for colleagues
- SetProperty for <keyword,value> pairs



# Good Programming Practise: documentation

```
MATLAB 7.6.0 (R2008a)
File Edit Debug Desktop Window Help
d:\HOME\matlab
Shortcuts New OET MCT WLT OEMCWL GRB
Adding OpenEarthTools, please wait ...

OETSETTINGS enable the OpenEarthTools matlab tools by adding all relevant matlab paths.

OpenEarthTools is a collection of open source tools
intended to be licensed under the GNU (Lesser) Public License
(http://www.gnu.org/licenses/licenses.html).

For more information on OpenEarthTools refer to the following sources:

* wiki: OpenEarth.Deltares.nl
* repository: https://repos.deltares.nl/repos/OpenEarthTools/trunk/matlab
* help blocks: Scroll through the OpenEarthTools directories and read interesting help blocks.
* walk down OpenEarthTools tree with:

    help oet_general
    help oet_applications
    help oet_io

See also: addpathfast, restoredefaultpath
oet\_general
oet\_applications
oet\_io

*** OpenEarthTools settings enabled! ***
>>
```

*www links*

*other m function*

*other directories in path*

# Good Programming Practise: documentation

```
>> help applications
```

```
OpenEarth applications
```

```
rijkswaterstaat - data: rijkswaterstaat data types (donar)
delft3d         - delftd file formats
knmi           - read knmi wind and meteo timeseries
swan           - swan toolbox
```

*contents.m*

```
>> help rijkswaterstaat
```

```
donar_read      - read ASCII text file from www.waterbase.nl
getwaterbase   - get data from waterbase.nl
getwaterbasestation - get stations names for parameter
getwaterbaseparameter - get parameter from waterbase.nl
hmcz_read      - read meteo file from hmcz@ rws
```

*H1 line*

```
>> help donar_read
```

```
DONAR_READ read ASCII text file from www.wate
```

```
DAT = donar_read(fname,<keyword,value>)
```

```
See also: getwaterbase, www.waterbase.nl
```

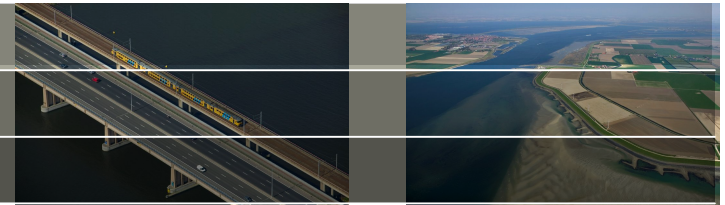
donar\_read.m

```
% DONAR_READ read ASCII text file fro
%
% DAT = donar_read(fname,<keyword,valu
%
% See also: getwaterbase, www.waterbas
```

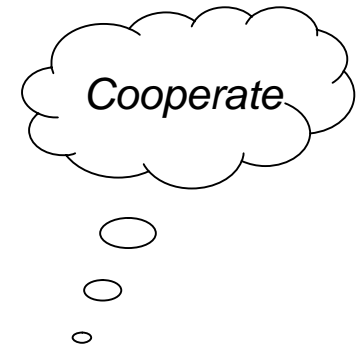
recap

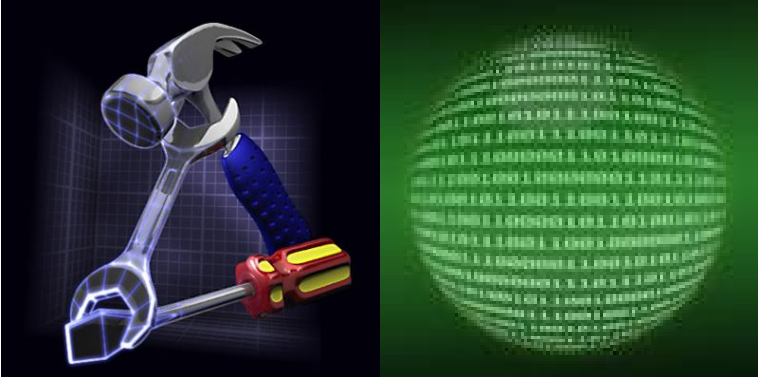
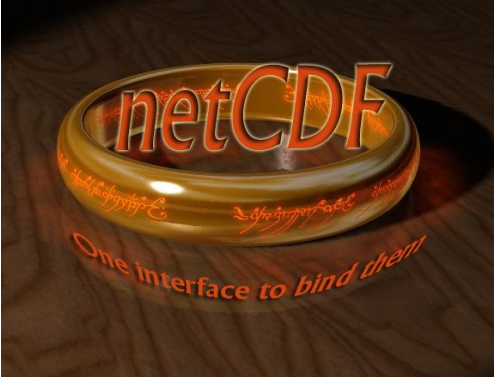
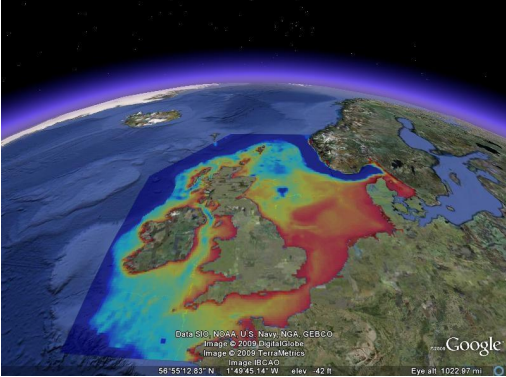





# Contents



0. The power of collaboration
1. Google Earth: web service for images
2. OPeNDAP/netCDF: web service for data
3. Subversion: web service for version control

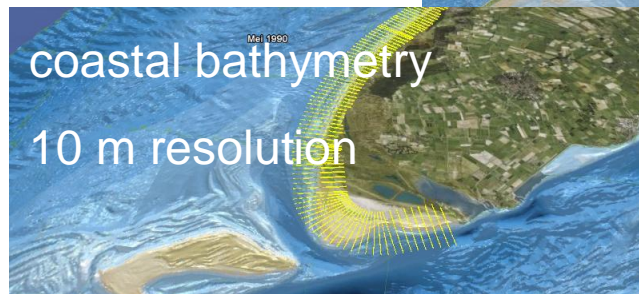
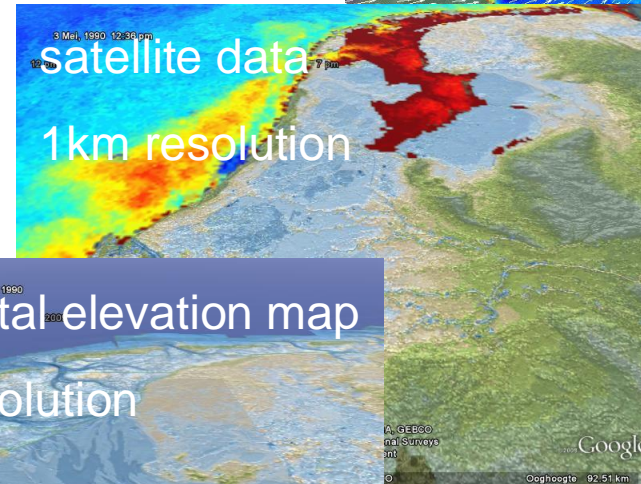
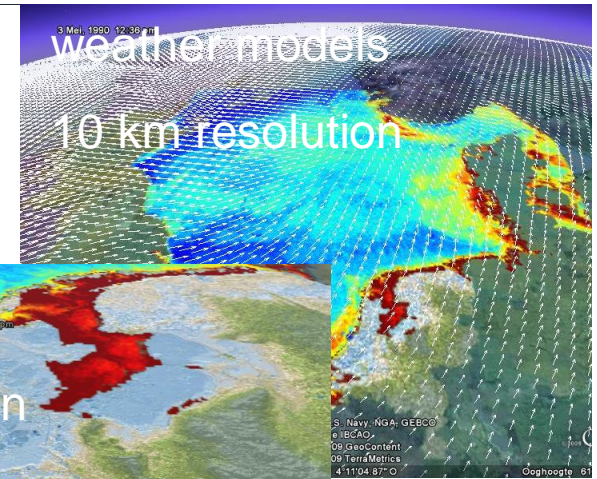


① Version control and backup	② Web access to datasets	③ Straightforward visualisation
tools      data & scripts	from pluriform to standard format!	open source software
		
		

# Open<sup>1</sup>Earth<sup>2</sup>

Open<sup>1</sup>-access Google-Earth<sup>2</sup>-alike of

- all environmental data products covering
- any range of physical scales located
- anywhere on the world
- under rigorous version control

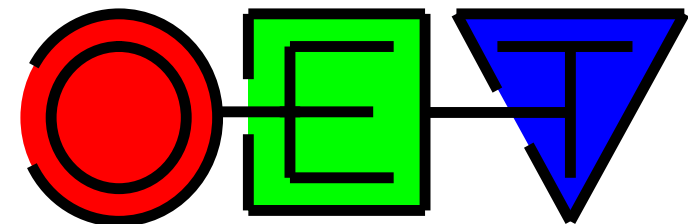


Process scale: km/yr



after De Vriend

scale of interest: km/yr





**Community of practice:** OpenEarth has a wide range of users (Building with Nature, EU FP7 MICORE, Delft Cluster etc.). Building with Nature facilitates training sessions.