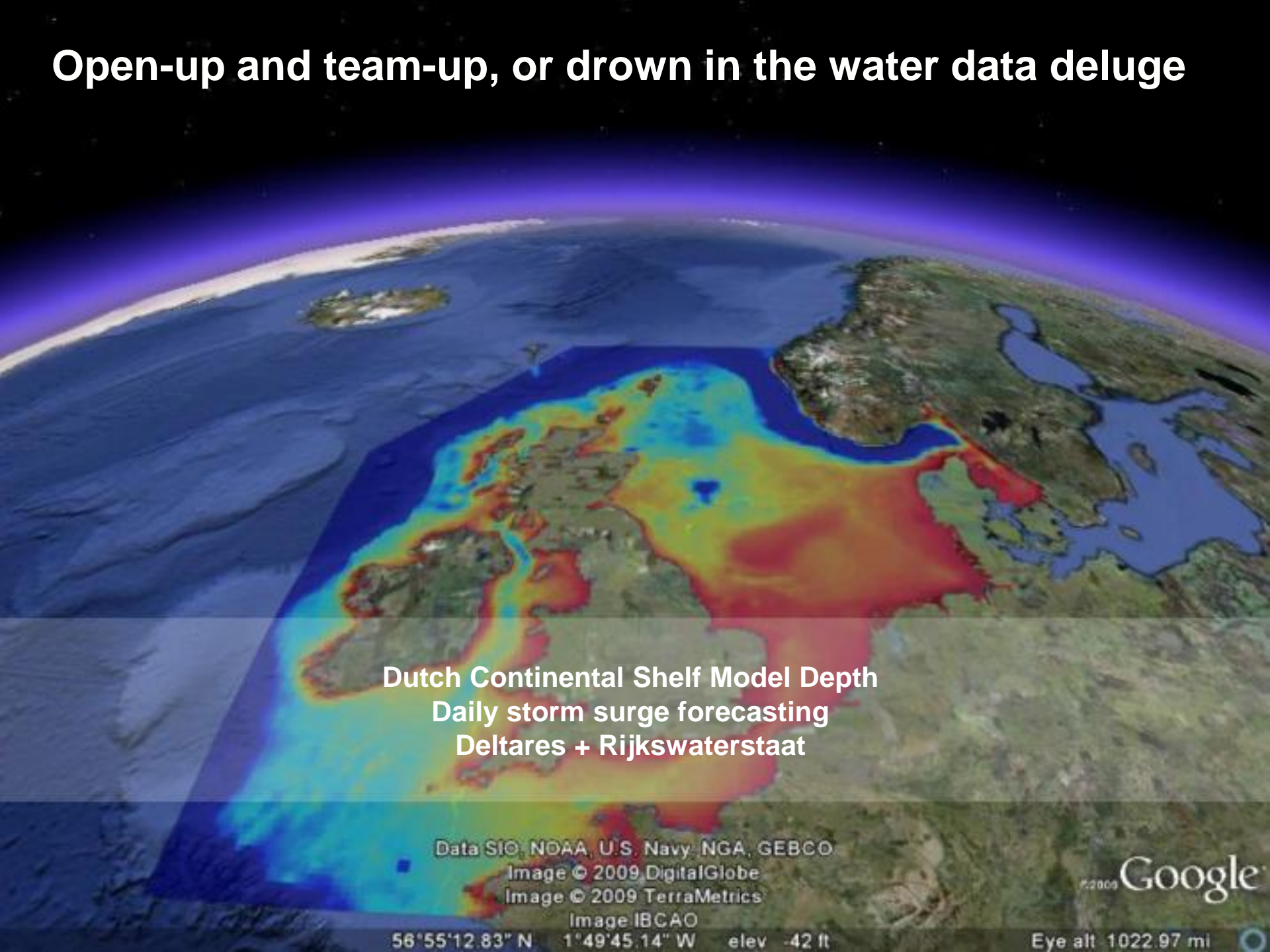


Open-up and team-up, or drown in the water data deluge



Dutch Continental Shelf Model Depth
Daily storm surge forecasting
Deltares + Rijkswaterstaat

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2009 DigitalGlobe
Image © 2009 TerraMetrics
Image IBCAO

56°55'12.83" N 1°49'45.14" W elev -42 ft

Google

Eye alt 1022.97 mi

Contents



4th paradigm: **connecting thread**

The problem: **data**

The problem: **models**

Solution: **fishing vessels teaming up**

Solution: **co-creation of tools**

Solution: **land, air and water**

Example: **Too much water**

Example: **Too little water**

Example: **Too dirty water**

Open networks will rule the world water industry

4th paradigm: 21st century = web-based community science

4 phases in science (Jim Gray †, Microsoft research)

1. **Empirical** (last 1000s yr)
Archimedes, ...
2. **Theoretical** (last 100s yr)
Newton, ...
3. **Computational** (last 10s yr)
von Neumann, ...
4. **Digital Data Deluge**: BIG data + merging of
 1. experiments;
 2. theory;
 3. simulations;
 4. mass-data gathering: Lidar, smartphones, PIV

IT and science need to team up: **e-Science**:

- IT cannot handle science any more
 - Science cannot handle IT any more
1. Past: data moves to scientist once (download)
 2. Now: data moves to scientist live (DataTube)
 3. Future: Scientist will move to data (mainframes again)

1) Marine & coastal labs



2) Marine & coastal math. models

$$\frac{\partial k}{\partial t} + \frac{u}{\sqrt{G_{\xi\xi}}} \frac{\partial k}{\partial \xi} + \frac{v}{\sqrt{G_{\eta\eta}}} \frac{\partial k}{\partial \eta} + \frac{\omega}{d + \zeta} \frac{\partial k}{\partial \sigma} =$$
$$+ \frac{1}{(d + \zeta)^2} \frac{\partial}{\partial \sigma} \left(D_k \frac{\partial k}{\partial \sigma} \right) + P_k + P_{kw} + B_k - \varepsilon.$$

3) Marine & coastal simulation software



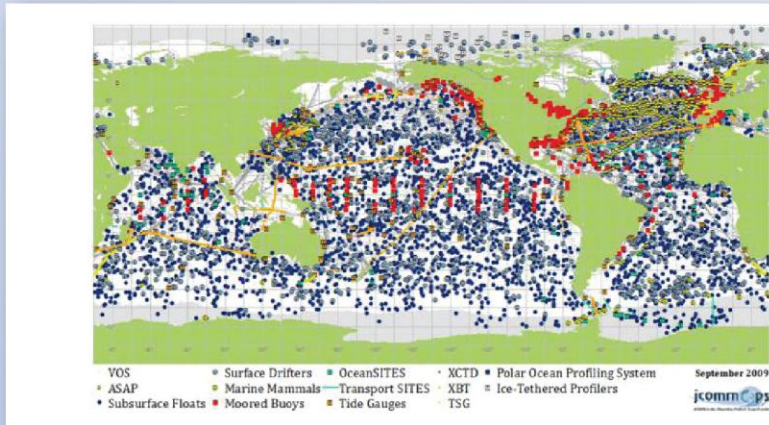
4) Marine & coastal open communities



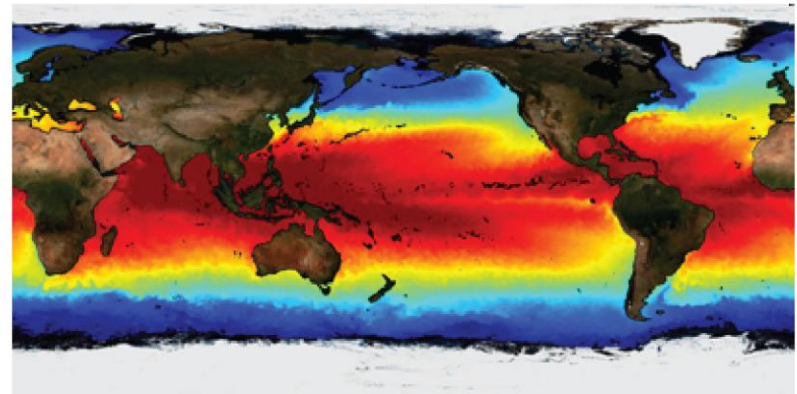
The problem: data



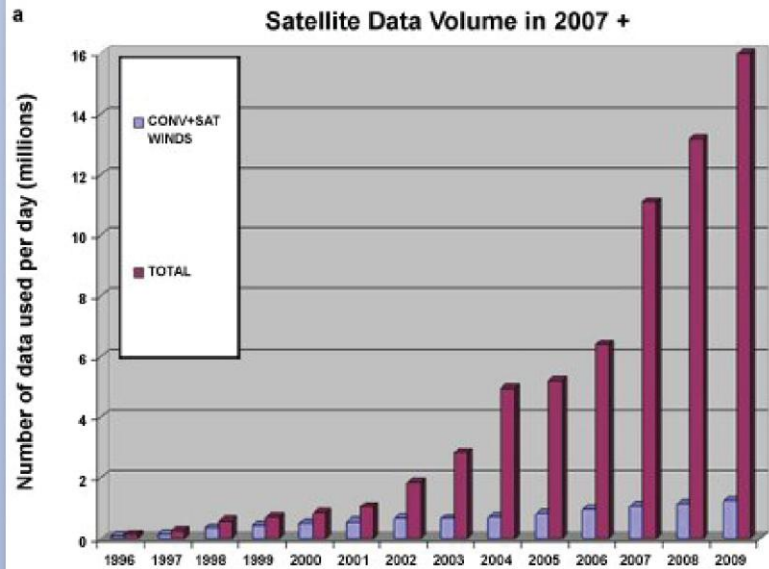
In-situ observations



Satellite observations



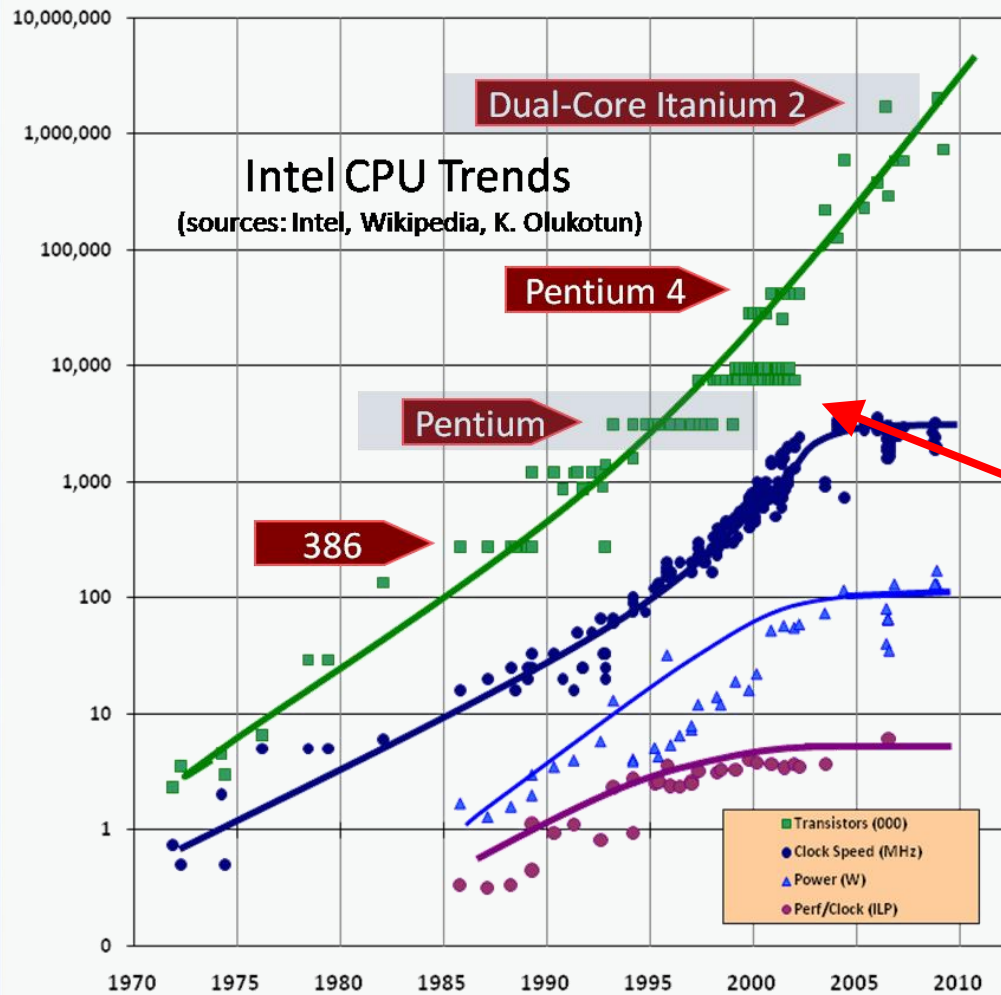
Source: ECMWF



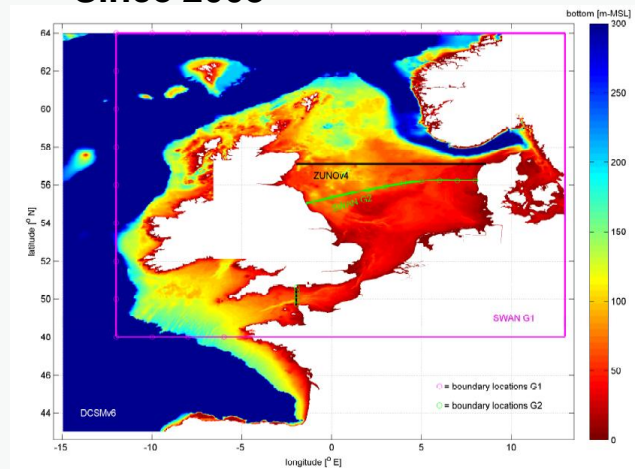
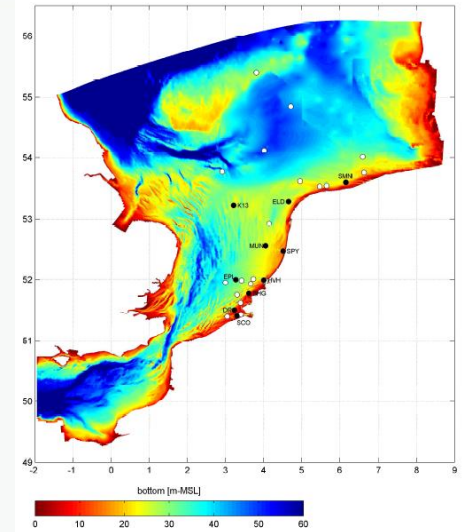
Source: Guardian



The problem: numerical models



**CPU frequency constant
Since 2003**

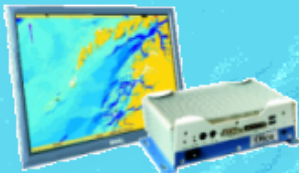


Community example: Fishermen gather bathymetry data

Olex: Sea floor data

www.olex.no/dybdekart_e.html


Olex




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Sea floor maps

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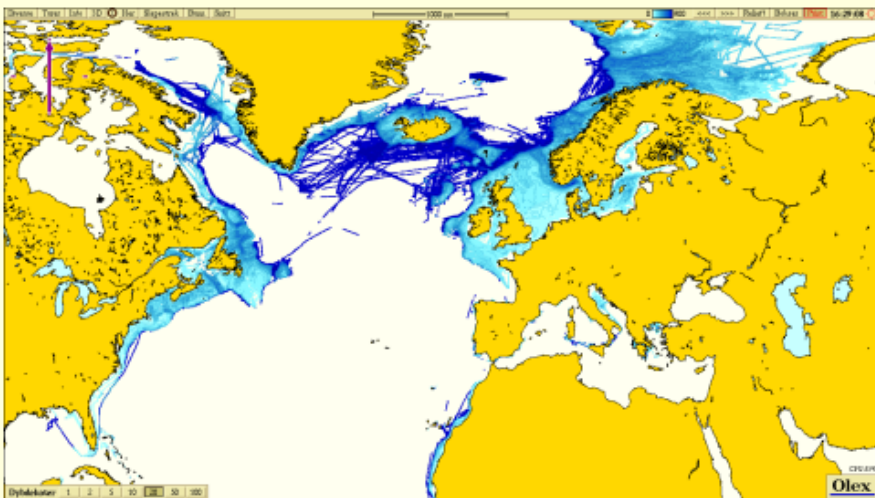
www.olex.no/bilder/Databasen.png

Collected sea floor data

Olex users are encouraged to share their sea floor data. This data sharing is free of charge and are organized by Olex AS. After sending their own sea floor data to their dealer or to Olex AS the users will get access to a database with collected depths from other Olex users all over the world.

The data sharing has become popular among the users, and more than two billion measured depths now forms the basis for a comprehensive sea floor map. This information is valuable for fishermen and other seafarers. The exchange of data is made by e-mail, diskette, USB-device or CD/DVD.

The complete database is available from 9 iso-files, each with a size of 3 to 4 gigabytes, which can be



The shared sea floor database

Community example: co-creation of tools

Deltares went open source:

- Delft3D
- OpenDa
- OpenEarth
- XBeach

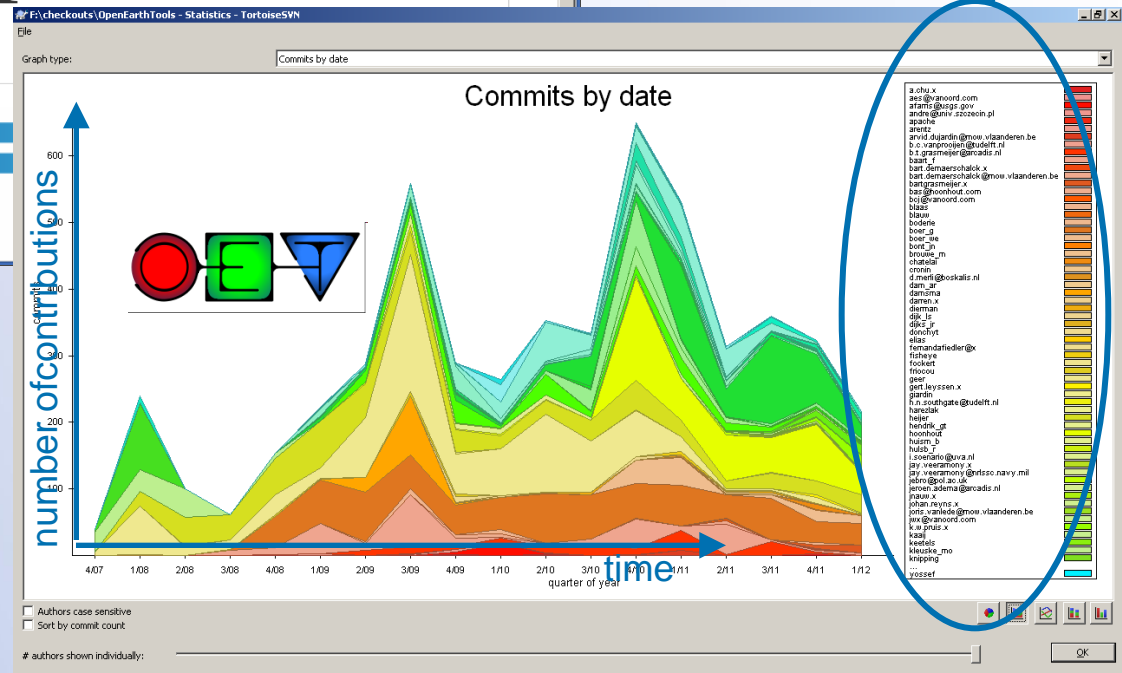
unique users



LinkedIn members

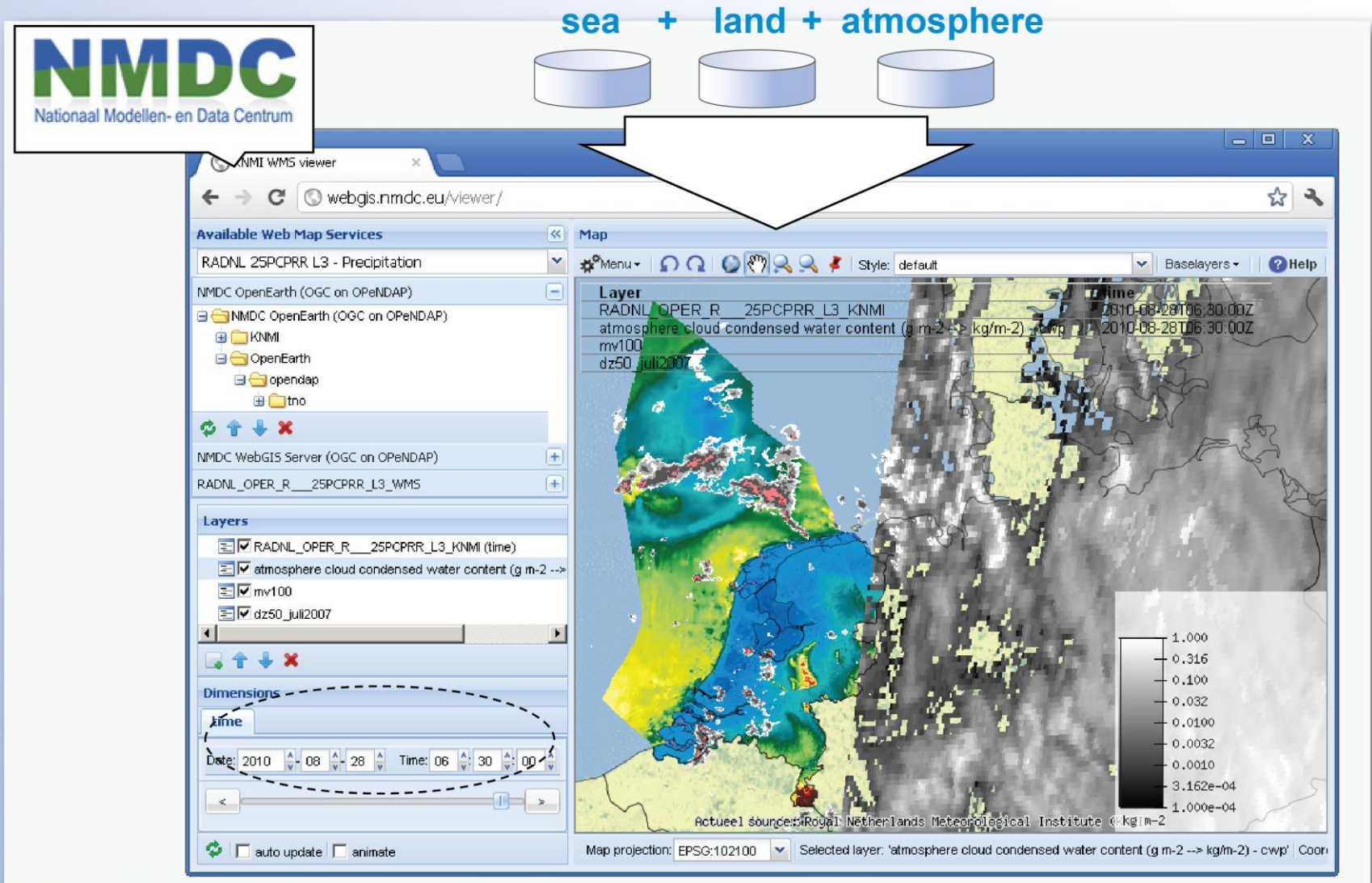


Location of members



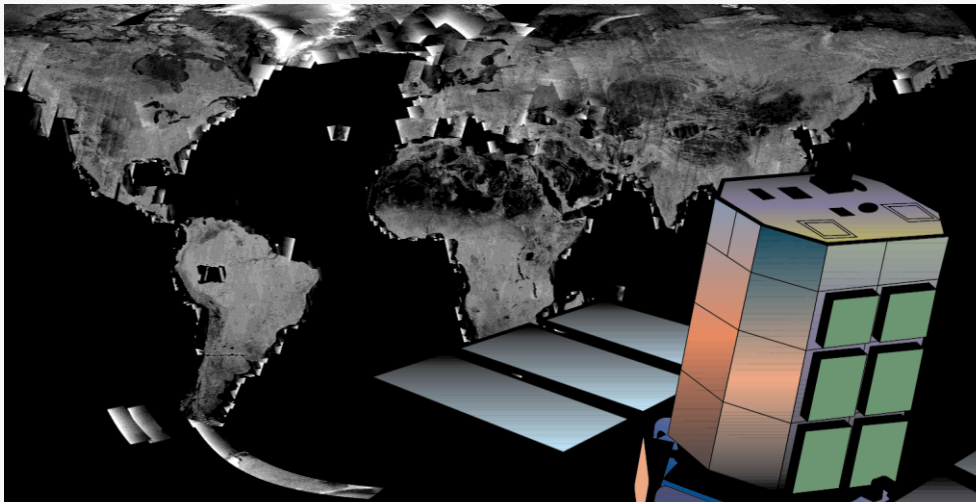
Unique contributions

Community example: land, air and water



Example 1: too much water: Global Flood Mapping

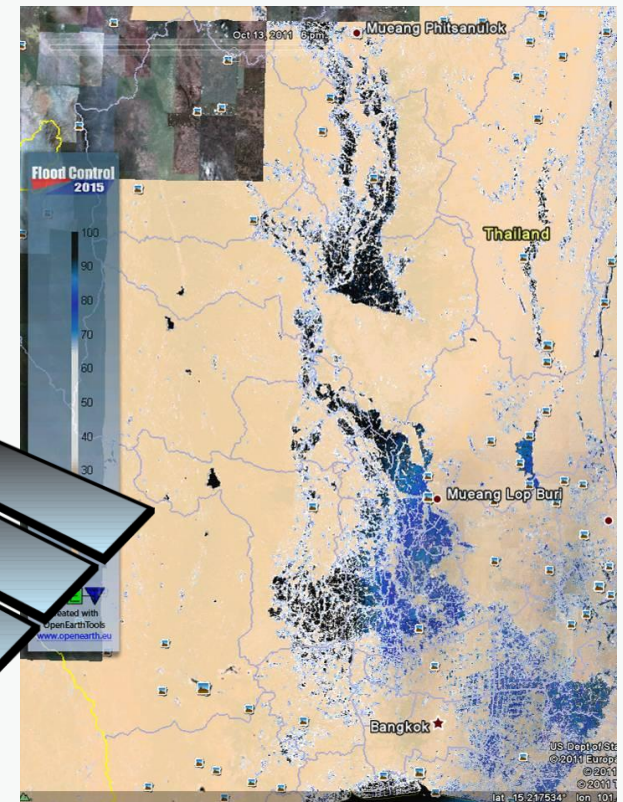
ESA Envisat (†) satellite provides global radar data, which can be processed automatically to produce flooding maps (water extent)



Global satellite coverage



Global Flood Observatory Initiative



Bangkok Thailand | 13 October 2011

Example 2: too little water: GLOWASIS



A collaborative project aimed at pre-validation of a GMES Global Water Scarcity Information Service
Explaining, sharing and improving water scarcity data

Seasonal forecasting of water scarcity

Observations and forecasts of

- Precipitation
- Water Demand
- Soil Moisture
- Hydrological
- Etc.

in a popular web portal AND
scientific download portal



Example 3: too dirty water: river vs. sea models



Open networks will rule the water industry

Cooperation

