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Software solutions for the exchange of large environmental data sets

Keith Haines
Jon Blower
Chunlei Liu
Adit Santokhee

Environmental Systems Science Centre (ESSC)
Reading University

HALO: ECMWF 16-17th Nov 2004

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Introduction

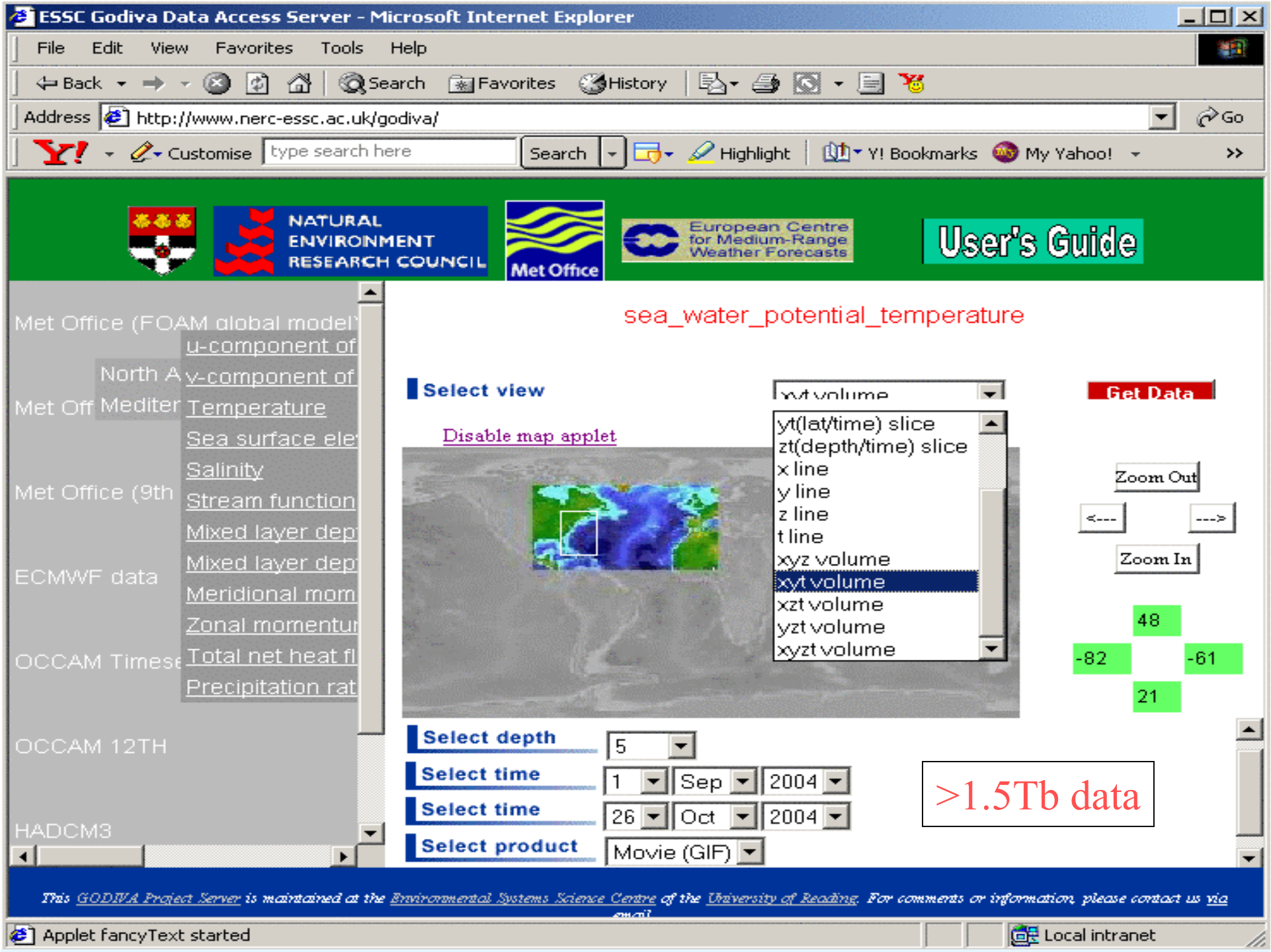
- NERC e-Science project GODIVA

Grid for Ocean Diagnostics, Interactive Visualisation and Analysis

⇒ Remote/distributed visualisation and analysis of large data sets

⇒ Web portal www.nerc-essc.ac.uk/godiva

- Web and Grid Services: evolving standards
- Make agency marine model data available to research community, MERSEA, GODAE, CASIX
- Example Approaches to remote data analysis/applications
- Some challenges for data access


ESSC Godiva Data Access Server - Microsoft Internet Explorer
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European Centre for Medium-Range Weather Forecasts
User's Guide
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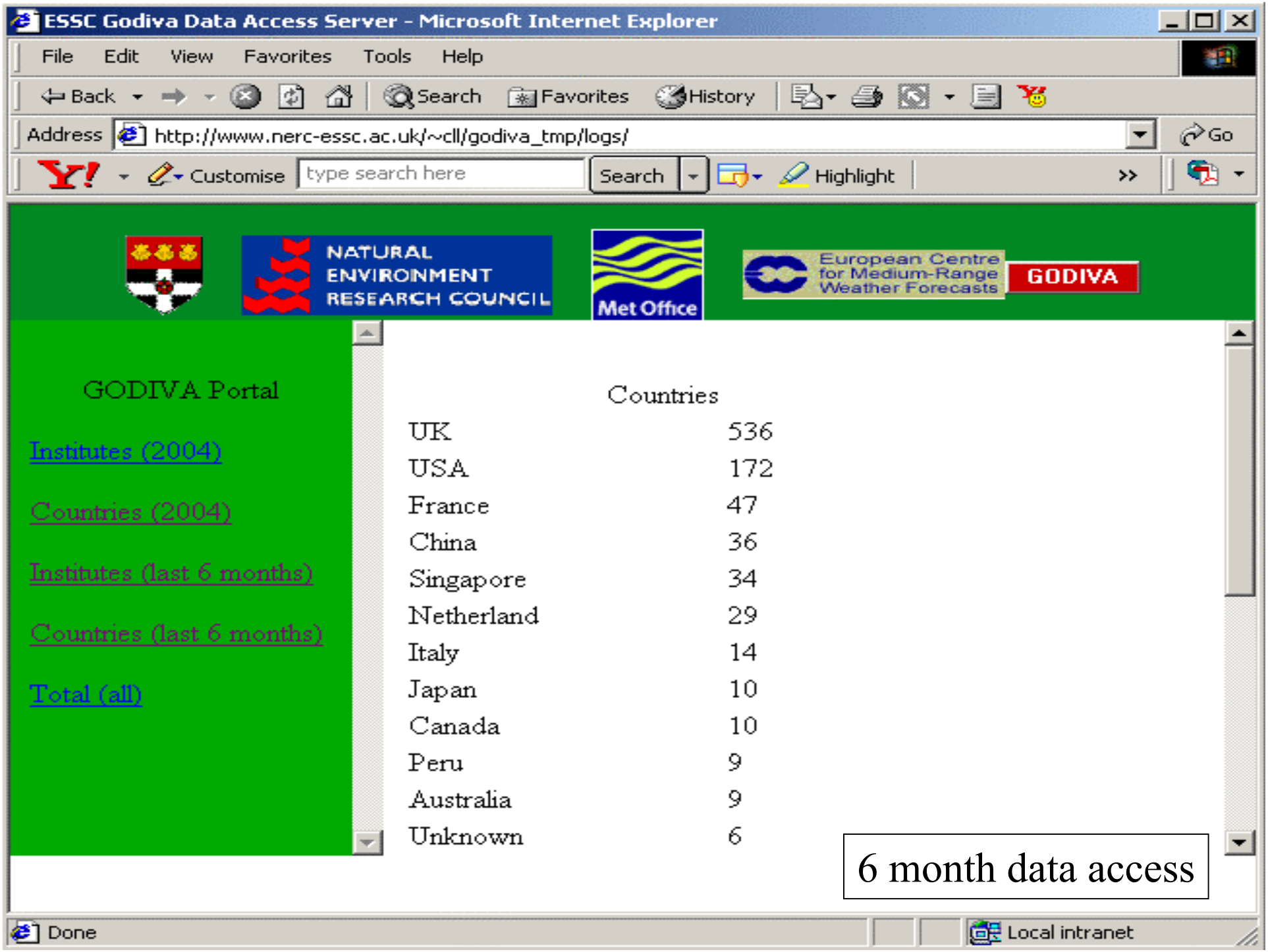
-61
21
Select depth 5
Select time 1 Sep 2004
Select time 26 Oct 2004
Select product Movie (GIF)
>1.5Tb data
This GODIVA Project Server is maintained at the Environmental Systems Science Centre of the University of Reading. For comments or information, please contact us via email
Applet fancyText started
Local intranet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NATURAL ENVIRONMENT RESEARCH COUNCIL
Met Office
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GODIVA
GODIVA Portal
Institutes (2004)
Countries (2004)
Institutes (last 6 months)
Countries (last 6 months)
Total (all)
Countries
UK 536
USA 172
France 47
China 36
Singapore 34
Netherland 29
Italy 14
Japan 10
Canada 10
Peru 9
Australia 9
Unknown 6
6 month data access
Done
Local intranet

Godiva data and visualisation portal

- Two alternative routes to data

OPenDAP: URL based

eg. www.nerc-essc.ac.uk:9090/dodsC/FOAM_NATL_MEANSSH?ssh[0:1:0][0:1:200][0:1:100]

GADS: Grid Access Data Service: SOAP XML based Web Service (Woolf et al; 2003)

Reads/Writes GRIB, NetCDF, HDF4/5……

Flexibility: Security, extended querying, Workflows and Grid Services

Recent work experimenting with databases (Santokhee et al 2004)

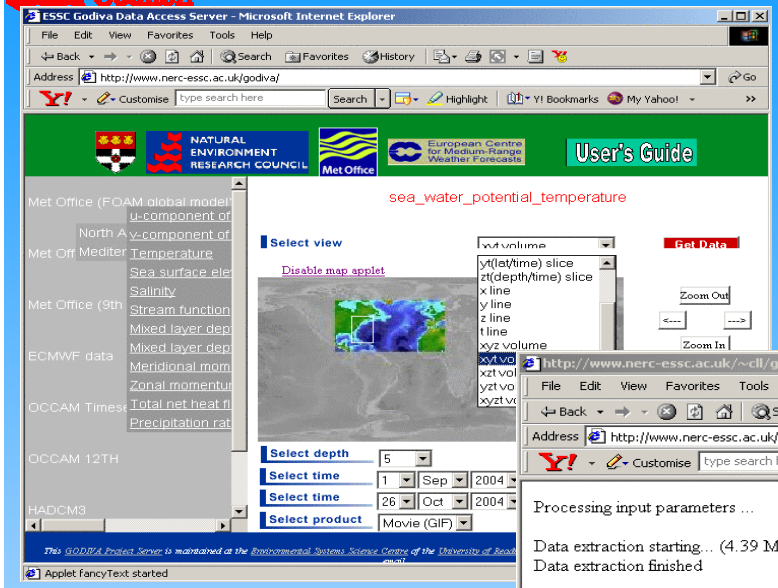
- Portal similar to Live Access Server: PCMDI

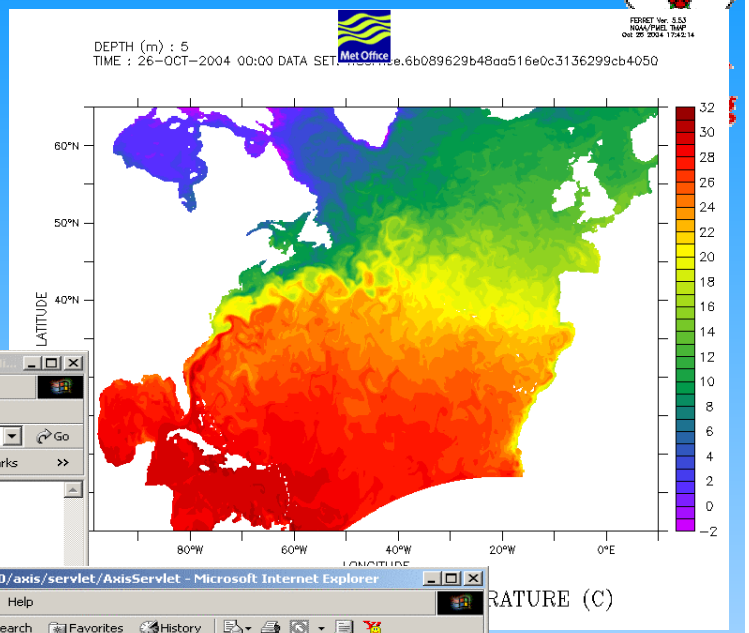
Security layer

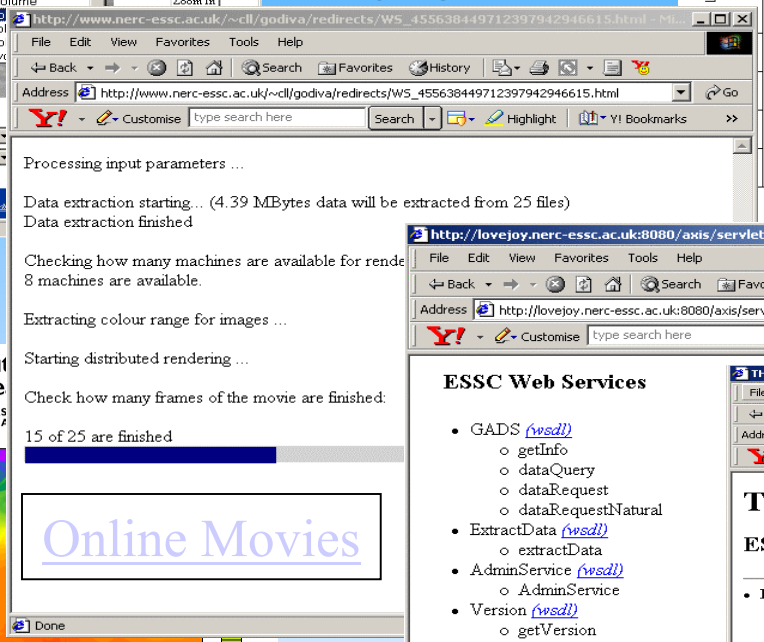
Make client specified movie loops online

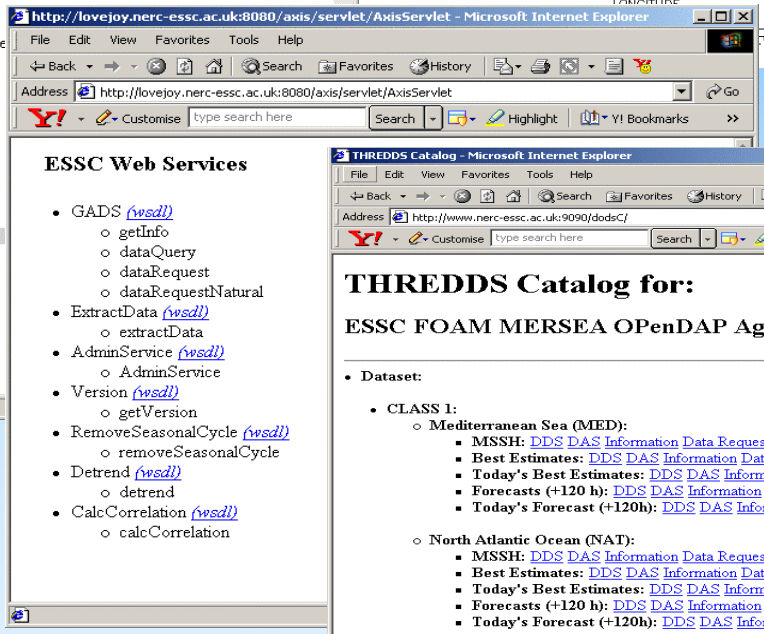
Other GODIVA groups interested in more advanced remote visualisation

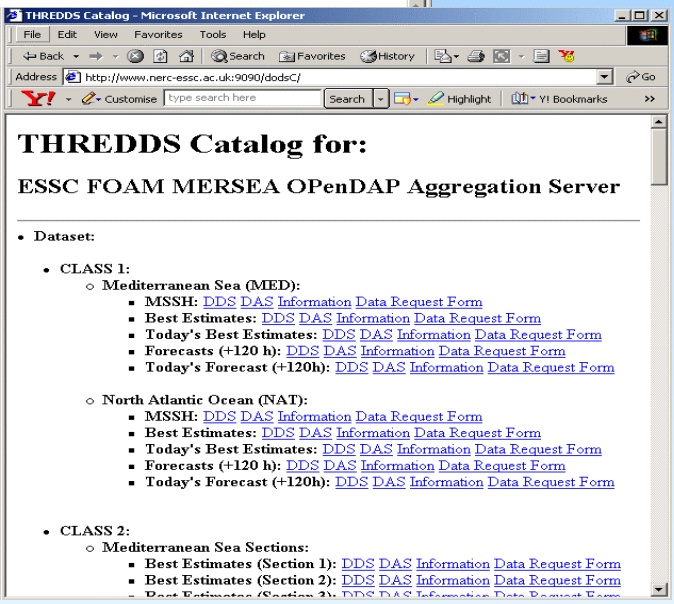
Data Services from ESSC

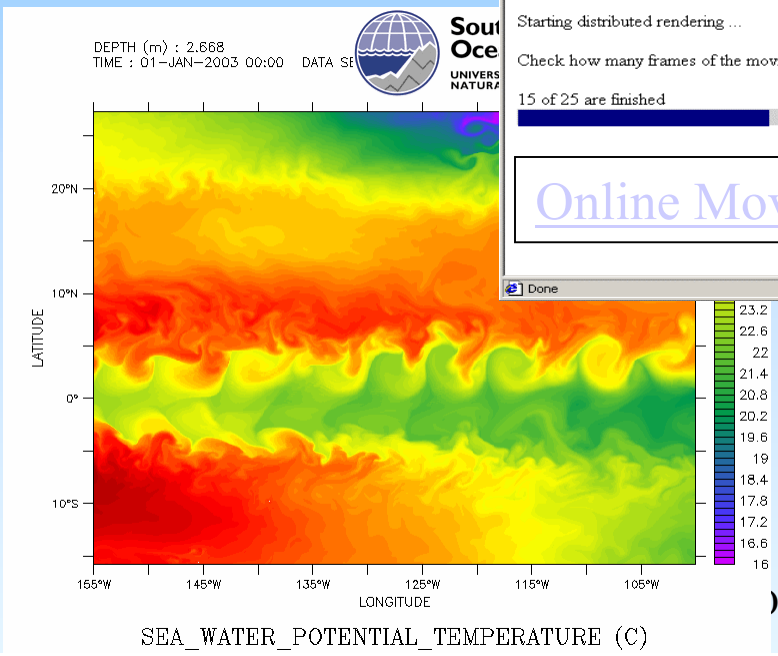












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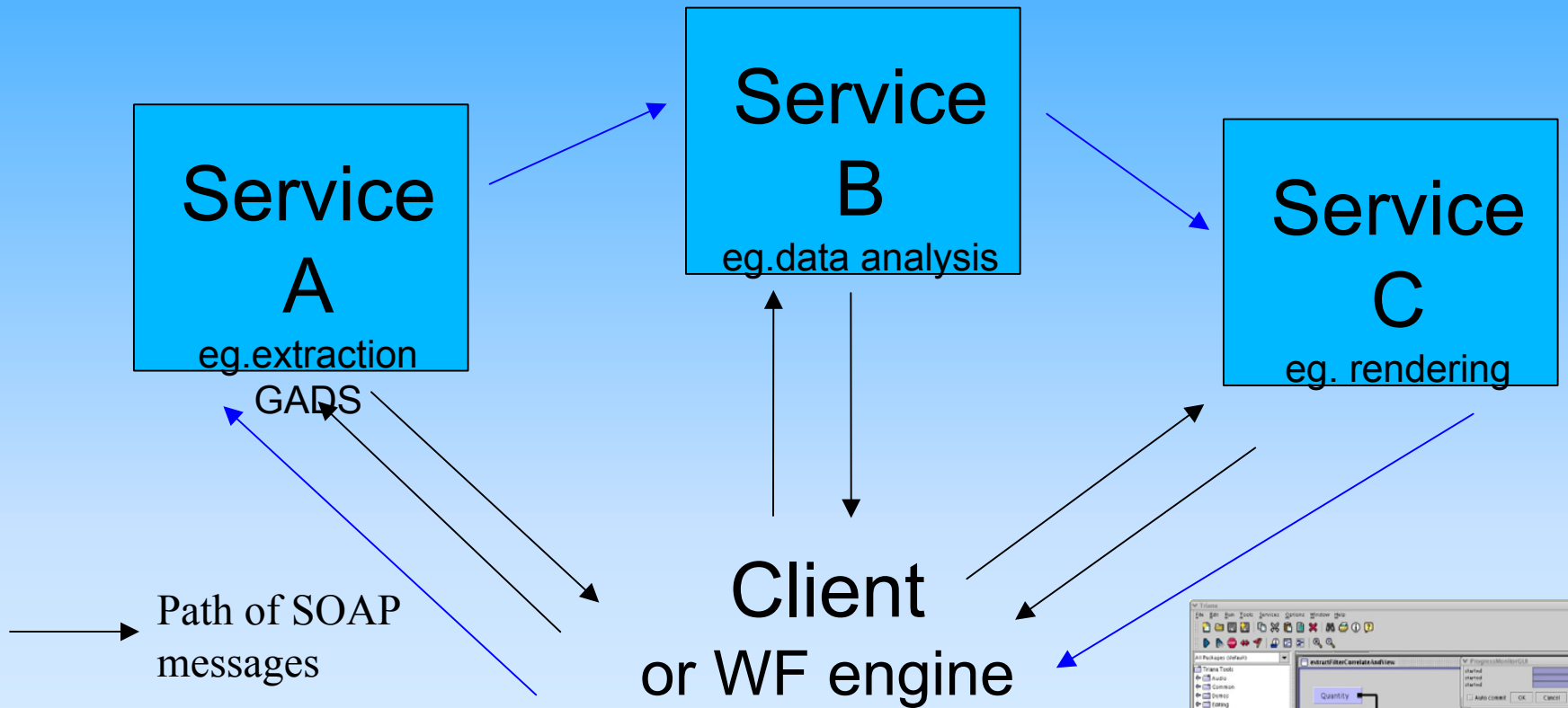
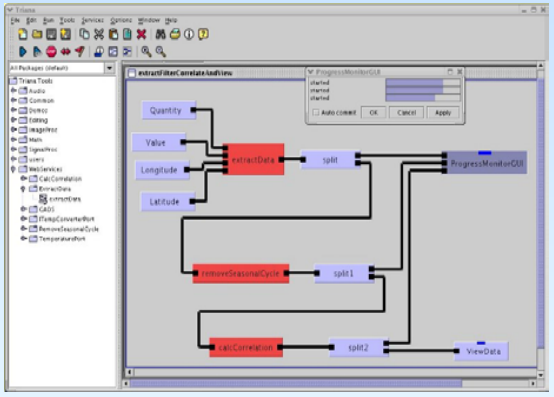
Workflow and Data processing





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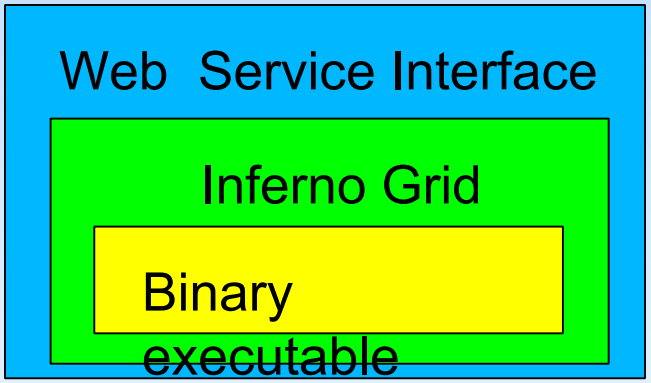
Data streaming

- If all services in the workflow were running as Unix filters on the same machine, we could write something like:
  - **`extract | process | render`**
- We want to pipe the data across a network in the same way
  - Split and combine parallel processing paths
  - Plus we'd like to be able to monitor progress for long running jobs
- Wrap binary executables with little or no modification
- Used lightweight Inferno software designed for distributed computing
- Inferno is Open Source for non-commercial use
- Details in Blower et al. (2004)

www.resc.rdg.ac.uk/publications/Blower_AHM_2004.pdf



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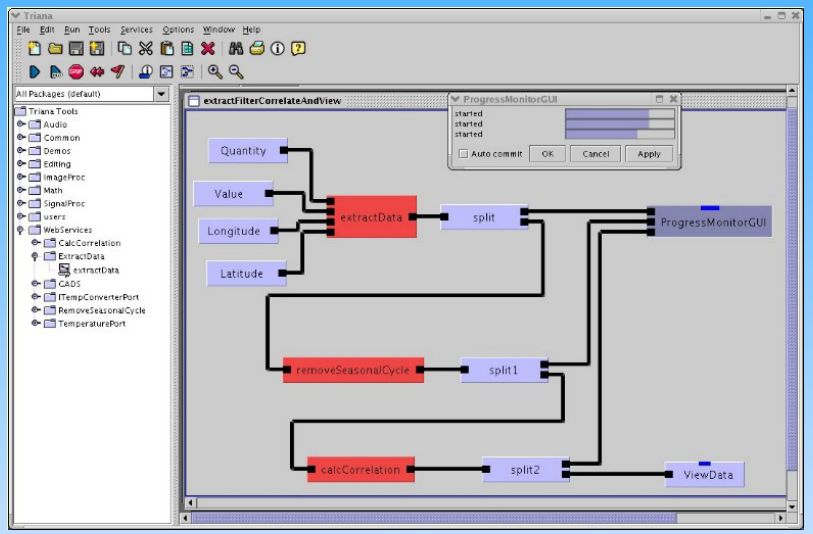
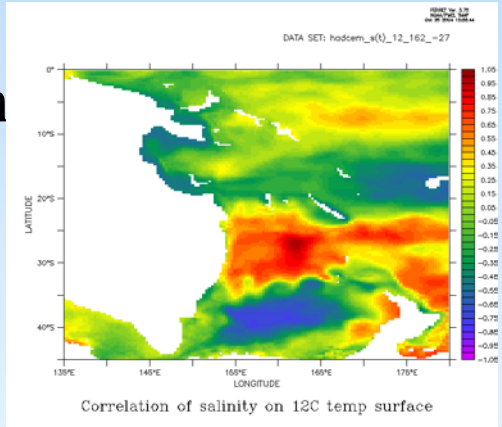
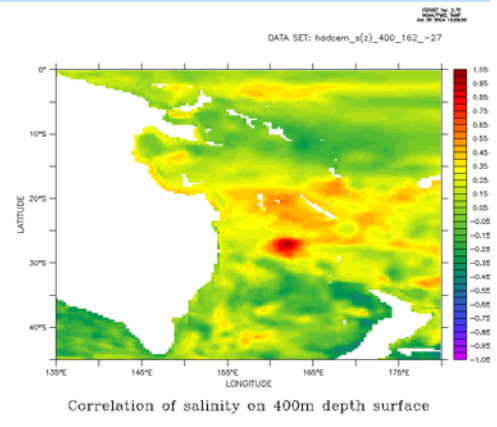
Example workflow: Model covariances

- Data assimilation involves using covariances to determine data influence
- Calculating covariance scales from model results computationally intensive
- Workflow compares ocean salinity covariances from coupled HadCEM model on z level and temperature surfaces





Correlation of salinity on 12C temp surface

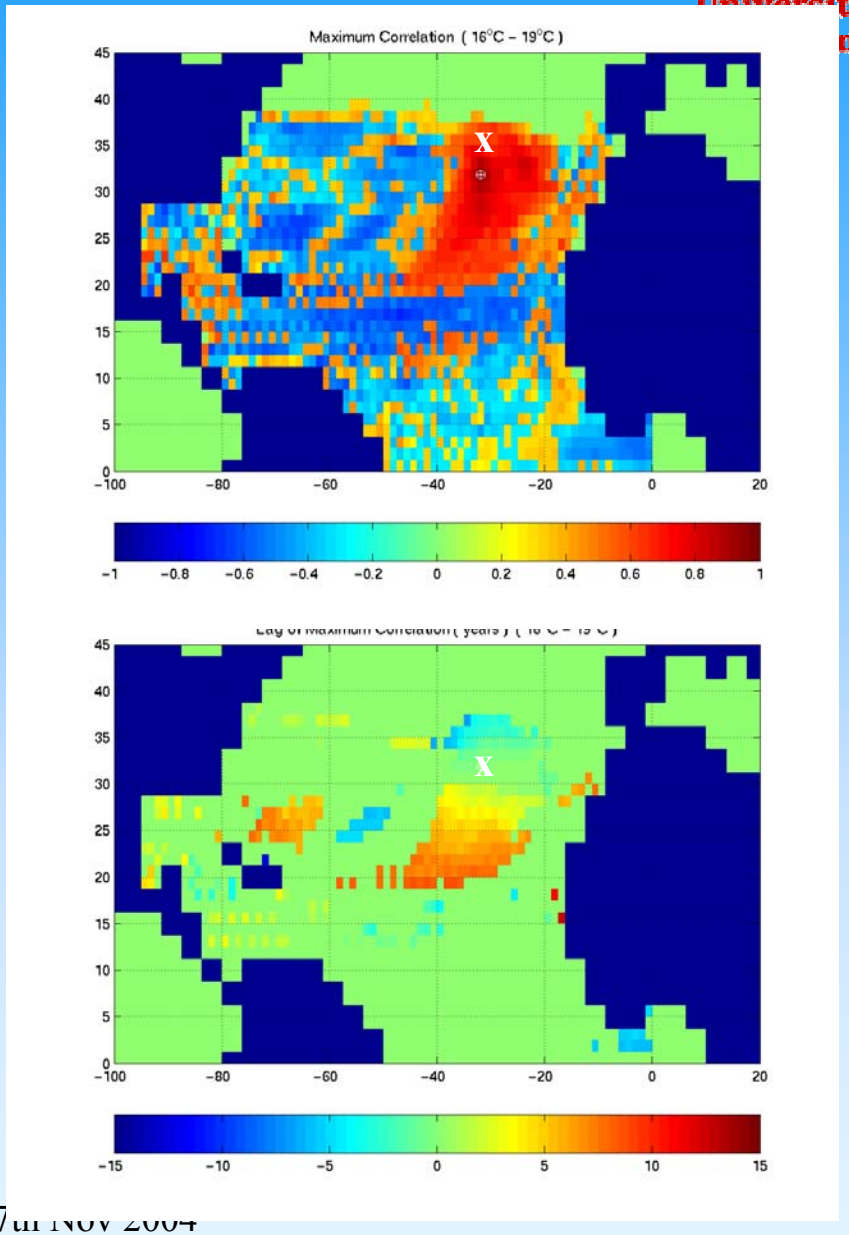


Correlation of salinity on 400m depth surface

Time-lagged covariances

(a) One point correlation map of 16-19C thickness below the winter mixed layer base. Maximum correlations shown for any lead-lag

(b) Lead-lag of optimum thickness correlations



Need a front end toolbox with Web Service capabilities, possibly based on CDAT/Python. Future development plan

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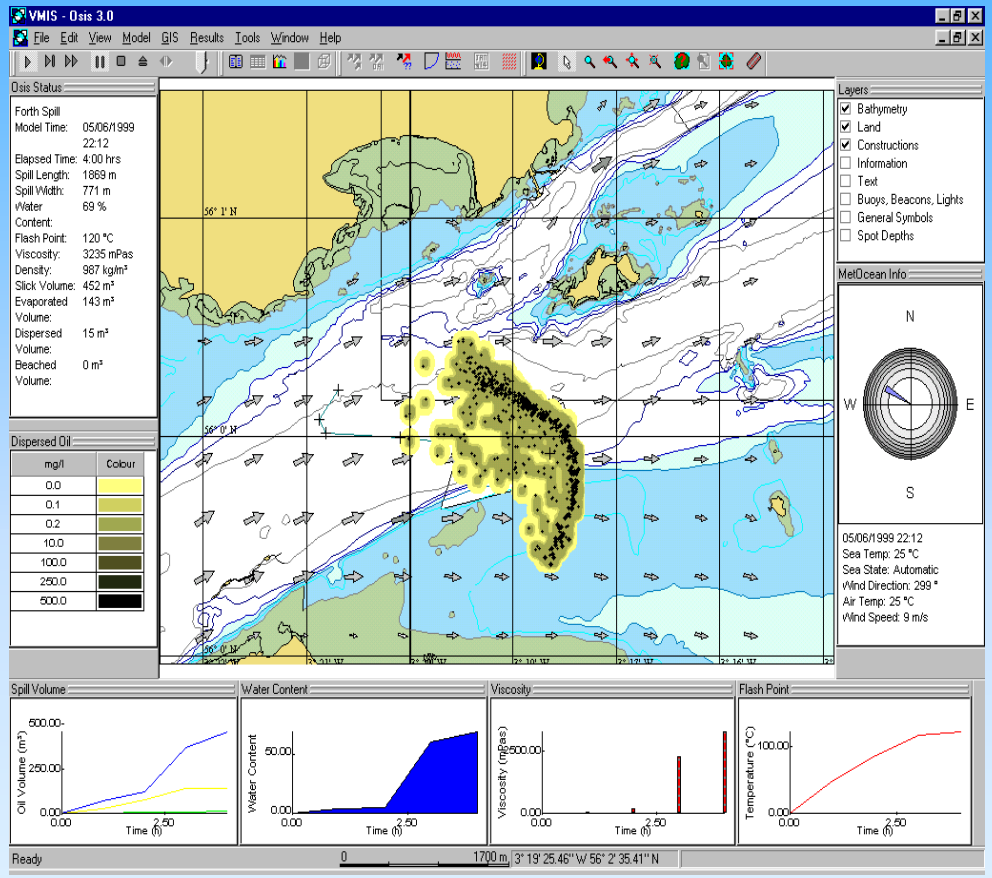
SARIS Example

- BMTs Search and Rescue at SEA (SARIS) tool has been modified to initiate GADS Web Service
- Real-time Met Office current data can be read from internet when system is run
- Potential implementation for UK CoastGuard



Oil Spill OSIS system

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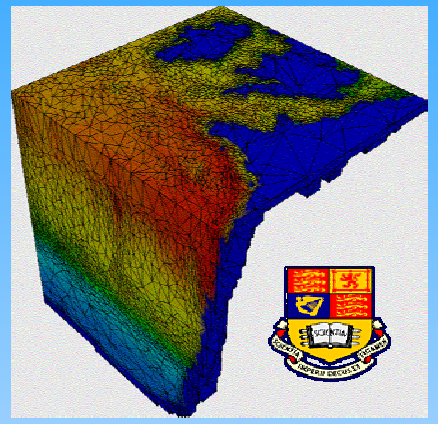
Data access wish list



- Hold data on native spatial grids

  eg. model data on distorted grids

  future modelling on unstructured meshes

- Interpolation tools => Client specified access resolution/format
- Compatibility with GIS (3/4D data)
- Query data by value

  eg. give me all the data with T>20C

  research and policy issues

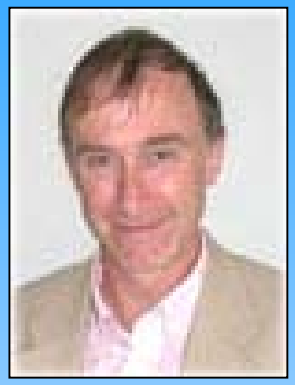
  database functionality

Reading e-Science Centre

Environmental e-Science Applications

Reading University's Environmental Systems Science Centre **ESSC**

Technical Director
Jon Blower
ESSC



Director
Keith Haines
ESSC

Director
Rachel Harrison
CS

Associated Personnel: Kevin Hodges, Chunlei Liu, Adit Santokhee, Kecheng Liu, Steve Gough,

Meteorology Dept.
Centre Global Atm. Mod.
Data Assim. Res. Centre
Met Office/Hadley Units
Plant Sciences Dept.

Future Directions for ReSC

- Toolbox front end with Web Services + data streaming for climate data analysis
- Spatial database technology for storing model output

HALO: ECMWF 16-17th Nov 2004

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www.resc.reading.ac.uk

External Collaborations

Met Office

BMT

European Centre for Medium-Range Weather Forecasts

Environment Agency

mca
Maritime and Coastguard Agency

SEEDA