

# Oceanography and Ocean Data Assimilation Geospatial Data Grids

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# New technology for data distribution and integration (GRID)

- **What is a “Grid”?**
- **Services on the internet**
  - **Web and Grid Services**
  - **Machine-Machine Communication Standards!**
- **Examples of some large/small Grid Projects**
  - **ESA, Particles Physics, Campus Grids**
- **Environmental Web Services**
  - **Data Sharing: OpenDAP and LAS**
  - **GIS and the Open GIS Consortium (OGC)**
  - **Data viewing tools:- Google Maps/Earth; OpenLayers**
- **Conclusions**

# Grids: a foundation for e-Research

- Integrating technology, enabling a whole-system approach to complex problems

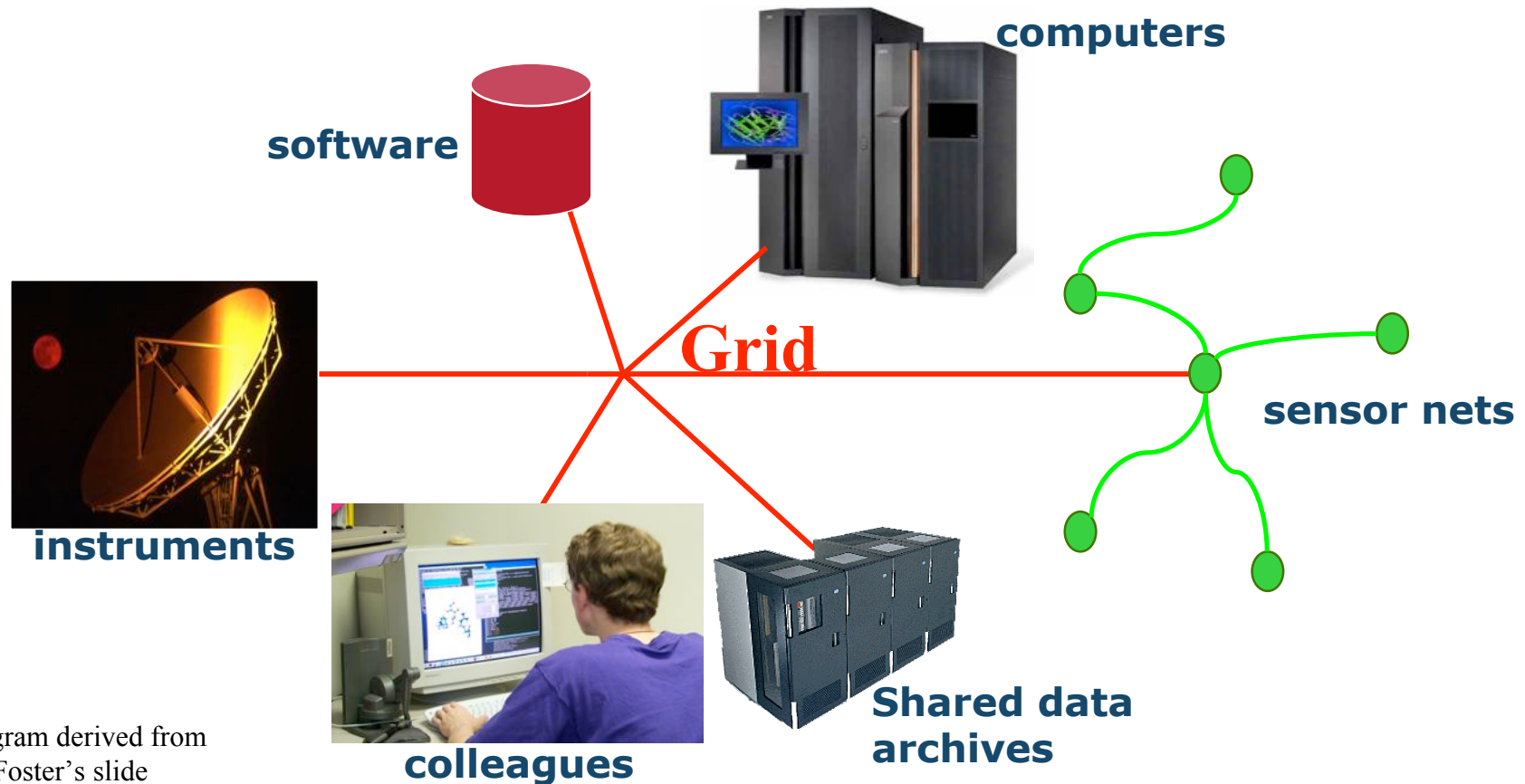


Diagram derived from  
Ian Foster's slide

# Operational example on a Grid

- Authorised Scientist schedules operations on all Resources with single sign on
- Instrument : Makes series of Measurements
- Instrument sends data to Permanent Data Store and to Computer Resource
- Computer resource makes diagnostics and compares with previous data in data store
- Particular result alerts scientist and requests Instrument to make more measurements before resuming normal schedule
  
- Many Grids only involve distributed computing resources and data stores
- Requires secure software for machine-machine communication across internet using Standard protocols

# Web Services

- A Web Service can be thought of as a Subroutine that is available over the internet with an Input and an Output
- The I/O is coded in with a standard protocol called a SOAP message (Simple Object Access Protocol)
- A SOAP message is written in XML eXtensible Markup Language in such a way that it conforms the a **Standard Format WSRF**
- Web Services can be initiated by people providing Input on a web page, but they can also be initiated by other web services or applications running on the internet
- Can therefore string web services together, just like subroutines, in a Workflow. Various tools exist to build complex workflows; [www.trianacode.org](http://www.trianacode.org), [taverna.sourceforge.net](http://taverna.sourceforge.net), BPEL..
- Services are normally managed locally by an Applications server such as Tomcat, JBoss, Jetty, IBM WebSphere, Oracle AppsSer.

# Example of dataQuery Request/Response Soap message

The screenshot shows the SOAP Monitor interface with a SOAP Request and Response for a dataQuery operation. The request and response XML are shown side-by-side. Both the request and response elements are circled in red.

**SOAP Request:**

```
<?xml Version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <ml:dataQuery soapenv:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <dataQueryRequest xmlns="http://schemas.xmlsoap.org/soap/encoding/">
        <overTime xmlns="http://schemas.xmlsoap.org/soap/encoding/">
          <overTimePeriod xmlns="http://schemas.xmlsoap.org/soap/encoding/">
            <start xmlns="http://schemas.xmlsoap.org/soap/encoding/">2005-03-01</start>
            <end xmlns="http://schemas.xmlsoap.org/soap/encoding/">2005-03-31</end>
          </overTimePeriod>
        </overTime>
      </dataQueryRequest>
    </ml:dataQuery>
  </soapenv:Body>
</soapenv:Envelope>
```

**SOAP Response:**

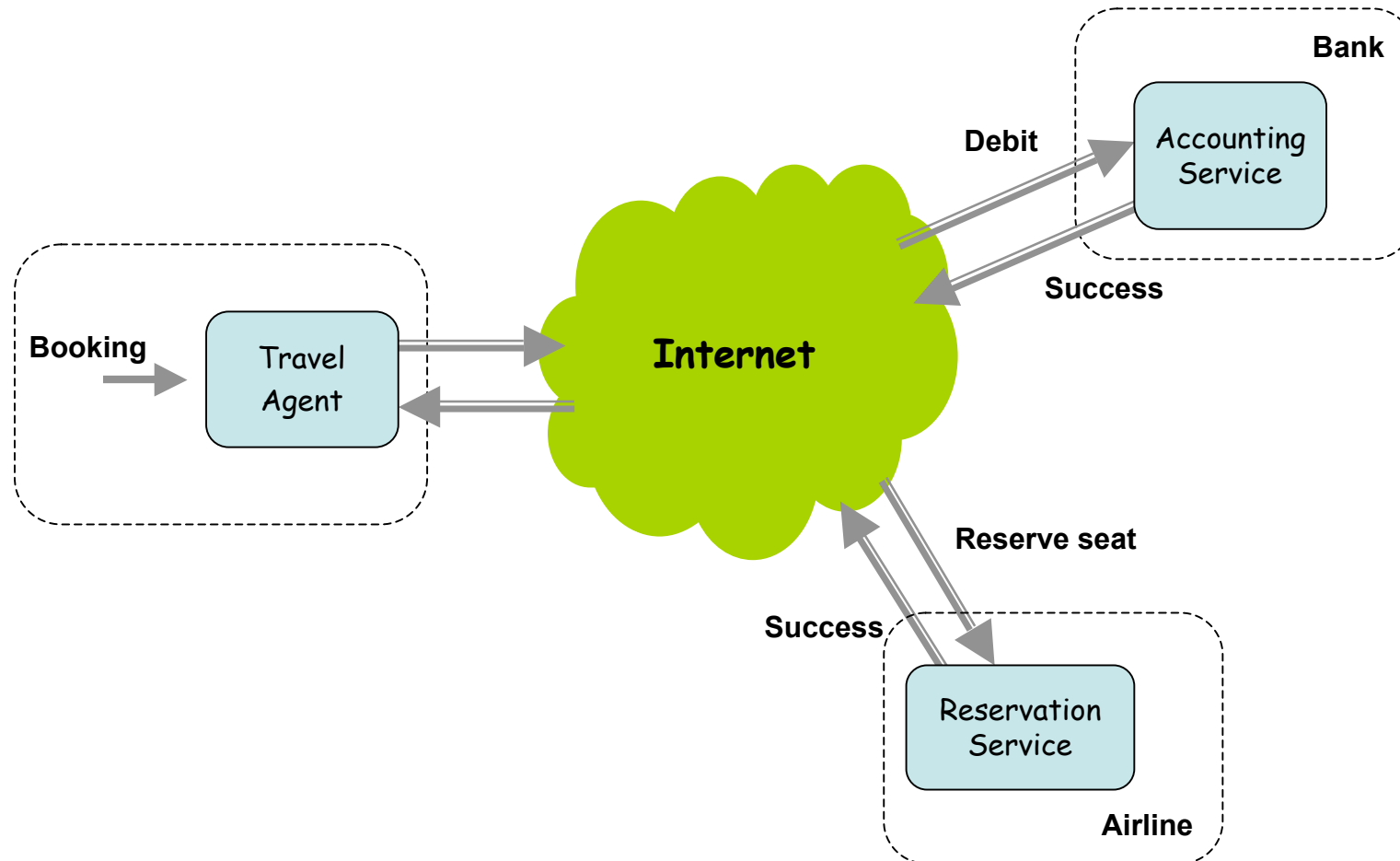
```
<?xml Version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
  <soapenv:Body>
    <ml:dataQueryResponse soapenv:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
      <dataQueryReturn xmlns="http://schemas.xmlsoap.org/soap/encoding/">
        <item soapenc:arrayType="xsd:string[1]">
          <item>Parameter name</item>
          <item>Last Modified</item>
        </item>
        <item soapenc:arrayType="xsd:string[2]">
          <item>FOAR_ONE_KARIBESOFF</item>
          <item>2005-03-31</item>
        </item>
        <item soapenc:arrayType="xsd:string[2]">
          <item>FOAR_ONE_DEGREE</item>
          <item>2005-10-28</item>
        </item>
        <item soapenc:arrayType="xsd:string[2]">
          <item>HERSEL_RATS_ANAL</item>
          <item>2005-03-08</item>
        </item>
        <item soapenc:arrayType="xsd:string[2]">
          <item>FOAR_FLUX_ANAL</item>
          <item>2005-03-08</item>
        </item>
        <item soapenc:arrayType="xsd:string[1]">
          <item></item>
        </item>
      </dataQueryReturn>
    </ml:dataQueryResponse>
  </soapenv:Body>
</soapenv:Envelope>
```



# Web Services

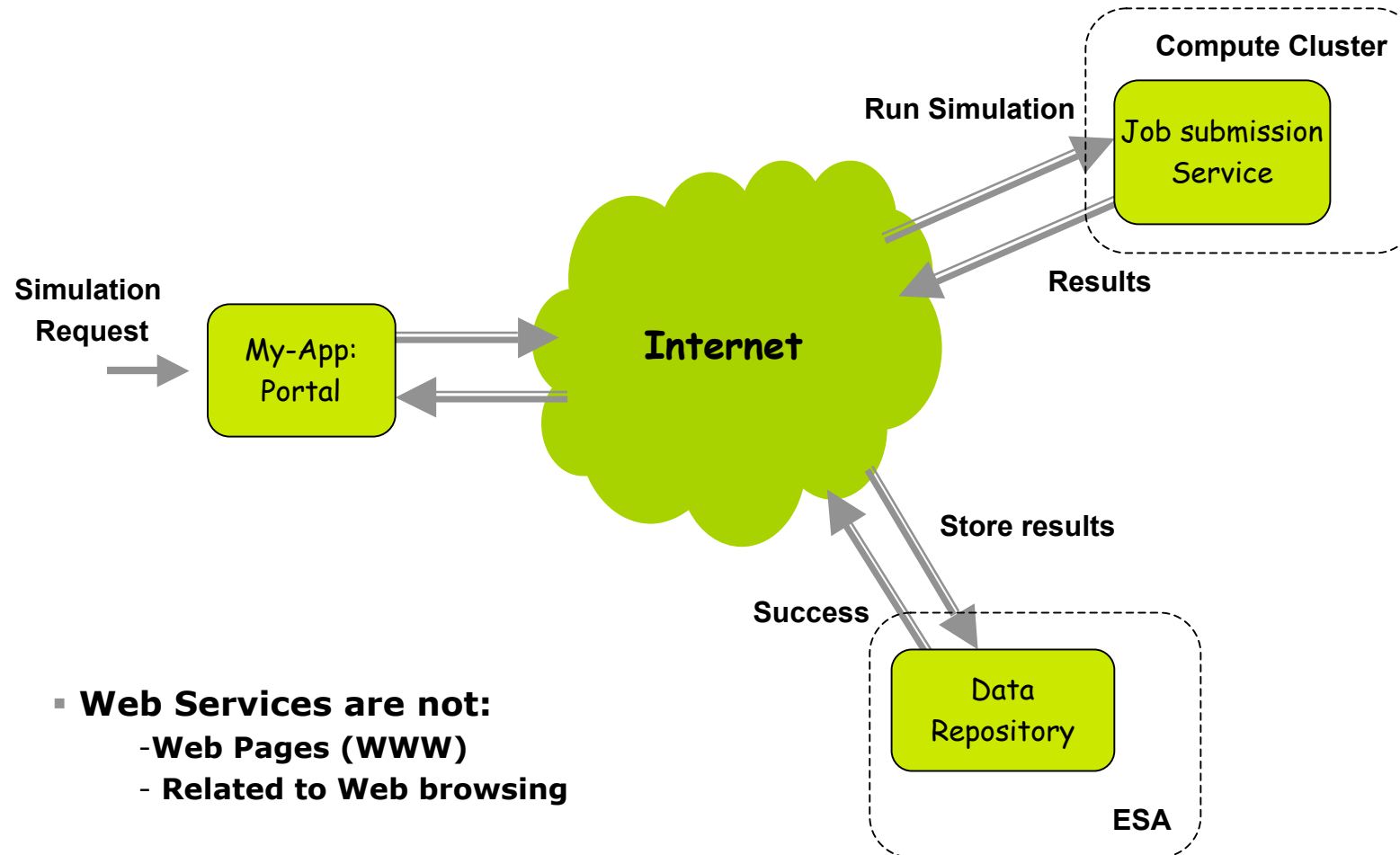
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- Services are normally managed locally by an Applications server such as Tomcat, JBoss, Jetty, IBM WebSphere, Oracle AppsSer.

# Web Services in e-Business





# Web Services in e-Science



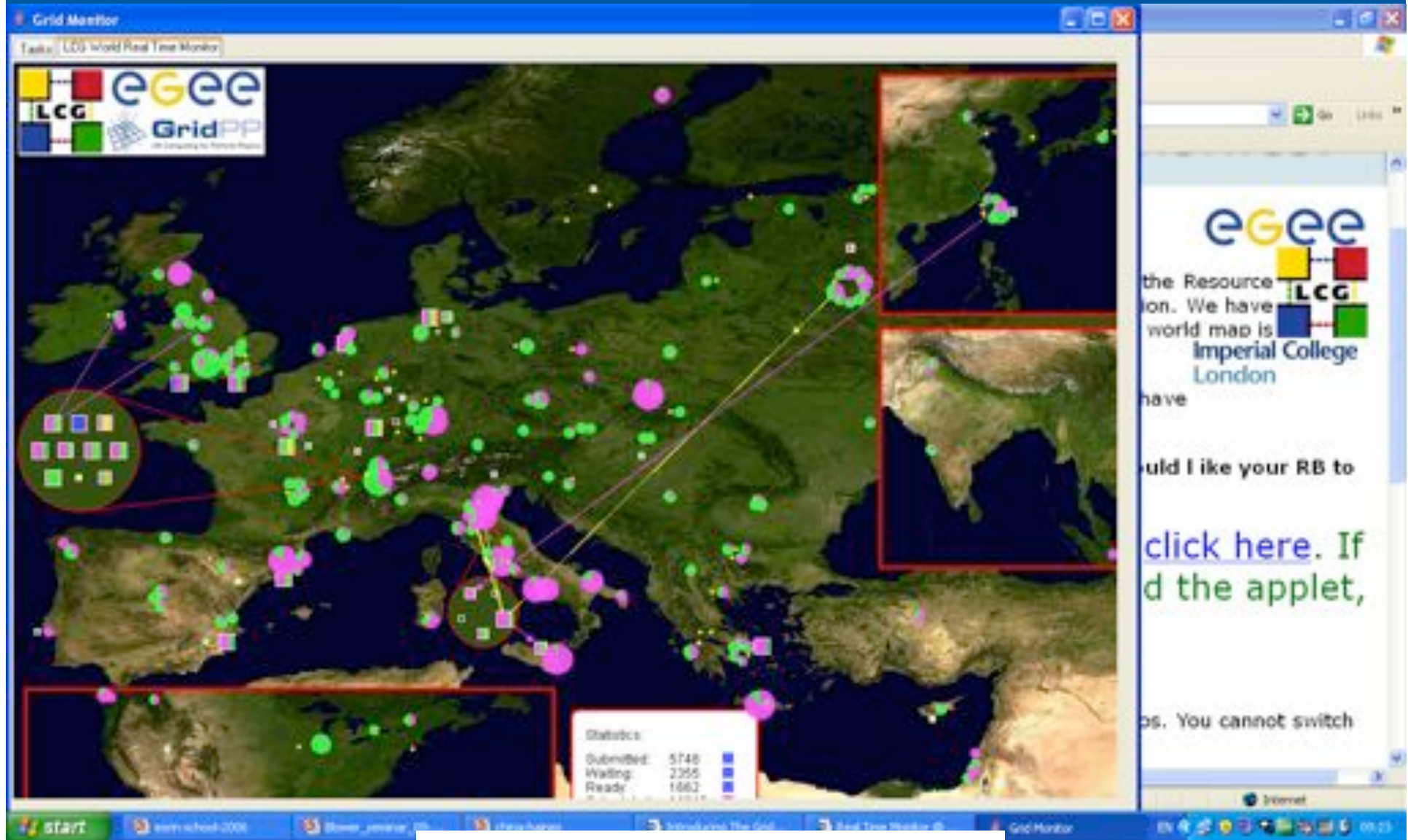
# Web Services

- Web Services may
  - Provide metadata, data
  - Do some computations
- May require some **Security** on Web Services (who uses them, how much resource is requested/available). Standards WS-Security
- WS originally designed for Business use => limitations
- XML based Communication method not suitable for large I/O
  - Work around eg. by passing URL links to large I/O data volumes
- Web Services designed for instant responses. Not suitable for significant computing or “Batch mode” tasks
- Solution => Grid Services which are Web Services with “State”
  - Can therefore request information on how far they’ve got

# Web and Grid Services

- Web and Grid Services are the basic building blocks of a “Grid” which is a set of distributed resources that can interoperate
- Key issue is Standards for machine-machine communication
  - Standards take a long time to agree upon (ISO)
  - Big computer companies have had tendency to try to set their own standards to lock users in
- Most “Grids” and Grid Service “middleware” packages are designed around access to computational resources, eg HPC, Compute clusters, Disk space, Databases
  - Big Science users are Particle Physics Community who plan to analyse LHC data on a global Grid from 2007 onwards
- Biggest problems in setting up a Computational Grid revolve around security => Digital certificates, **Globus toolkit**, Not so user friendly, g-Lite, other solutions eg. Inferno....

# Particle Physics Grid for LHC



# EU Grid project

Welcome to EGEE [Enabling Grids for E-science] - EGEE Project Portal - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://www.eu-egee.org/

Google egee

Home

Register as a Community Member | Login

## Welcome to EGEE (Enabling Grids for E-science)

The Enabling Grids for E-science project brings together scientists and engineers from more than 90 institutions in 22 countries world-wide to provide a seamless Grid infrastructure for e-Science that is available to scientists 24 hours-a-day. Conceived from the start as a four-year project, the second two-year phase started on 1 April 2006, and is funded by the European Commission.

Expanding from originally two scientific fields, high energy physics and life sciences, EGEE now integrates applications from many other scientific fields, ranging from geology to computational chemistry. Generally, the EGEE Grid infrastructure is ideal for any scientific research especially where the time and resources needed for running the applications are considered impractical when using traditional IT infrastructures.

The EGEE Grid consists of over 20,000 CPU available to users 24 hours a day, 7 days a week, in addition to about 5 Petabytes (5 million Gigabytes) of storage, and maintains 20,000 concurrent jobs on average. Having such resources available changes the way scientific research takes place. The end use depends on the users' needs: large storage capacity, the bandwidth that the infrastructure provides, or the sheer computing power available.

### EGEE'06 CONFERENCE 25-29 September 2006, Geneva, Switzerland



CALL FOR ABSTRACTS NOW OPEN

#### Latest News

On July 14, 2006 the Institute of Physics in Belgrade (IPB) and its Scientific Computing Laboratory were hosts to high level delegations from EU Directorate General for Research, headed by Janez Potočnik, Commissioner for Research, and from the Ministry of Science of Serbia, headed by Aleksandar Popović, Minister of Science.

[Read more](#)

#### Try the GRID

[Click here](#)

#### Become a User

Want to become a user of the EGEE Grid? [Click here](#)

#### FAQ

For the Project FAQ, [click here](#)

#### Contact EGEE

Get in touch with the EGEE Project Office at [projectoffice@eu-egee.org](mailto:projectoffice@eu-egee.org). If you have questions about the

# UK National Grid Service



# The many scales of grids

International instruments,..

International grid (EGEE)

National datacentres,  
HPC, instruments

National grids (e.g.  
National Grid Service)

Wider collaboration  
greater resources

Regional grids (e.g.  
White Rose Grid) 3 UK  
Universities.

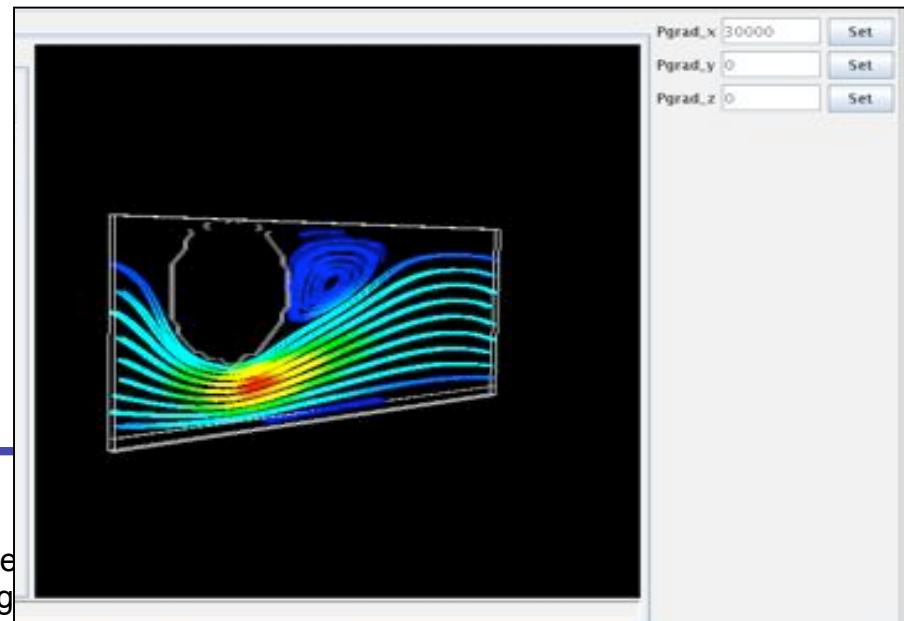
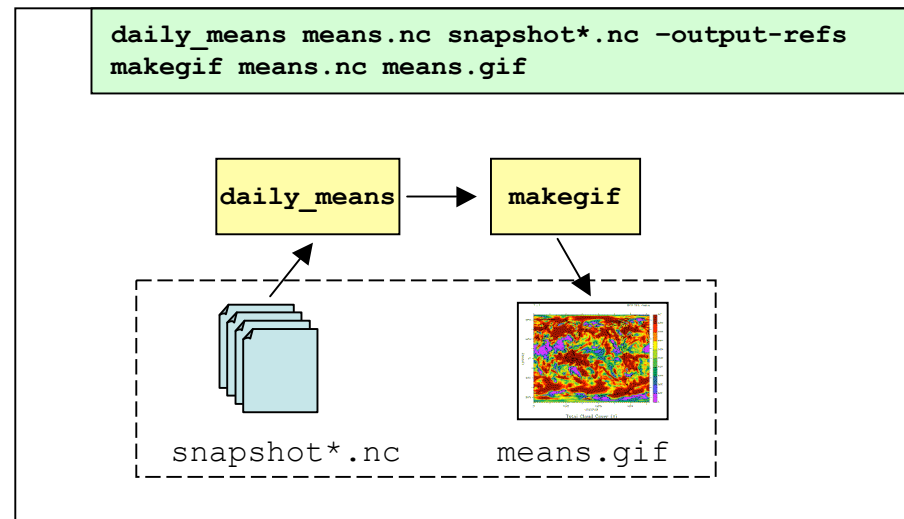
Institutes' data;  
Condor pools,  
clusters

Campus grids

Desktop

# Styx Grid Services

- Easy-to-use, lightweight middleware for e-Science
- 5-minute installation
- Can expose existing executables as services
- Run them from the command line exactly as if they were local programs
- Create workflows with simple Unix-type shell scripts (above right) over distributed network using ssh security
- Been used for computational steering and collaborative visualization (below right)
- Blower et al 2006  
[www.resc.reading.ac.uk](http://www.resc.reading.ac.uk) publics.  
<http://jstyx.sf.net>





# Environmental Web and Grid Services?

- Big problems in Environmental science revolve around Large and diverse data sets; In Situ, Satellite Observations, Model Output
- Need Standards to manage large geospatial data sets, in particular standards for METADATA; eg. Data Type, Provenance and Geospatial and Temporal structure
- ESA runs a “Grid on Demand”
  - Processing resources to provide client tailored ESA satellite data
  - Open call for Users
- UK has sponsored a number of “Environmental e-Science” projects
  - ClimatePrediction.net
  - NERC DataGrid
- Visualisation of Environmental data on the Internet
  - LAS/OPenDAP, GODIVA/GADS, OpenGIS, Google Earth, OpenLayers

Earth Observation GRID on Demand: - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://eogrid.esrin.esa.int/

Google Grid on Demand

esa Grid on-Demand

Earth Observation GRID

Not logged Last updated: 15 April 2006

Welcome to services page of European Space Agency (ESA) Grid on-Demand Services and Infrastructure (GOID) for Earth Observation Applications.

The ESA GRID integrates high-speed connectivity, distributed processing resources and large volume of data to provide science and industrial partners with improved access to and products. This portal offers access to, and support for, science-oriented Earth Observation GRID services and applications, including access to a number of global geophysical ENVISAT products.

Full story +

Measuring the Vegetation Change in Europe

The ENVISAT MERIS (Medium Resolution Imaging Spectrometer Instrument) Global Vegetation Index (MGI) was designed to assess and monitor the state and health of terrestrial vegetation using MERIS measurements acquired in space (at the so-called 'top of atmosphere').

Using the blue, red and near-infrared spectral bands of MERIS, as well as information on the angular geometry of illumination and observation, this algorithm was optimized to deliver the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) in terrestrial plant canopies.

The FAPAR is used as an indicator of the state and productivity of vegetation and has been recognized as a fundamental surface parameter for environmental studies by international organizations. This quantity represents the fraction of the solar energy which is absorbed by vegetation and therefore plays the role of a battery during the plant photosynthesis process.

The Grid on-Demand Services and Infrastructure generates maps of MGI for Europe on a monthly basis with a Time Composite Algorithm which selects, for each location, the value of MGI actually measured during the period that is the closest to the temporal average over the compositing period for that location.


Luigi.Fusco@esa.int

ESA EO Principal Investigator Portal - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://exp.esa.int/esa/esa/e=IDUWAdPge0k2m2m0u9mthol5v5hAofTDUFWG6mG

Google Search



**31-Jul-2006 07:11** Contact us

Exploitation Results & News	EO Grid Processing on Demand	G-POD
<ul style="list-style-type: none"> <li>Results</li> <li>News</li> <li>Search</li> <li>Focus on PI</li> <li>Round table</li> <li>AD Submission</li> <li>Call 1 &amp; Open Ads</li> <li>Category 1 PI</li> <li>G-POD</li> <li>TM</li> <li>Previous ADs</li> <li>Update &amp; Reporting</li> <li>Services</li> <li>About this site</li> <li>ESA Data Policy</li> <li>FAQ</li> <li>Related Links</li> <li>How to get ESA data</li> <li>HOME</li> </ul>	<p>Welcome to the submission area for Category-1 data users on the Earth Observation GRID Processing on Demand environment</p> <p>ESA is offering all scientists with the possibility to perform bulk processing and/or validation of their own algorithms exploiting the large ESA earth-observation archive together with ESA available GRID computing and dynamic storage resources.</p> <p>The deadline for proposal submission is 1st September 2006.</p> <p>A maximum of 10 proposals will be selected for implementation in the frame of this Call.</p> <p><a href="#">Invitation letter</a></p> <p><a href="#">Call for Proposals</a></p> <p><a href="#">Terms and Conditions for the utilisation of data under the ESA Category-1 systems</a></p> <p><a href="#">Qualities for the submission of proposals</a></p> <p><a href="#">Proposal Submission</a></p> <p><a href="#">More about G-POD</a></p> <p>Contact the <a href="#">ESA EOPI@esa.int</a> and <a href="#">Outlet Desk</a> for further information.</p>	

start | search school 2006 | Home\_januar\_200... | File names | GOCDNO | GOCDNO\_2006\_06... | ESA EO Principal Inve... | 14:07

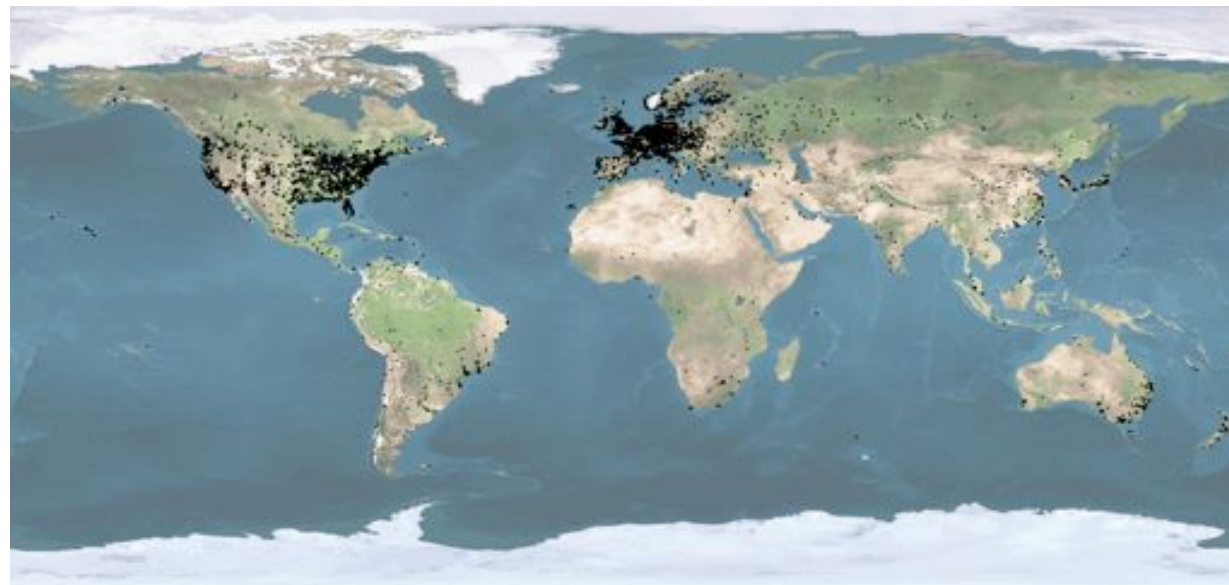


climateprediction.net



- **Distributed Global Collaborations**

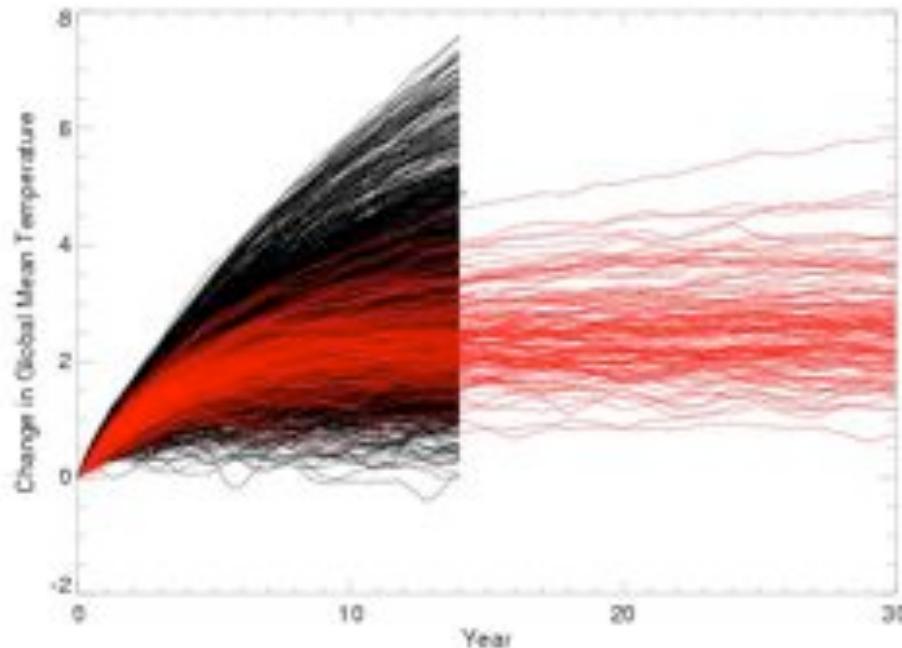
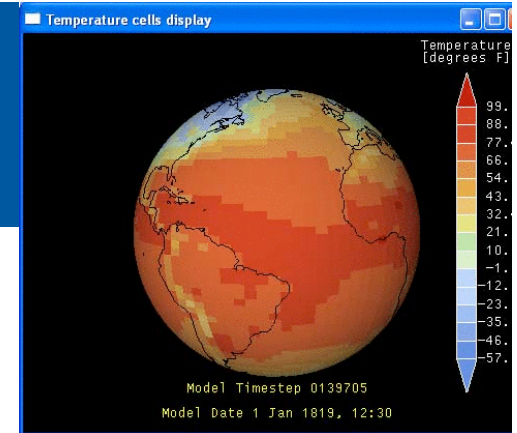
- Hadley climate model cut down to run on single PC (cf. Seti@home)
- 105,000 people from 150 countries have donated 10,000 years of computing time to undertake climate change experiments.





climateprediction.net

- Over 2,500 simulations over a 45 year period showed a possible temperature increase of 2 - 11°C by




- **Results from 2,579 15 year runs by climateprediction.net**
- **Results from 127 30 year runs of the Hadley model on the Met Office supercomputer**

http://boinc.berkeley.edu - BOINC - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites RSS Feeds Print Print with Pictures Stop

Google BOINC Search AddLink Options BOINC



# BERKELEY OPEN INFRASTRUCTURE FOR NETWORK COMPUTING

BOINC is free, open-source software for **volunteer computing** and desktop grid computing.


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## Volunteer


Use the idle time on your computer (Windows, Mac, or Linux) to do all sorts of scientific research:

1. **Choose projects**
2. **Download** and run BOINC software
3. Enter the projects' URLs, your email address, and password.

[Details](#) | [Download](#) | [Web sites](#) | [Add-ons](#) | [Survey](#)

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**csbyseti** is contributing 63 GigaFLOPS  
country: Germany | team: SETI.Germany



25.5%

- Rosetta@home
- Einstein@Home

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## News

July 26, 2006  
**Chess960@home** is open for testers. This project studies a game that is like classical chess except that the initial configuration of pieces is chosen randomly from among 960 possibilities.

July 25, 2006  
Welcome to three new BOINC-based projects. Two are mathematical: **Riesel Sieve** looks for prime numbers of the form  $k2^n-1$ , and **Rectilinear Crossing Number** studies a problem in computational geometry. The third, **SpinHenge@home**, studies molecular magnets and controlled nanoscale magnetism, which may have applications in medicine and biotechnology.

July 27, 2006

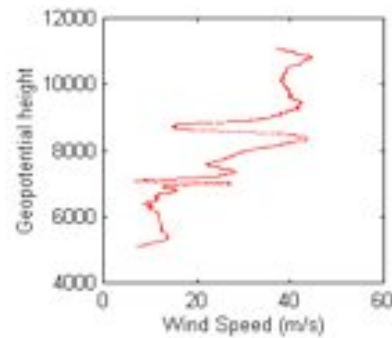
# NERC Data Grid (NDG)



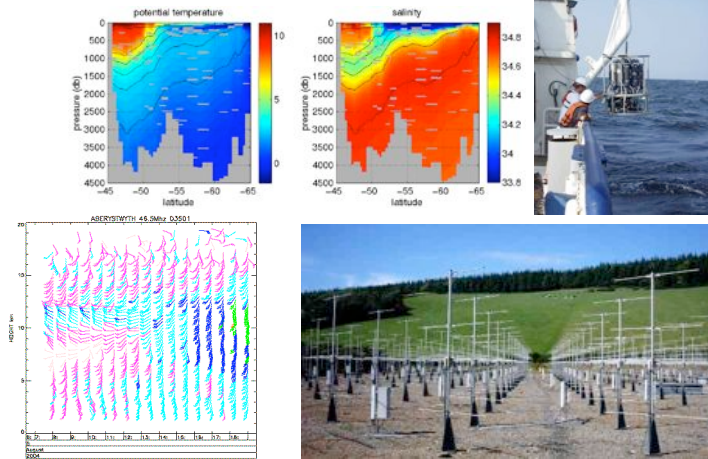
- NERC e-Science project led by British Atmospheric Data Centre (BADC)
- Developing software for data **discovery** and **delivery**
- Data will be distributed between NDG and other groups (NDG won't hold everything)
- Vast diversity of data types (all NERC data!)
- Rigidly standards-based (ISO)
  - Metadata is all-important: enables data discovery
  - Have created CSML (Climate Science Markup Language) – describes 7 feature types
- Producing whole array of **OGC-compliant Web Services**
  - Key task is to add proper security

# Climate Science Markup Language CSML

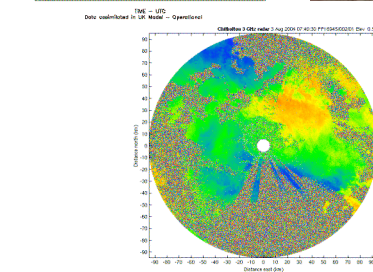
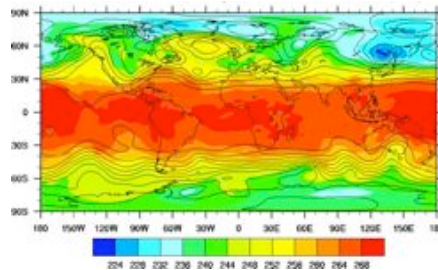
## ProfileFeature



## ProfileSeriesFeature



## GridFeature





# Visualising Environmental Data on the Internet

- Live Access Servers
- GODIVA Project
- Geographical Information Systems GIS
- OpenGIS Consortium (OGC) Standards
- Google Maps and Google Earth
- Open Source Counterparts

# Live Access Server

**Live Access to USGODAE Data**

Search:

Variable(s): temperature

Select your desired view (geometry of output) and output (type of product). Then set the 4-D region (lon-lat-depth-time) and any additional constraints.

Select view: Longitude/Latitude map (xy)

Select output: Color plot

Select region: Full Region

Select time: 01 Aug 2006

Select depth: 75

Select options:

- Image format: Default
- Plot size: default
- View interpolation: Off
- Show reference map: Default
- Evaluate expressions:
- Level fill style: Default

**Widely used in Climate Community (esp. US)**

**Uses OPenDAP/DODS for data exchange. URL coded interface to NetCDF files. Aggregates across files**

**Uses Ferret for graphics  
1d Graphs  
2d Sections or Maps**

**Used by EU Mersea project**

**Not easy software to run/modify**

# Mersea: NE Atlantic ThEmatic Portal (TEP)



- In UK NCOF (National Centre for Ocean Forecasting) responsible for NE Atlantic Forecasting and Services within Mersea
- Range of models from 1/8° to 1 nm
- OPenDAP Server with 7 day forecasts
- Central Mersea Live Access Server
- Development and presentation of Application Services during EU ECOOP

**Thematic Portals**

Thematic Portals	Ocean Modelling Systems	Operator
North-East Atlantic DATA	Foam - Polcoms	NCOF United Kingdom

**North-East Atlantic**

Sea surface temperature from the NCOF FOAM 1/8 degree ocean model. The upper right box forms the MERSEA NE Atlantic TEP area

**THREDDDS Catalog for: ESSC FOAM MERSEA OPenDAP Aggregation Server**

**Dataset:**

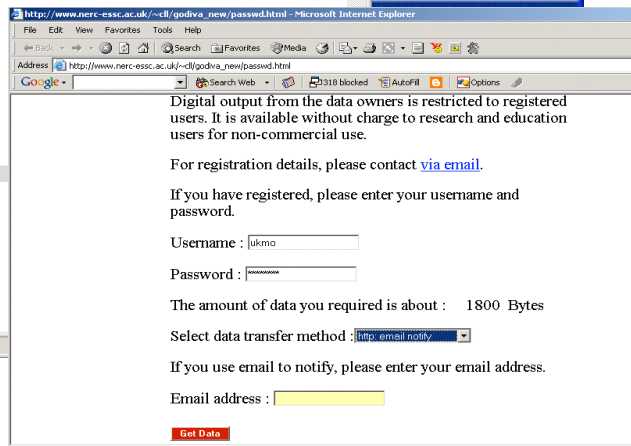
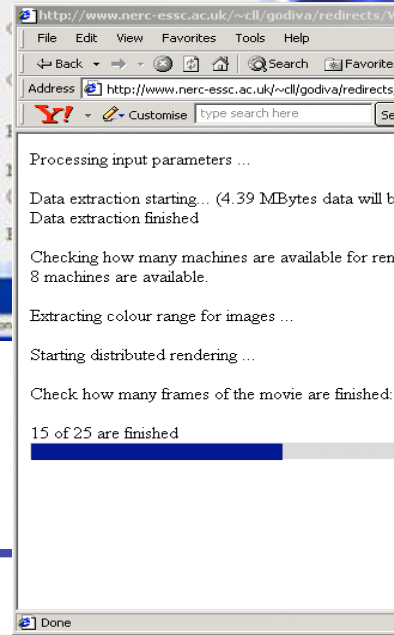
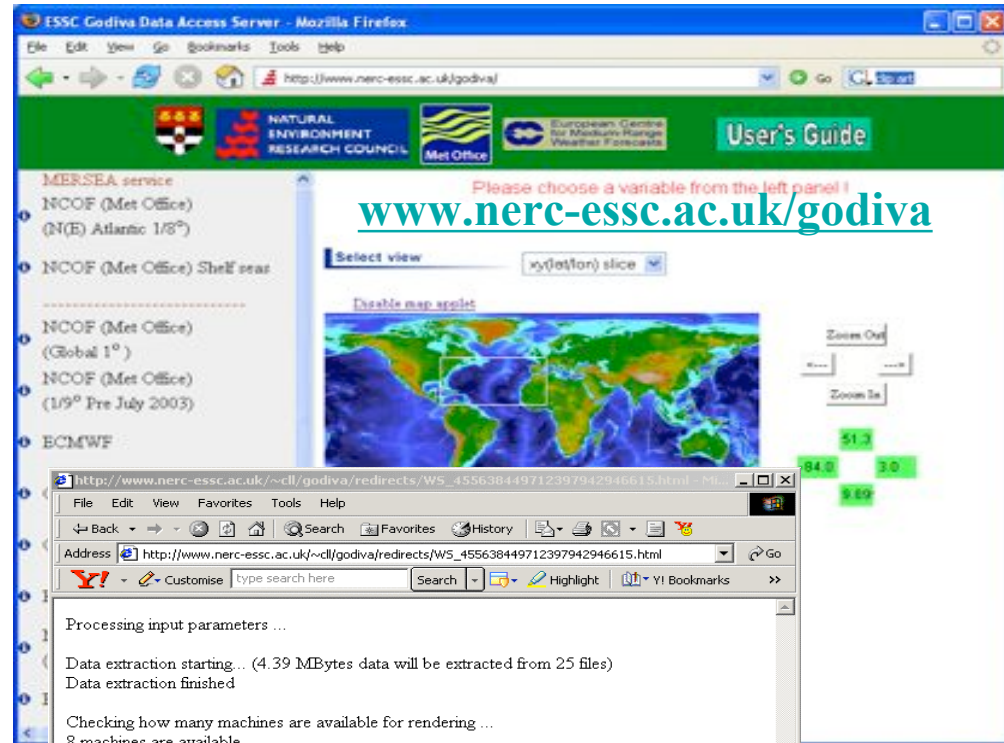
- CLASS 1:
  - Mediterranean Sea (MED):
    - MSSH: [DDS DAS Information Data Request Form](#)
    - Best Estimates: [DDS DAS Information Data Request Form](#)
    - Today's Best Estimates: [DDS DAS Information Data Request Form](#)
    - Forecasts (+120 h): [DDS DAS Information Data Request Form](#)
    - Today's Forecast (+120h): [DDS DAS Information Data Request Form](#)
  - North Atlantic Ocean (NAT):
    - MSSH: [DDS DAS Information Data Request Form](#)
    - Best Estimates: [DDS DAS Information Data Request Form](#)
    - Today's Best Estimates: [DDS DAS Information Data Request Form](#)
    - Forecasts (+120 h): [DDS DAS Information Data Request Form](#)
    - Today's Forecast (+120h): [DDS DAS Information Data Request Form](#)
- CLASS 2:
  - Mediterranean Sea Sections:
    - Best Estimates (Section 1): [DDS DAS Information Data Request Form](#)
    - Best Estimates (Section 2): [DDS DAS Information Data Request Form](#)
    - Best Estimates (Section 3): [DDS DAS Information Data Request Form](#)

[www.nerc-essc.ac.uk/ncof/mersea](http://www.nerc-essc.ac.uk/ncof/mersea)

# GODIVA Project

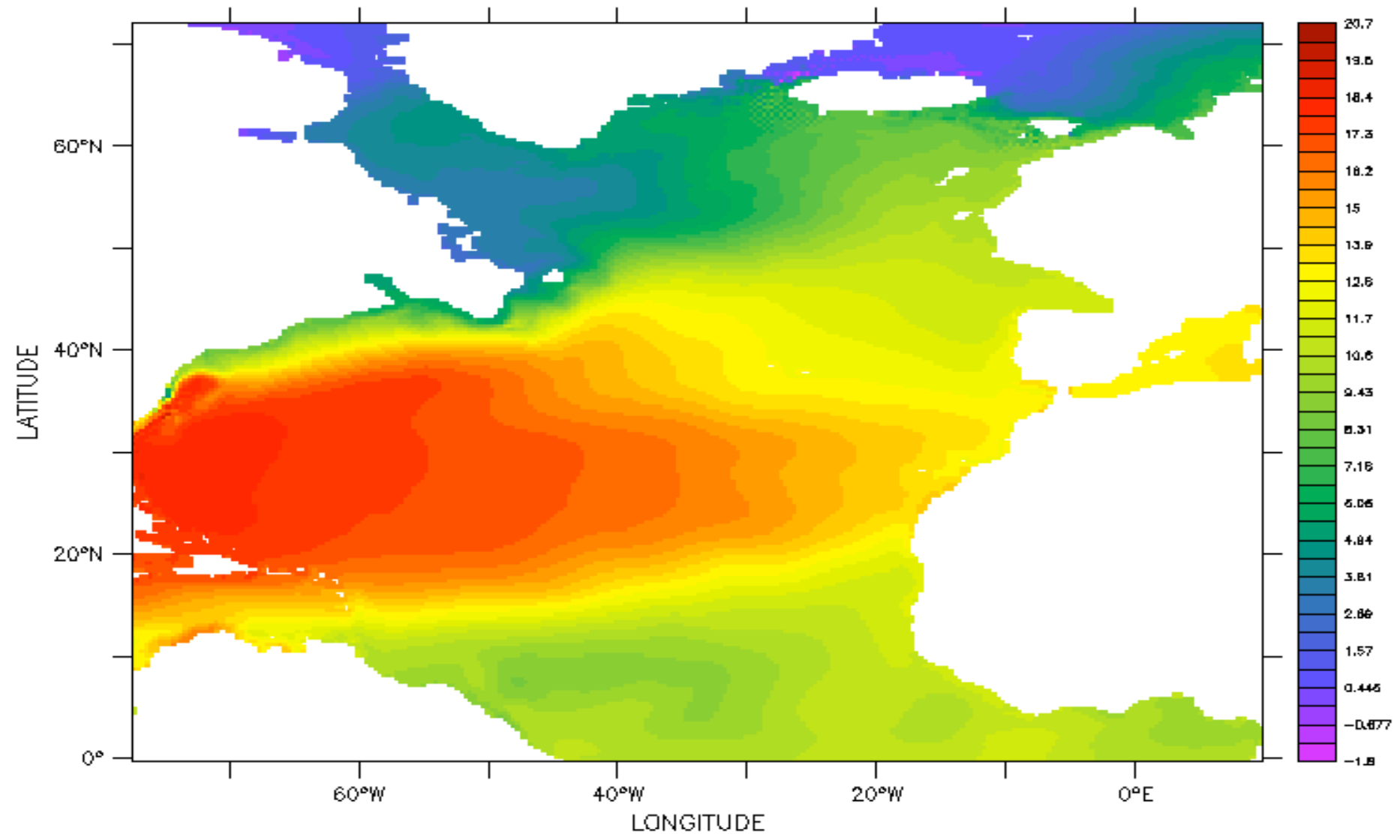


- The GODIVA Web portal provides a graphical interface to data at Reading Univ.
- Web Service GADS (Grid Access to Data) instead of OPenDAP, Woolf et al (2003)
- Access to Operational Met Office ocean forecasts (last 5 years)
- Users can make simple visualisations
  - pictures and movies (uses Grid computing)
  - Secure data download
  - GADS WS can be accessed directly by third party software



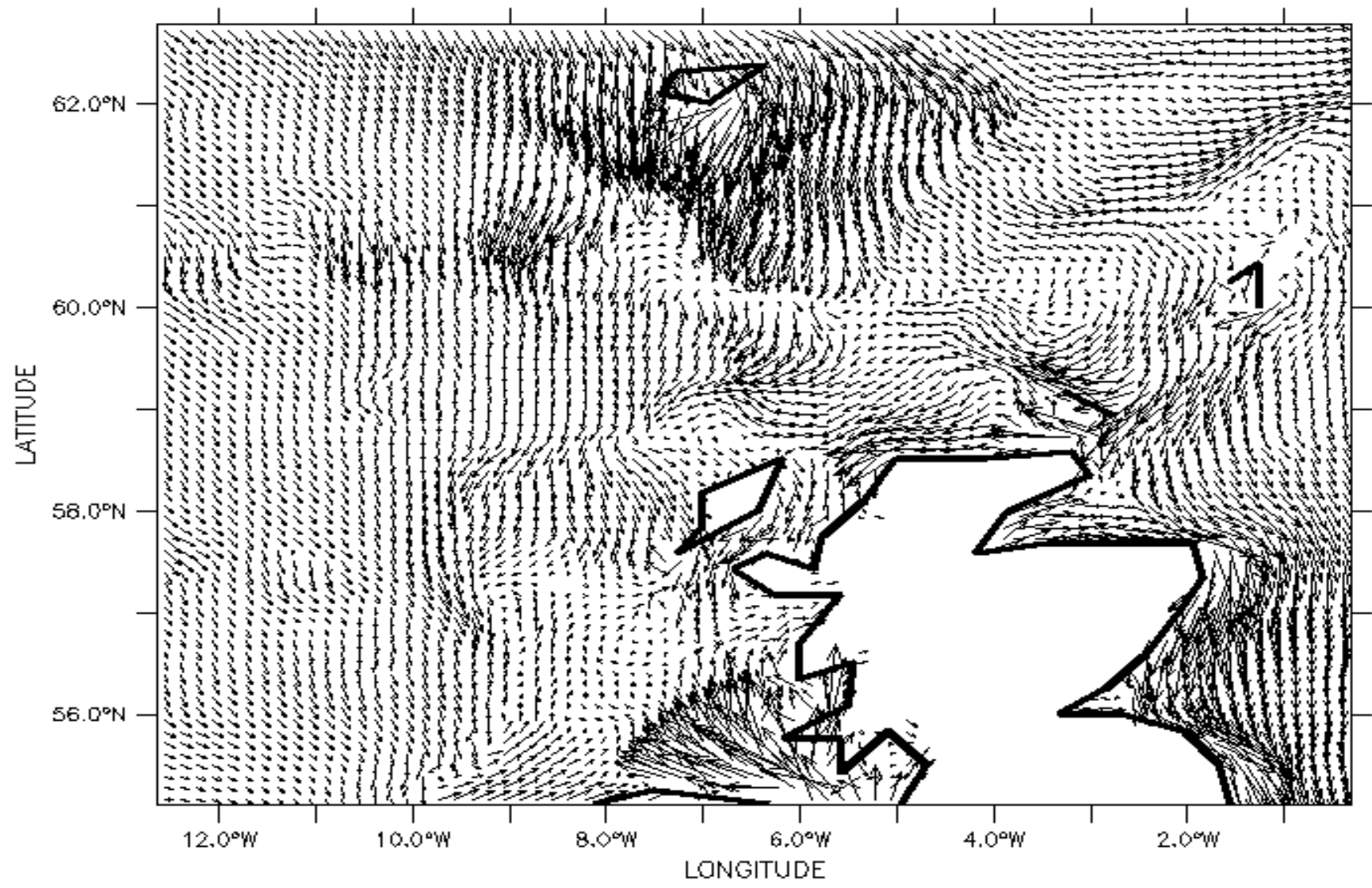
DEPTH (m) : 325.8

TIME : 30-OCT-1991 00:00 DATA SET: WService.b60ff58b20847fa064dab5c4544dc54a.nc



SEA\_WATER\_POTENTIAL\_TEMPERATURE (C)

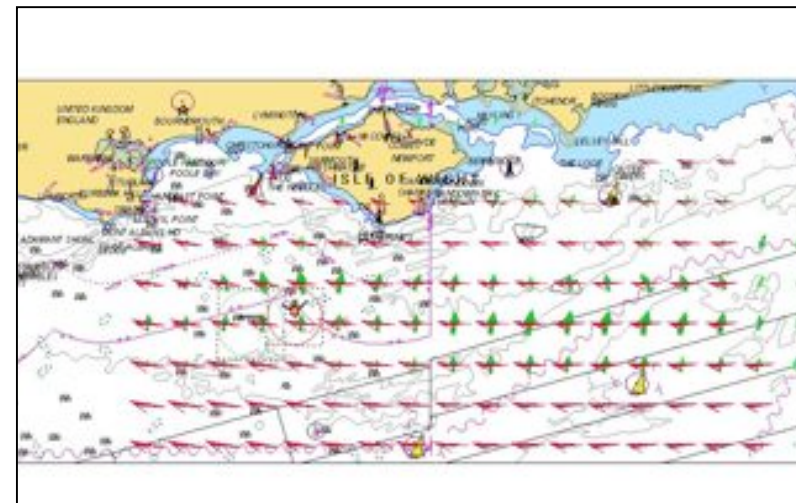
TIME : 10-FEB-2006 01:00



U vs V cm/s  
→ 100.

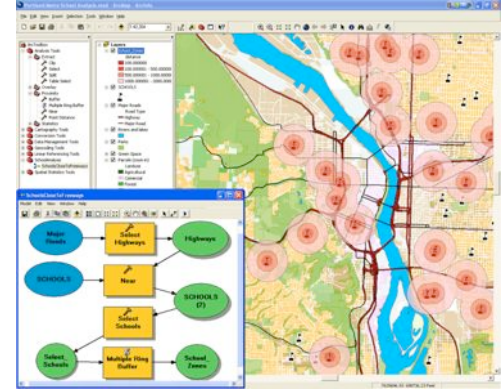
# GADS application: Search and Rescue

- British Maritime Technology produce software (SARIS) to help the Coastguard with Search and Rescue
- Predicts drift patterns of people and objects that have fallen overboard
  - This significantly cuts the time to rescue
- Have worked with BMT to produce prototype that uses **live Met Office data from GADS** to improve its predictions
  - Uses forecasts of surface winds and surface currents
- Can also be applied to oil spills



# Geographical Information Systems (GIS)

- Many companies produce GIS software for manipulating and visualizing geographical data
  - e.g. ArcInfo, Mapitude, many more
  - Big business!
- Very sophisticated and powerful
  - Spatial statistics, geoprocessing, mapping...
  - e.g. identify high-risk flood zones, assess effectiveness of ambulance centres etc...
- Historically very map-oriented (2-d or “2.5d”)
  - Hence not so useful in ocean/atmosphere sciences (need 4-d)
- Vendors typically used proprietary formats and interfaces
  - Users “locked in” to a particular vendor, hard to share information
- The **Open Geospatial Consortium (OGC)** is addressing these issues





# OGC Web Services



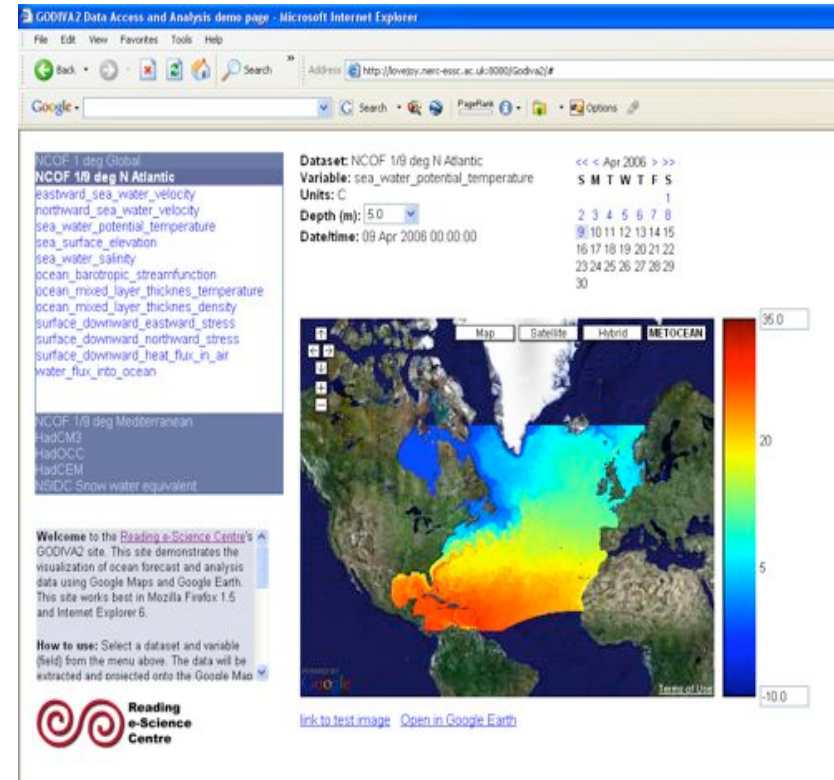
Web Service	Purpose
Web Map Server (WMS)	Serves map <b>images</b> (cf. Streetmap, Multimap)
Web Feature Server (WFS)	Serves geographical <b>features</b> (roads, rivers, hospital locations etc)
Web Coverage Server (WCS)	Serves multidimensional <b>data</b> (e.g. numerical model output)
Web Processing Server (WPS)	<b>Processes</b> data
Lots more in pipeline!	

(roughly in decreasing order of maturity)  
Services can be composed to create a distributed  
geospatial  
application

# The GODIVA2 Server



- Web Portal for Google Maps/Earth linked to GADS library
- Renders images from gridded NetCDF data
- Overlay data from different URLs in same image
- Highly interactive (pan & zoom)
- Only Mercator projections (Google maps)
- Loads javascript from Google site (API may change)
- Developing projects with
  - National Centre for Ocean Forecasting NCOF
  - EU Mersea (GMES Op. Oceanog.)
  - UK Hydrographic Office (Charts)
  - BMT Commercial Maritime Services

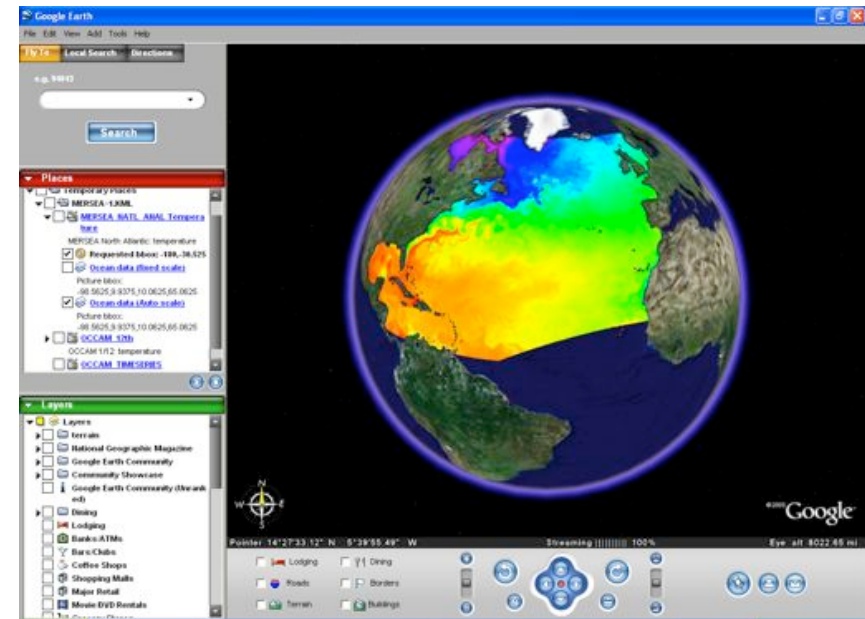


<http://lovejoy.nerc-essc.ac.uk:8080/Godiva2>

# Google Earth



- Can initiate from GODIVA2 portal
- Free closed-source executable for Windows, Mac, Linux
- Multiple GIS Overlays
- Reads images using KML metadata Examples
- Only Plate Carrée images
- Support for vector and raster data
- Support for vertical display increasing
- No support for time dimension
- Can add new datasets but currently can't change .exe



- But what about completely OpenSource licence software?

# Example of a KML file

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://earth.google.com/kml/2.0">
<GroundOverlay>
  <description>Overlay shows Mount Etna erupting on
    July 13th, 2001.</description>
  <name>Large-scale overlay on terrain</name>
  <Icon>
    <href>http://bbs.keyhole.com/ubb/z0302a1700/etna.jpg</href>
  </Icon>
  <LatLonBox id="khLatLonBox751">
    <north>37.919</north>
    <south>37.465</south>
    <east>15.358</east>
    <west>14.601</west>
    <rotation>0</rotation>
  </LatLonBox>
</GroundOverlay>
</kml>
```

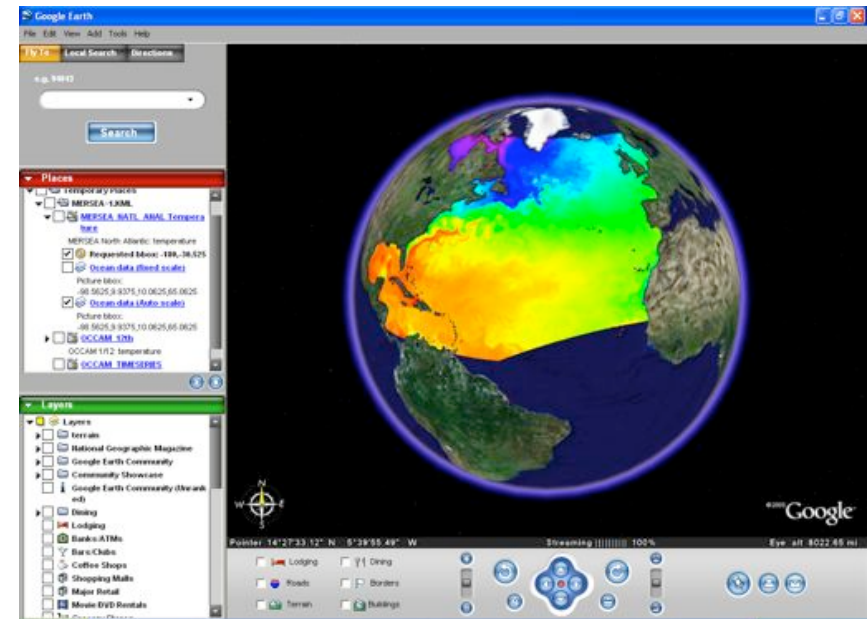
# DAMOCLES Ice Buoys in Google E



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# An OpenSource version of Google Maps



OpenLayers: Home - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://www.openlayers.org/

OpenLayers

Home Support & Development

Wiki Tutorial Download Gallery Email Links

## Get OpenLayers Now

Latest stable release: OpenLayers-1.0 for gz | [Link to the hosted version](#) | [See Screenshots](#)

## About...

OpenLayers makes it easy to put a dynamic map in any web page. It can display map tiles and markers loaded from any source. MikiCzika developed the initial version of OpenLayers and gave it to the public to further the use of geographic information of all kinds. OpenLayers is completely free, Open Source Javascript, released under the BSD Licence.

## Put a map in your page.

We've released a Map Viewer Service that lets you put a map in your page easily. Just put this HTML in your page:

```
<iframe src="http://openlayers.org/viewer/"
width="400px" height="400px"
scroll="no"
margin="0px" style="border: none;"
></iframe>
```

Read more examples in the 20-second tutorial. The visual appearance of the MapViewer is not yet stable. If you like it, please join the users' email list and tell us about your use.

## For Developers!

OpenLayers is a pure Javascript library for displaying map data in most modern web browsers, with no server-side dependencies. OpenLayers implements a (still-developing) Javascript API for building rich web-based geographic applications, similar to the Google Maps and MSN Virtual Earth APIs, with one important difference – OpenLayers is Free Software, developed for and by the Open Source software community.



World Map  
Satellite  
Layers

**Put an open map widget in any web page!**  
Double-click to zoom in, and drag to pan. Hold down the shift key and drag to zoom to a particular region.

Internet

start | www.school-2008 | www.journal\_20-0... | File names | OpenLayers Home - ... | goCNO | goCNO\_2008\_v1-... | 0N | 13:08

- ESSC Web Map Server
  - gib\_allev\_day10\_000303.nc
  - FOAM\_20050422\_0.nc
  - 20060511-UKMO-L4Uhfnd-GLOB-v01.nc
  - POLCOMS\_MRCS\_NOWCAST\_20060731.nc
    - sea\_water\_salinity
    - sea\_water\_potential\_temperature
    - eastward\_sea\_water\_velocity
    - northward\_sea\_water\_velocity
  - MET OFFICE FOAM GLOBAL 1 DEG DATA

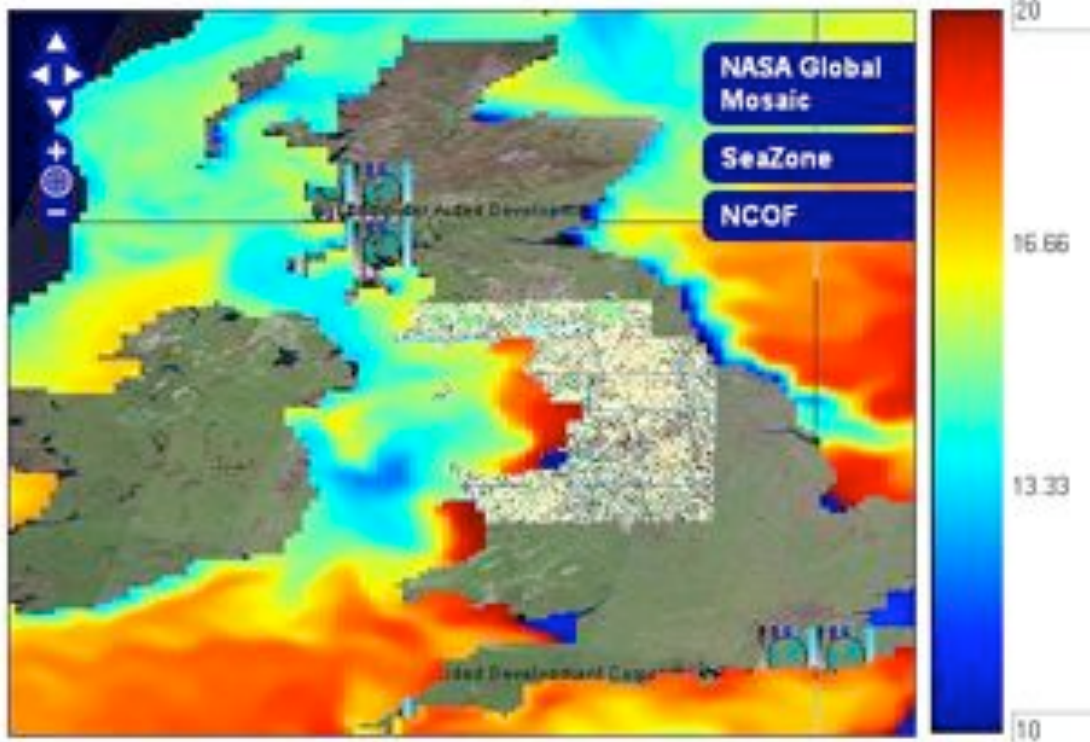
Layer set: POLCOMS\_MRCS\_NOWCAST\_20060731.nc  
 Layer: sea\_water\_potential\_temperature (C)  
 Elevation: -5.0 m  
 Datetime:



**Reading  
e-Science  
Centre**

Welcome to the [Reading e-Science Centre's](#) GODIVA2 site. This site demonstrates the visualization of ocean forecast and analysis data using Google Maps and Google Earth. This site works best in [Mozilla Firefox](#) but also works in most modern browsers such as Internet Explorer 6.0 and Opera 8.5.

How to use: Select a dataset and variable



[link to test image](#) [Open in Google Earth](#)

Overlay opacity: 100%







Cadcorp SIS Map Browser - Open 3

File Edit View Tools Window Help

2300300

Open Window Definitions

- Open 3
  - JPL World Map Service
  - CDAT based Web Map Se
  - Cadcorp SIS Web Map Se

Open 3

DisplayView ThemeView

NZ 886° 1 637' 0in

Track Co-ordinates

624.0km 1: 2,300,000

City of Reading

**WWW.ICEAGE-EU.ORG**

### Project summary

ERA is investing heavily in e-infrastructure (e-*i*) to stimulate industry, improve the lives of citizens, accelerate research and gain international competitive advantage. For Europe to realise this expectation, there needs to be a diverse, knowledgeable, creative community, skillfully exploiting e-infrastructure. ICEAGE will catalyse the necessary infrastructure and skills by establishing a world-wide initiative to inspire innovative and effective Grid Education (GE) . By Grid Education we mean not only education in the use of the Grid, but also the use of the Grid in education. We use the term "Grid" in a broad sense to include computing and communications technology, working practices and policies that underpin e-Infrastructure.

Good education in rapidly advancing scientific domains is particularly labour intensive. It must draw on the expertise of a small community of pioneers. A major objective of ICEAGE is to provide an effective mechanism for distilling their knowledge and rapidly propagating it across Europe . ICEAGE will create a forum to bring together experts world-wide to expand and advance Grid Education. Building on EGEE, ICEAGE will enable students and educators to obtain and develop Grid Education via sustained, large-scale, multi-purpose e-Infrastructures. ICEAGE will demonstrate the wide potential of Grids, revealing new creative and business opportunities which will lead to the inclusion of social, ethical and economic issues in educational programmes. ICEAGE will show clearly how education can benefit from e-Infrastructure.

ICEAGE will deliver a programme of educational events. Its outcome will be the adoption by European Universities of courses in many disciplines to support the deployment and exploitation of e-Infrastructure. ICEAGE will ensure that citizens are well prepared to use e-Infrastructure in their private and professional lives. It will stimulate European educators by closely coupling the ICEAGE forum with a pioneering educational system, based on e-Infrastructure, involving a dynamic programme of events, shared strategies, information and material. The actions on Education and Training in ICEAGE are to be understood as actions on dissemination of knowledge (in the broader sense).

### Related Links

- Related Projects
- Places and funding available for the e-Science MSc/Diploma programme at the University of Edinburgh in 2006/7

# Conclusions: Getting Involved in Grid

- Stick to OGC standards if you are planning to handle Environmental data on the internet
- If you are keen software developer join OS groups like OpenLayers and help develop capability
- If you are interested in computational grid or software for setting up grids try
  - [www.nesc.ac.uk](http://www.nesc.ac.uk) or Open Middleware Infrastructure Institute (OMII)  
[www.omii.ac.uk](http://www.omii.ac.uk)
- If would like to try using Grid computing set up by others try
  - [www.eu-egee.org](http://www.eu-egee.org) or seek access to the ESA Grid
- UK has an environmental e-science institute in Cambridge which runs training workshops specifically for environmental scientists [www.niees.ac.uk](http://www.niees.ac.uk); usually free to attend
- Or go to another European summer school! [www.iceage-eu.org](http://www.iceage-eu.org)

End of third Lecture