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Ordnance  
Survey



# Carbones.eu: an open-source geoportal for climate science

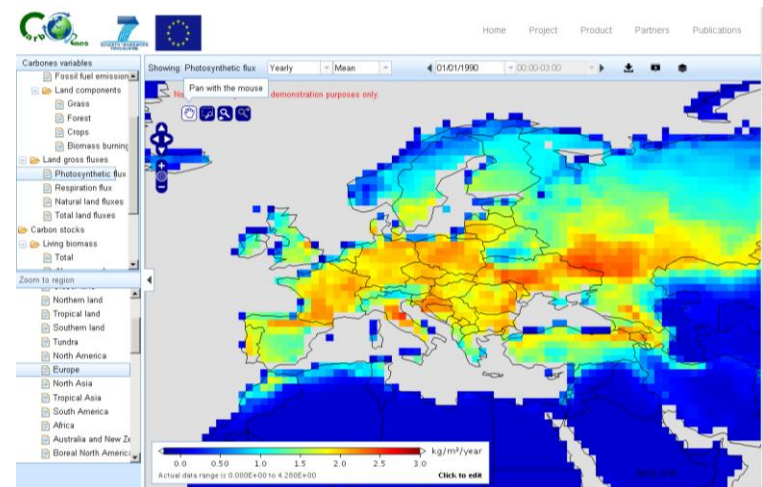
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CERC

# Overview

- CARBONES: an open source geoportal for climate science
- Features and demonstration
- Architecture and technology
- Lessons learned



# The CARBONES project

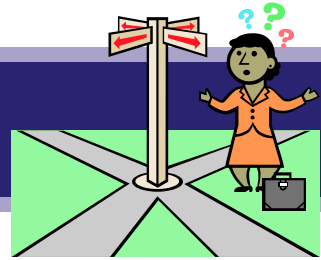
- CARBONES: an EU FP7 science project
- Produced a global reanalysis of carbon fluxes and stocks for 1990-2010
  - Helps climate scientists improve their models
  - Improves understanding of the global natural capital represented by carbon in biomass
- CERC developed the geoportal to present the output from the scientific project

# The challenges



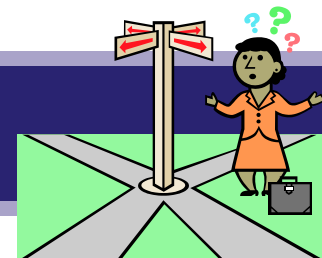
- The challenges for the CARBONES geoportal:
  - Provide a useful data visualisation for scientific specialists *and* the public and policymakers
  - Big data: 1 million map layers from 500 GB of data
  - Interoperability and open standards:
    - Earth Science standards for the scientific users.
    - GIS standards for interoperability with other services and for INSPIRE compliance.

# Decision: user interface



- Key decision: custom or generic user interface?
  - **Generic user interface:** off-the-shelf, so very easy to implement, but not as user friendly.
  - **Custom user interface:** requires development, but very user-friendly.
  - The geoportal shows a set of very similar datasets: there was great scope for a custom user interface.
  - CERC chose to develop a custom user interface.

# Decision: open source



- Key decision: open-source or closed-source?

Advantages of open-source	Caveats about open-source
Customizable, flexible	Requires development resources
Avoid dependency on one single vendor	Dependent on a viable community
No license fees: possibly cheaper?	Community support is dependent on a viable community. May require skilled staff.

- Using open standards avoids dependencies on any one vendor or community

# Open standards: netCDF



- Data are in netCDF format with metadata using the Climate and Forecast conventions
  - netCDF is a data file format and API.
  - An open, hierarchical, extensible, portable, binary file format for data and metadata.
  - Efficient disk space usage *and* fast performance.
  - netCDF was invented by scientists (Unidata); it is the preferred format for the scientific users; it is now also an OGC standard.



# Open standards: OGC



- Used Open Geospatial Consortium standards for services
  - Flexibility, interoperability, INSPIRE compliance
  - WMS for maps (view service)
  - CS-W for metadata
- Download views and animations in KML
  - KML is an OGC standard



# Geoportal features

- A user-friendly interface
- Interactive web maps and graphs
- Animations playing directly in the map viewer
- User-editable colour scales for the raster maps
- Metadata; data download; PDF creation; export views and animations to KML
- Pure JavaScript (no browser plug-ins required)



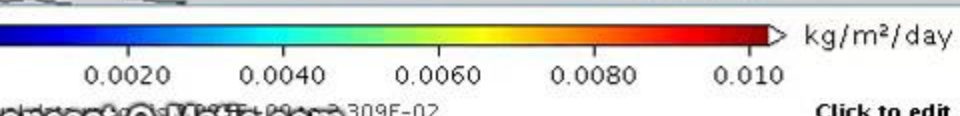
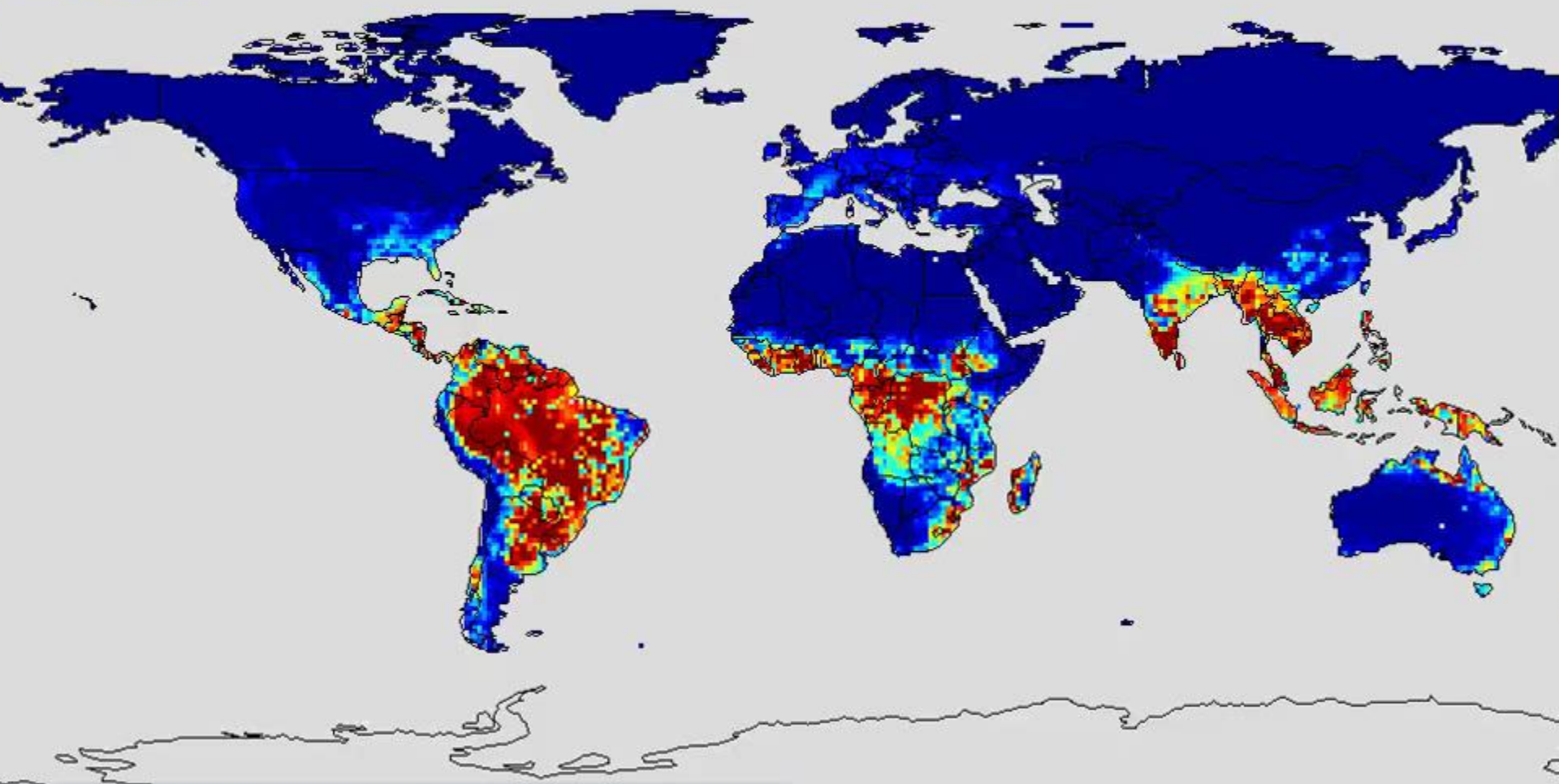
g: Photosynthetic flux

Daily

Mean

01/01/1990

03:00-06:00



# Regional time series

Time series of regionally aggregated carbon fluxes, carbon stocks and other fluxes

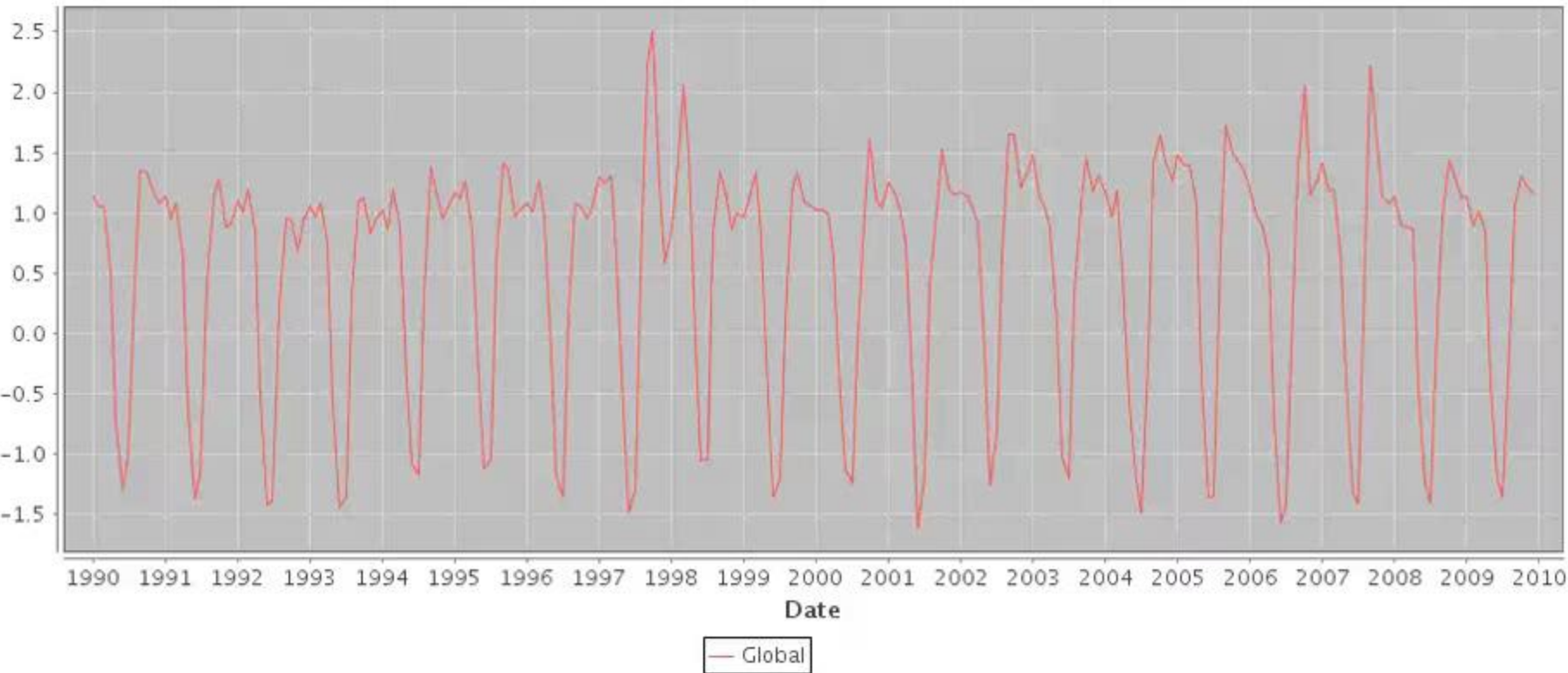
Total carbon fluxes ▾

Monthly ▾

Mean ▾

Regions ▾

Total land + ocean fluxes (Natural + Fossil) (Gt/mc)



Start Date 01/01/1990 ▾

00:00-03:00 ▾

End Date 01/01/2010 ▾

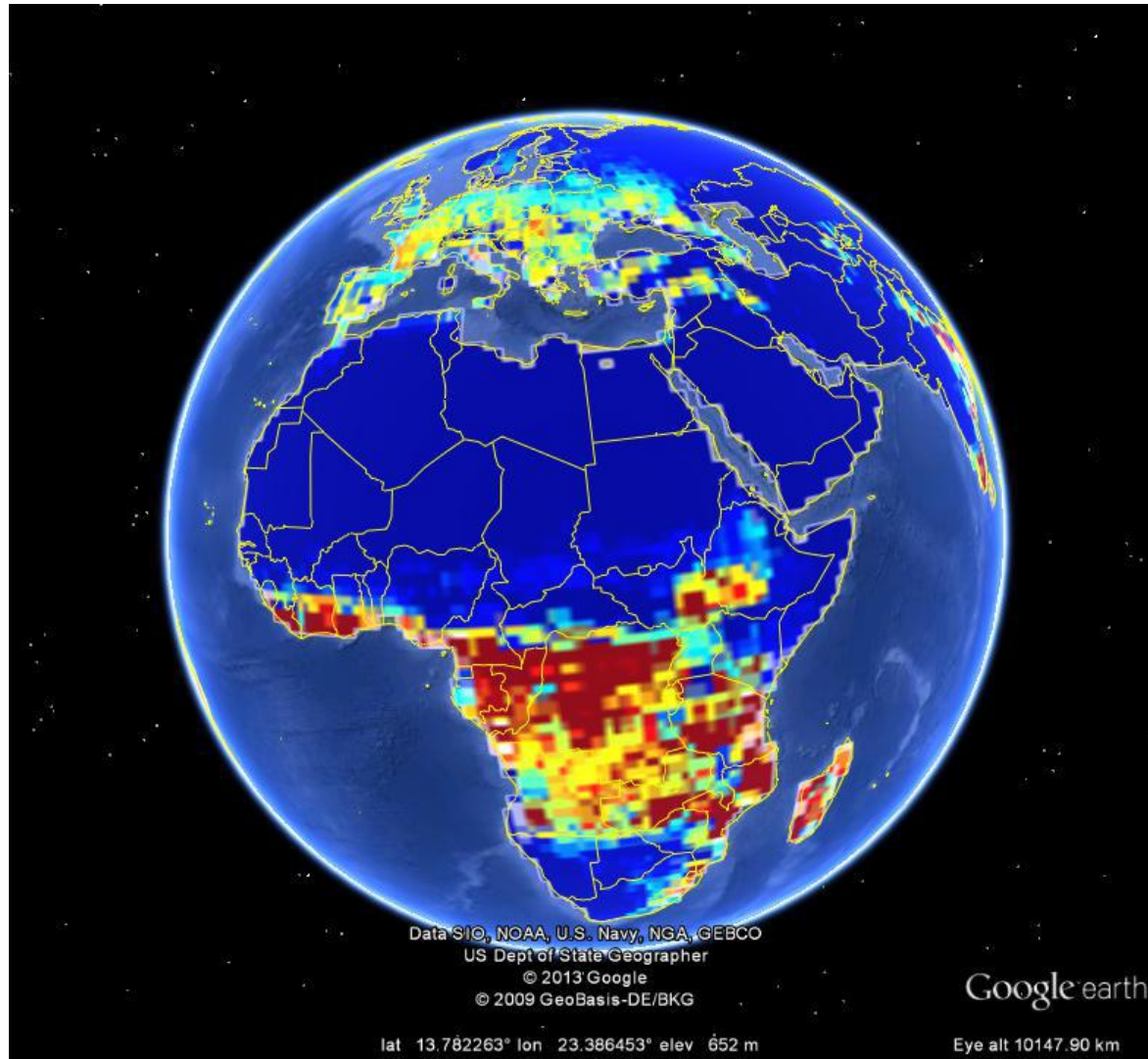
00:00-03:00 ▾

Download

Export to PDF



# CARBONES data in Google Earth

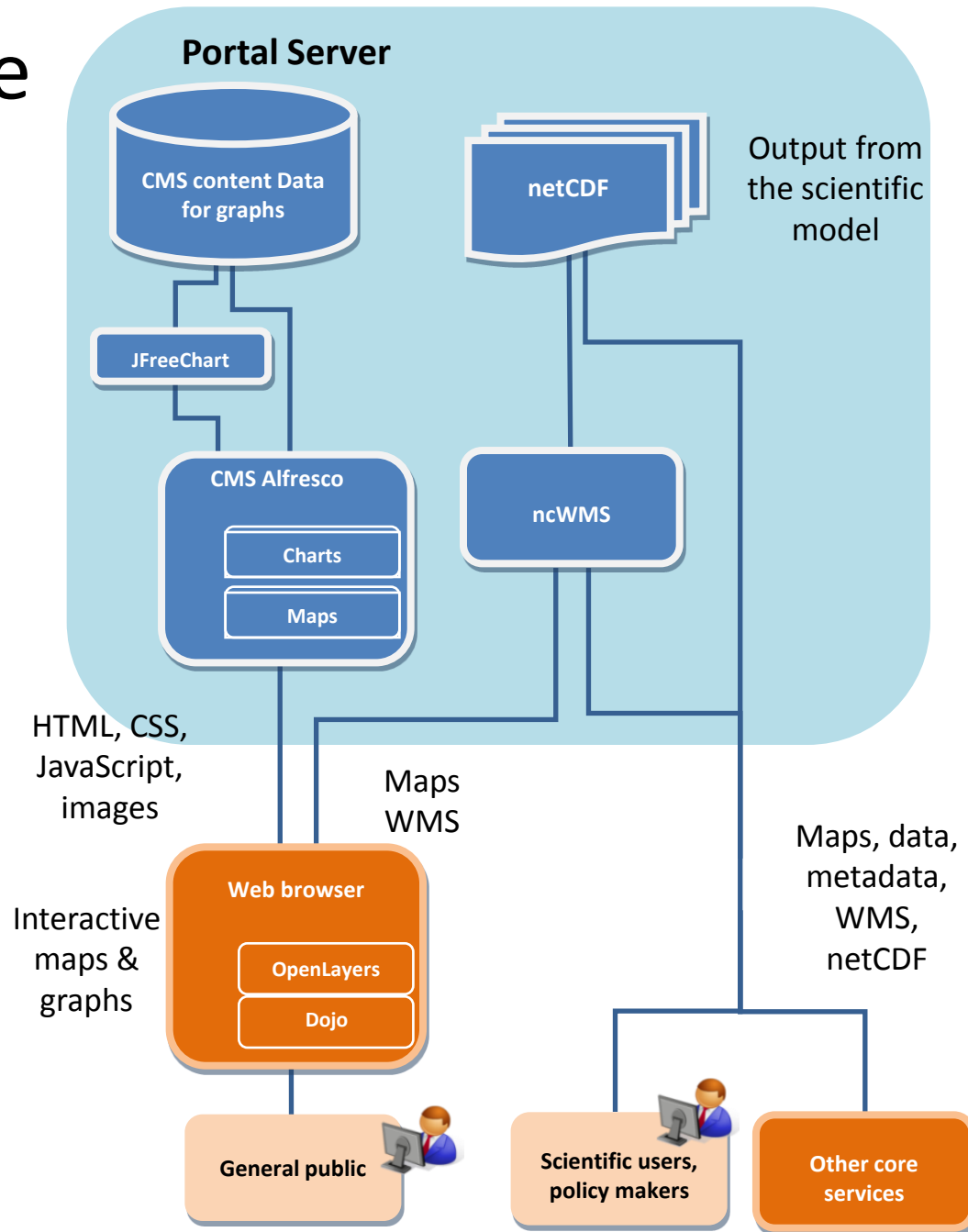


# Geoportal software

Functionality	Notes	Software
View service (WMS)	Map production on the server	<ul style="list-style-type: none"><li>• ncWMS for netCDF</li><li>• MapServer for other layers</li></ul>
Maps	Uses the WMS	OpenLayers JavaScript API
Graphs		JFreeChart
Content Management System	For content editing by staff without software development skills	Alfresco
Languages		Java, JavaScript, PHP
Server stack		Linux, Apache, Tomcat
Server database		PostgreSQL and POSTGIS



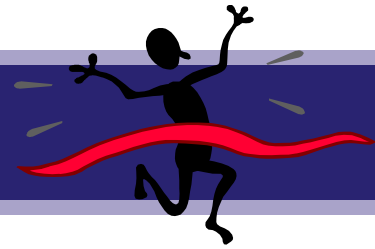
# Architecture



# ncWMS: WMS from netCDF

- ncWMS is a free and open-source server component that produces OGC WMS from scientific data
  - Developer: University of Reading e-Science Centre
  - Reads directly from the netCDF data files
  - Creates animations and graphs
  - CERC contributed code patches that have been adopted in the main trunk of ncWMS

# Project outcome



- Scientific users, including sponsors of rival geoportals, made very generous comments:
  - “Congratulations on the great user interface, a dream.”
  - “The mapping is very useful. The time series are great and very intuitive.”
- Portal code developed by CERC is published as free open-source at [carbones.googlecode.com](http://carbones.googlecode.com)



# Lessons learned



- Need good collaboration between scientists and technologists for a good user interface.
- A custom user interface gives very good results, but requires development resources.
- Open source approach can be very successful.
- Open standards are great!

# Acknowledgements

- CERC would like to thank the CARBONES project co-ordinators Noveltis and the scientific co-ordinator LSCE.
- CARBONES was supported by the European Commission under FP7.

# Conclusion

- And thank **you** for your attention!
- Any questions?

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