



A standard-based distributed framework for ocean models assessment

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S. Davolio³
G.M. Sannino⁴**

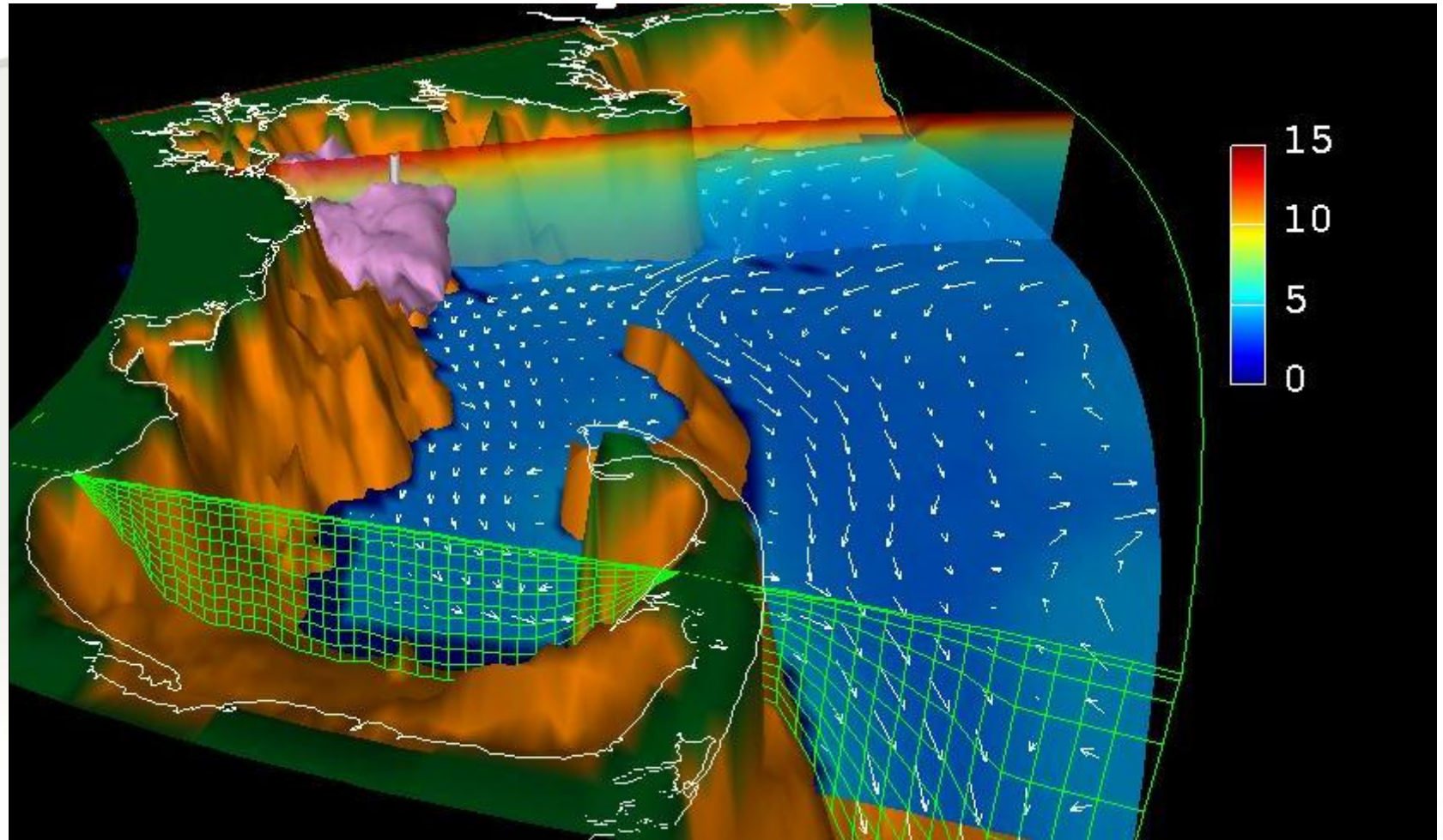
¹CNR-ISMAR, Venezia, Italy

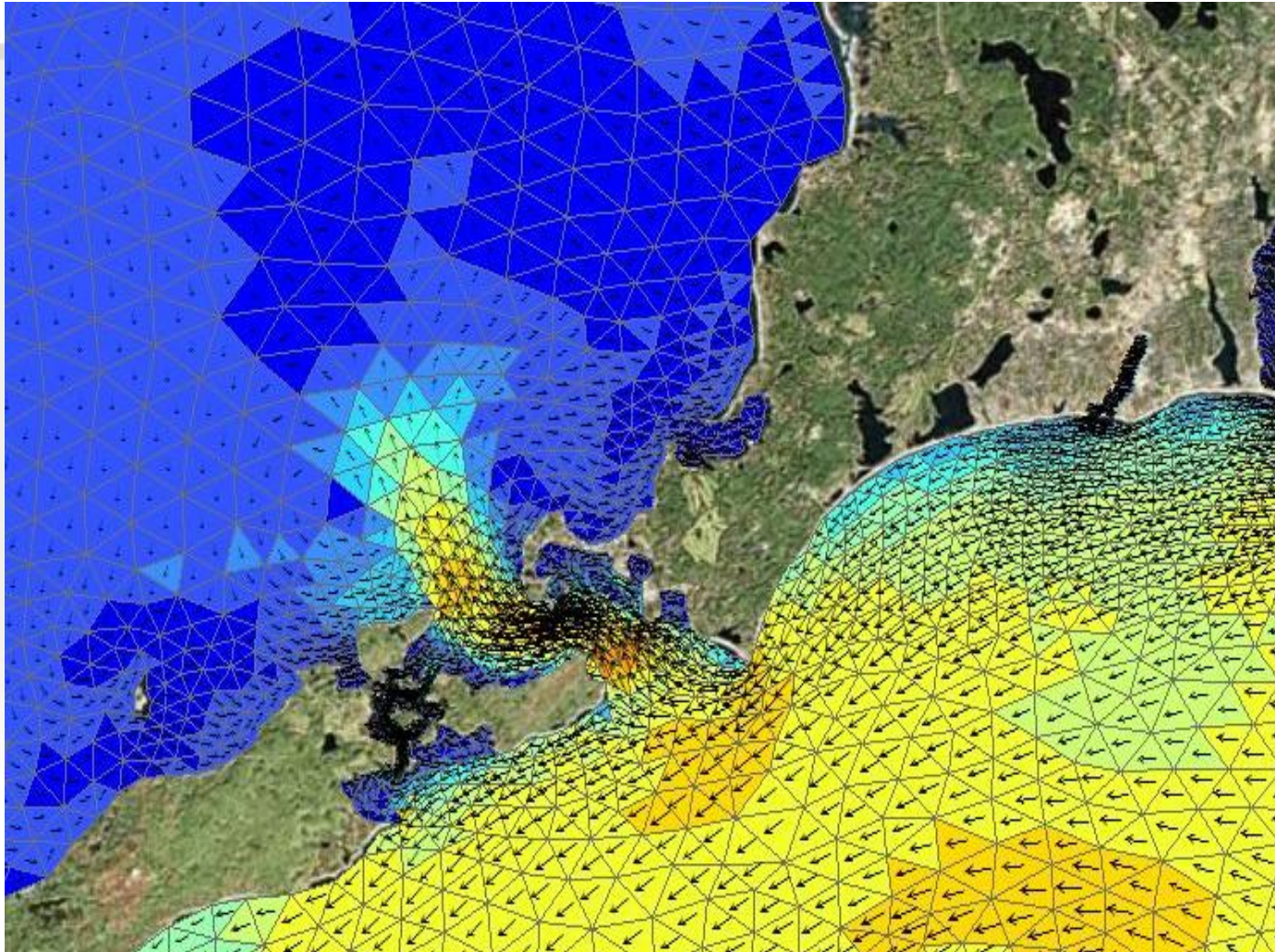
²USGS, Woodshole, USA

³CNR-ISAC, Bologna, Italy

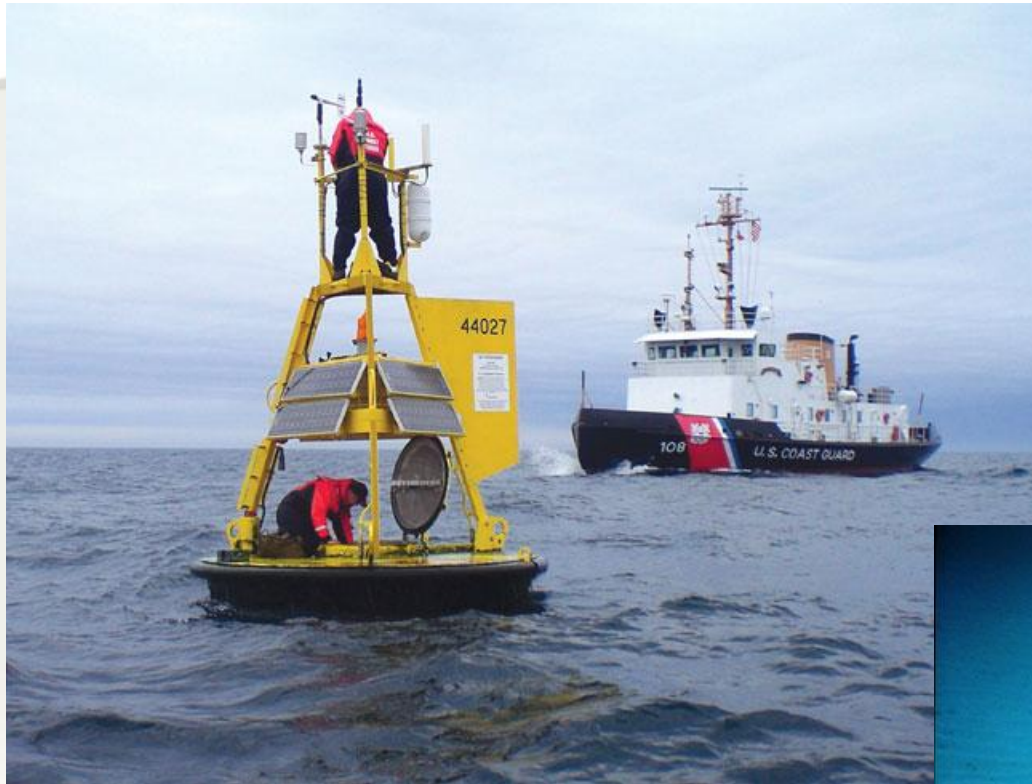
⁴ENEA, Roma, Italy

- Growing ocean and coupled numerical model output (and data from observatories) production in the coastal environment and in the deep sea regions (“big data” problem)***
- There is a lack of efficiency in data retrieving and exchange among scientists***
- There is a strong need for a common platform for a more efficient data management and exploitation***
- We face an increasing request of quick data/model visualization from third parties***





Courtesy of R. Signell



Johns Hopkins
Applied Physics Institution

Courtesy of R. Signell

IOOS[®] INTEGRATED OCEAN OBSERVING SYSTEM

- *Worldwide net of technician and technologies, allowing a common and standardized approach to data and protocols*
- *Effort to reach this goal at inter-national scale (in our case, improve the Mediterranean situation)*
- *For: coastal, marine resources, emergency managers; physical and ecological oceanographers; local, international “policymakers”; anybody using the sea for recreational purposes!*

DATA CATALOG



REGIONAL PARTNERS



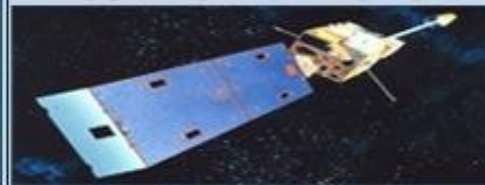
DATA MANAGEMENT



INTERAGENCY PROGRAMS



COMMUNICATIONS



GLOBAL OBSERVATIONS



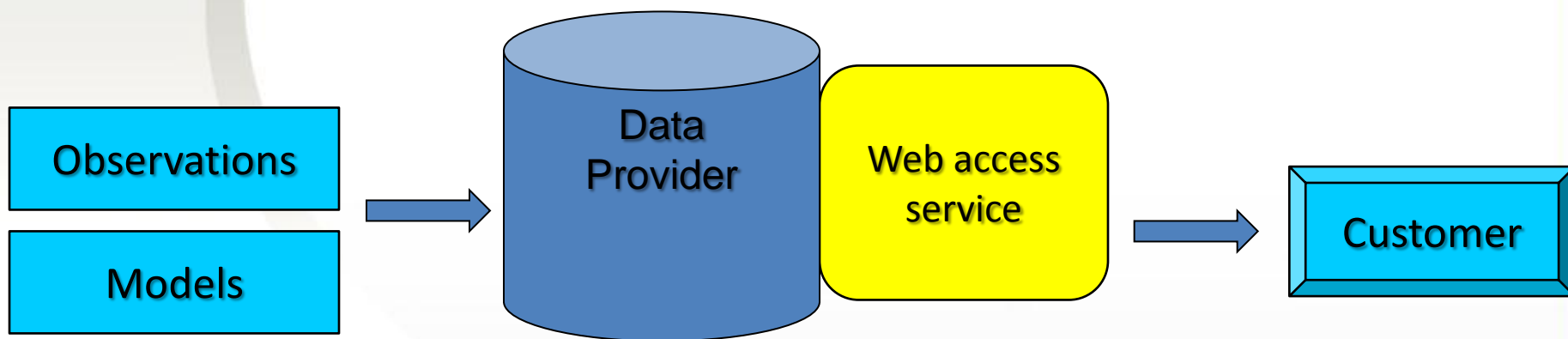
- **Adopt open standards & practices**



International
Organization for
Standardization



- **Avoid customer-specific stovepipes**
- **Standardized access services implemented at data providers**



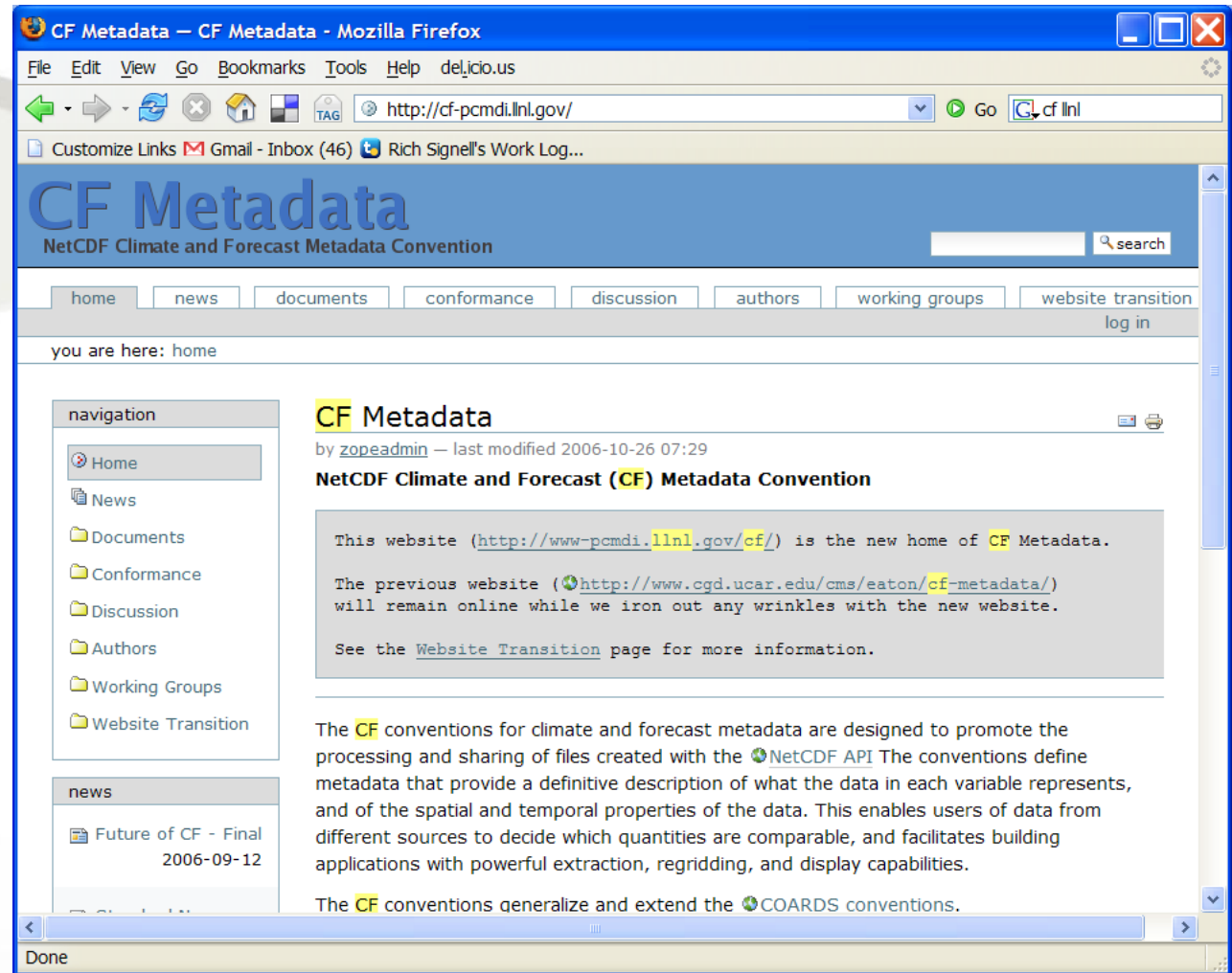
Groups using CF:

GO-ESSP: Global
Organization for Earth
System Science Portal

IOOS: Integrated
Ocean Observing
System

ESMF: Earth System
Modeling Framework

OGC: Open Geospatial
Consortium (GALEON:
WCS profile)



CF Metadata — CF Metadata - Mozilla Firefox

File Edit View Go Bookmarks Tools Help del.icio.us

http://cf-pcmdi.llnl.gov/

Customize Links Gmail - Inbox (46) Rich Signell's Work Log...

CF Metadata

NetCDF Climate and Forecast Metadata Convention

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news

- Future of CF - Final 2006-09-12

CF Metadata

by zopeadmin — last modified 2006-10-26 07:29

NetCDF Climate and Forecast (CF) Metadata Convention

This website (<http://www-pcmdi.llnl.gov/cf/>) is the new home of CF Metadata.

The previous website (<http://www.cgd.ucar.edu/cms/eaton/cf-metadata/>) will remain online while we iron out any wrinkles with the new website.

See the [Website Transition](#) page for more information.

The CF conventions for climate and forecast metadata are designed to promote the processing and sharing of files created with the [NetCDF API](#). The conventions define metadata that provide a definitive description of what the data in each variable represents, and of the spatial and temporal properties of the data. This enables users of data from different sources to decide which quantities are comparable, and facilitates building applications with powerful extraction, regridding, and display capabilities.

The CF conventions generalize and extend the [COARDS](#) conventions.

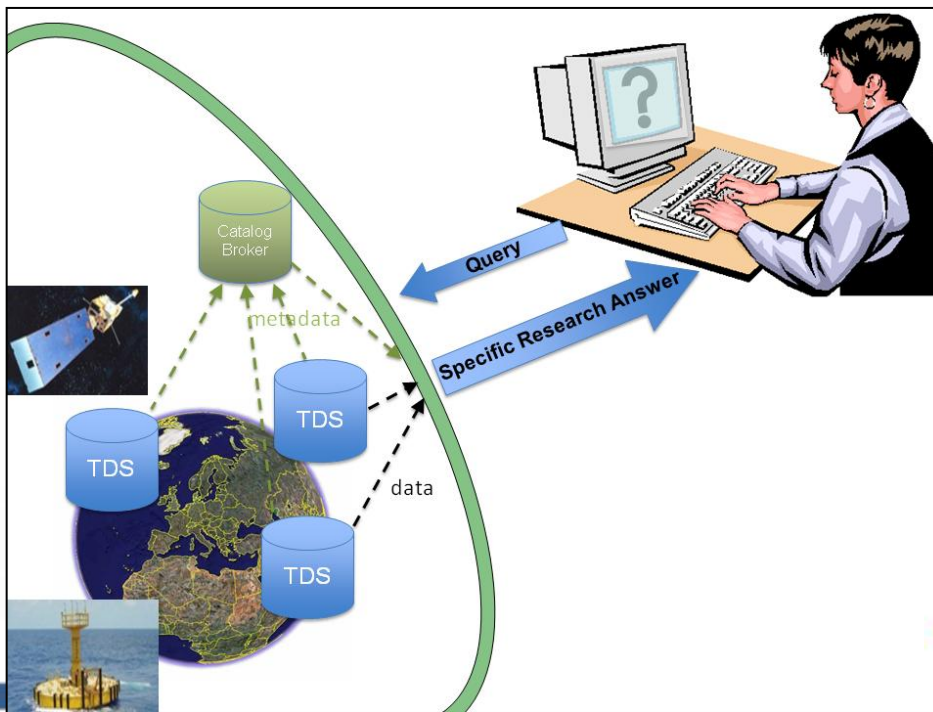
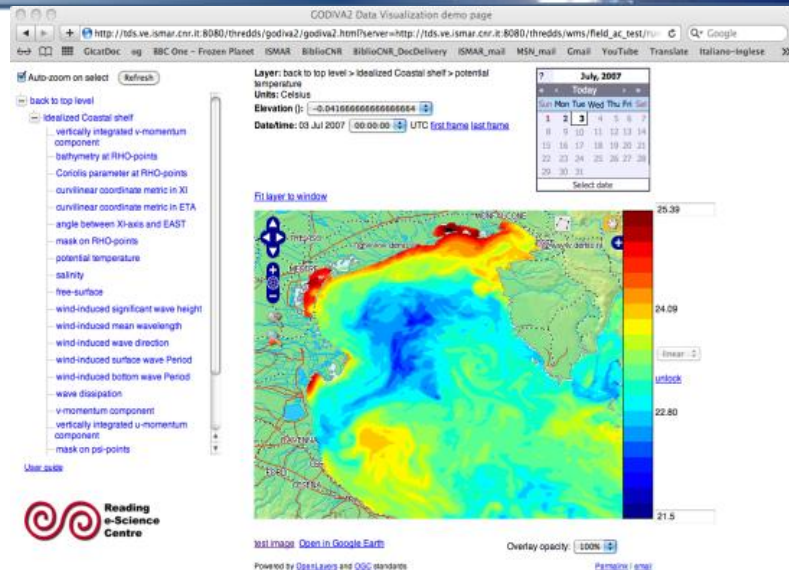
Done

CF Convention Draft Spec for
Unstructured Grid: http://bit.ly/ugrid_cf

- To mitigate the lack of efficiency in data retrieving and exchange among scientists
- To aim at common platform for data management

THREDDS (Thematic Real-time Environmental Distributed Data Services)

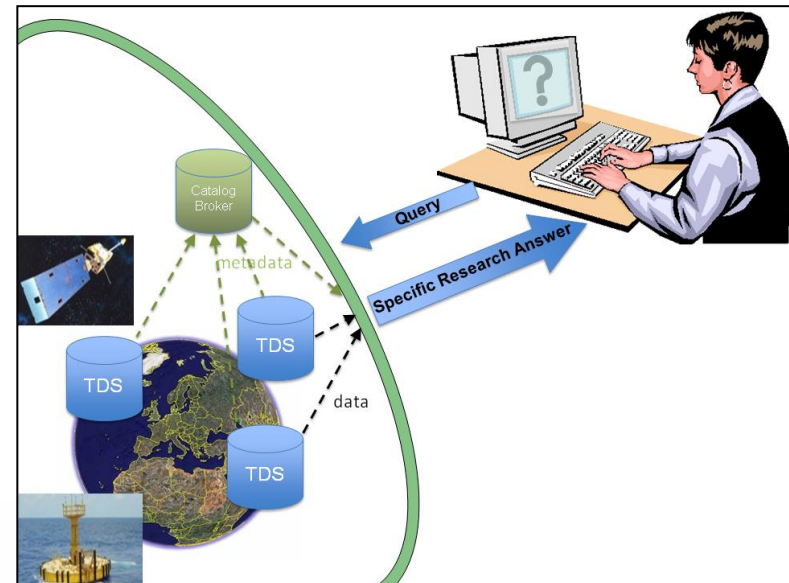
Middleware to bridge the gap between data producers and data users



- *The THREDDS Data Server (TDS) is a web server that provides metadata (to end users or brokering systems) and access to the scientific datasets content using OPeNDAP, OGC WMS and WCS, HTTP...*
- *Besides providing access to the metadata, the TDS allows to access the data contents as well*
- *The TDS can aggregate several files into virtual datasets, freeing the user from annoying details (e.g. storage and naming) and providing a much easier access to large datasets*

Bottom line: to improve the scientific data access we need a “Common Data Model” (CDM). So I can also talk with a “broker”...

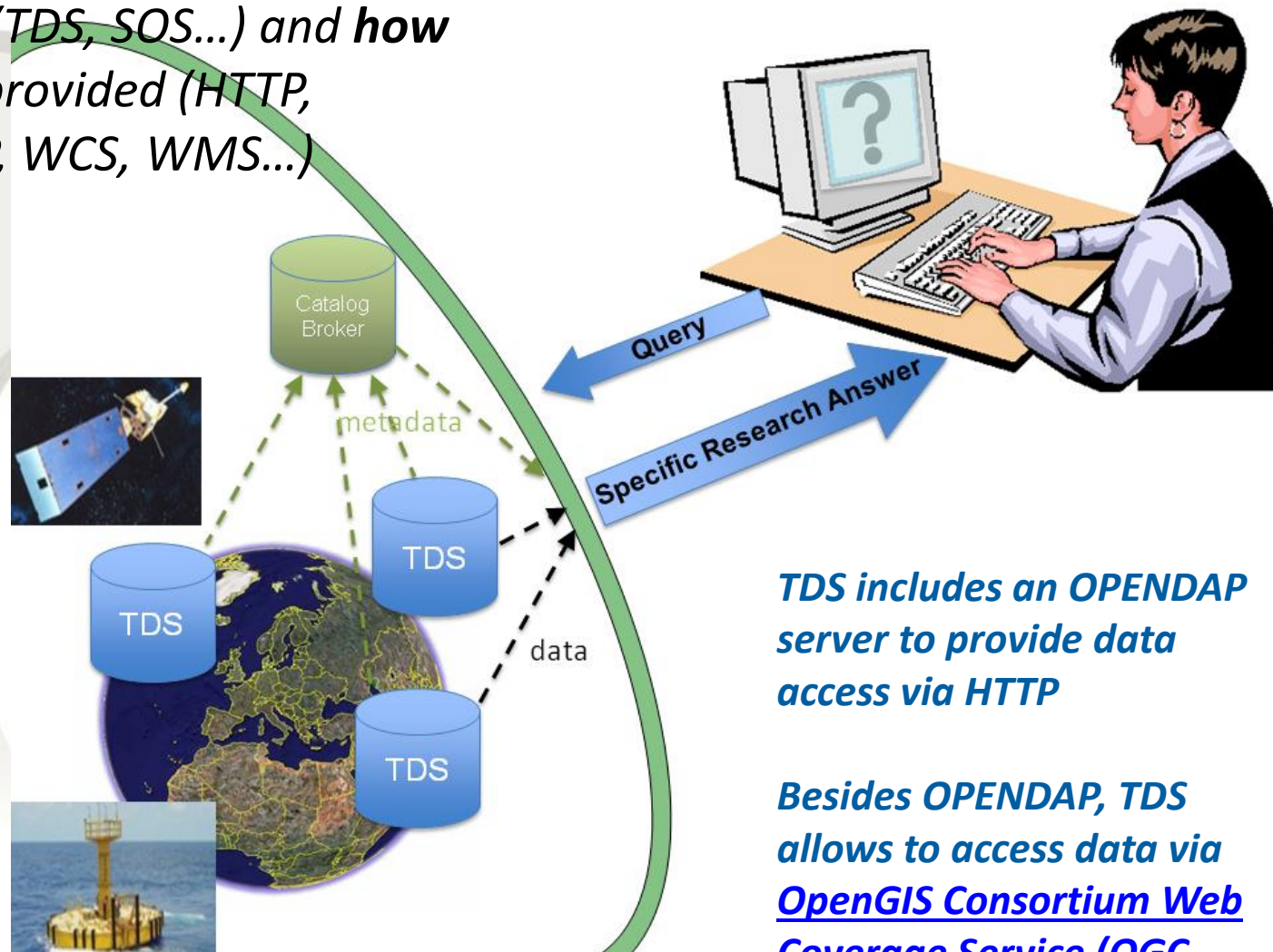
UNIDATA, www.unidata.ucar.edu (US University consortium) developed a common API for different datatype employed by the scientific community



Unidata

*Providing data services, tools, & cyberinfrastructure leadership
that advance Earth system science, enhance educational opportunities, & broaden participation*

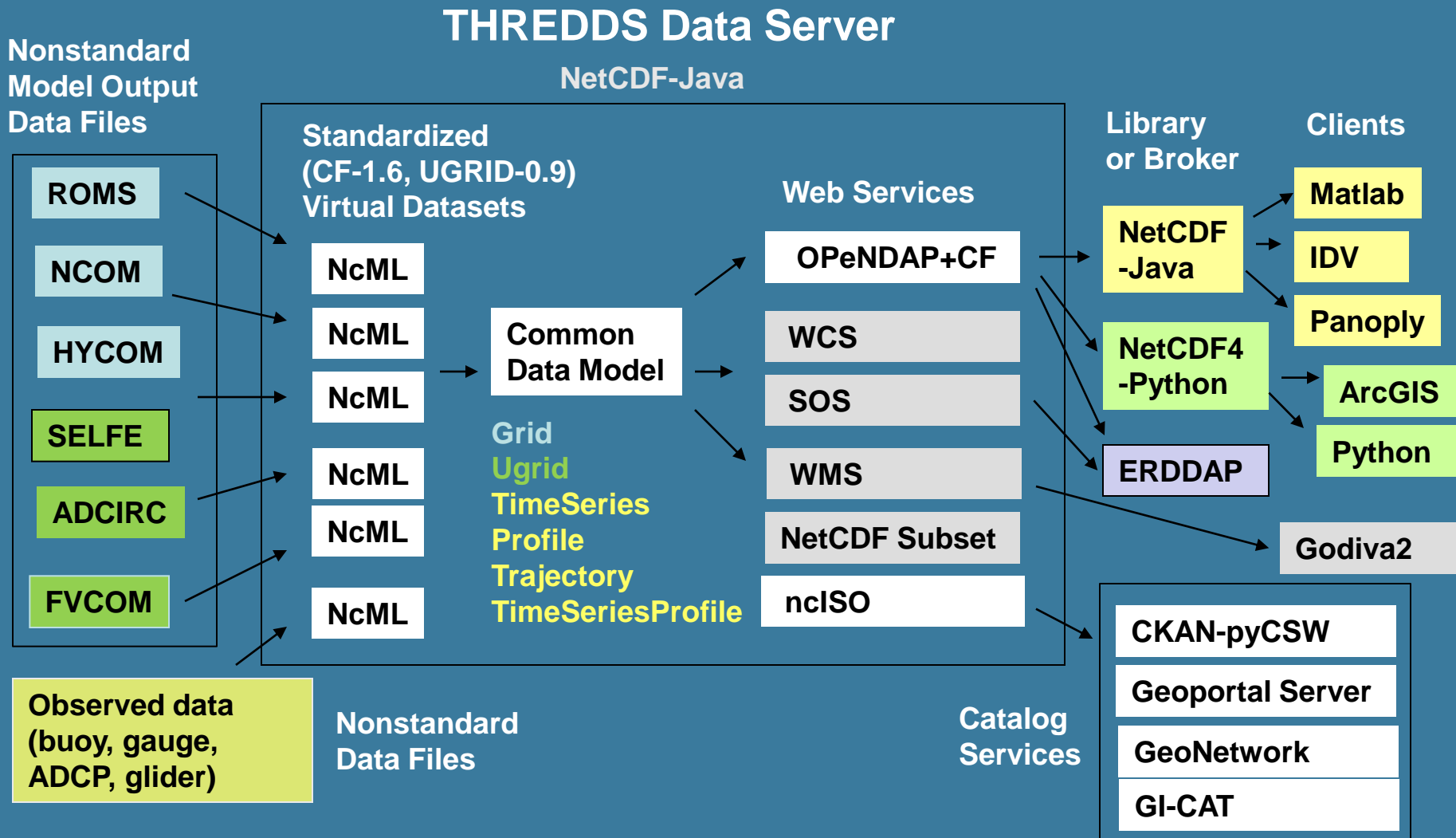
*Gi-CAT: looking for data? I tell you **who** (TDS, SOS...) and **how** they are provided (HTTP, OPENDAP, WCS, WMS...)*



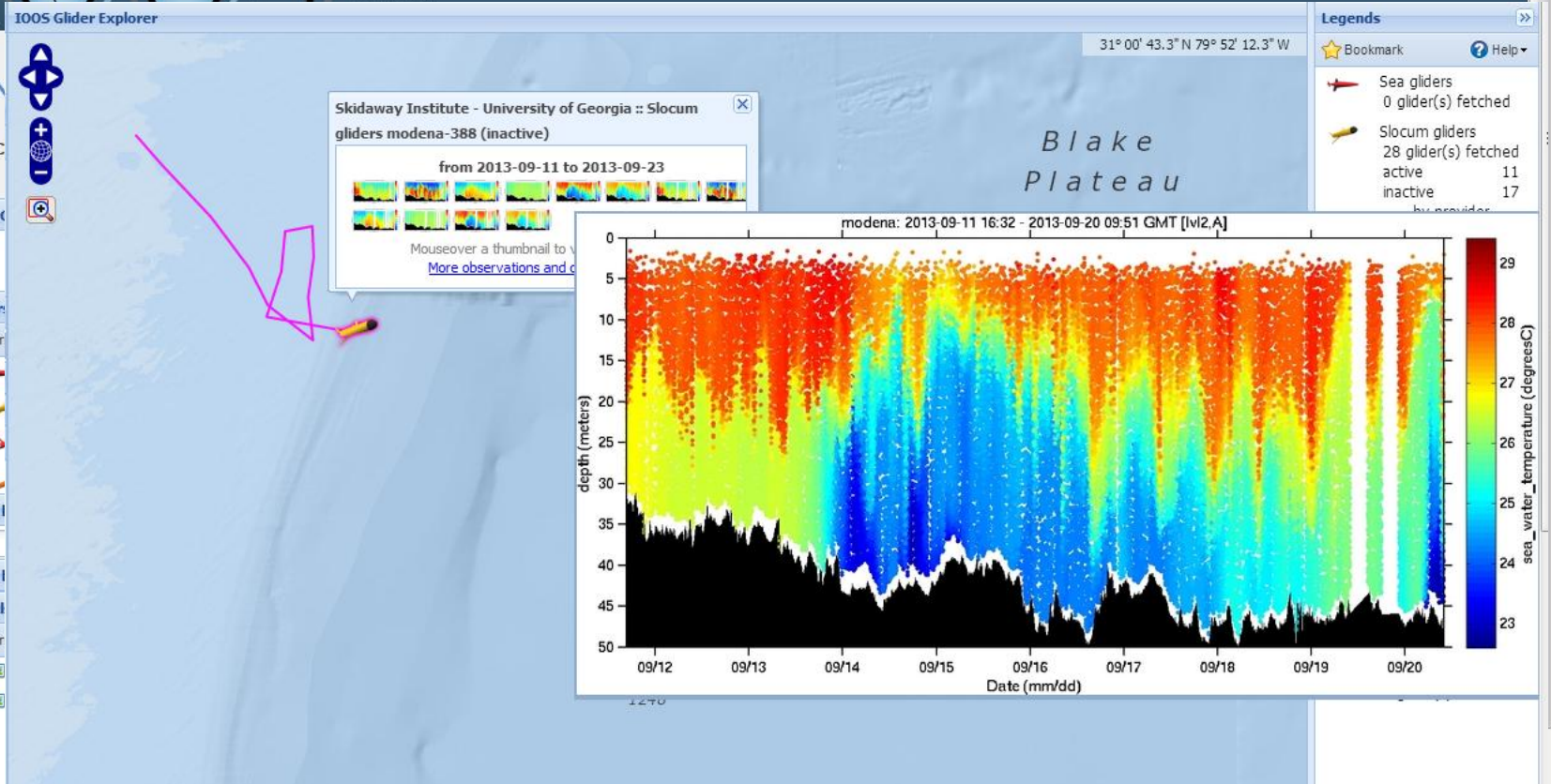
TDS includes an OPENDAP server to provide data access via HTTP

Besides OPENDAP, TDS allows to access data via [OpenGIS Consortium Web Coverage Service \(OGC WCS\)](#) protocol

IOOS Data Infrastructure Diagram



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scripps latest report 13
 2013-09-30 11:04 UTC
 Unknown gliders 0 glider(s) fetched



Available online at www.sciencedirect.com



Journal of Marine Systems 69 (2008) 154–161

JOURNAL OF
MARINE
SYSTEMS

www.elsevier.com/locate/jmarsys

Collaboration tools and techniques for large model datasets

Richard P. Signell^{a,*}, Sandro Carniel^b,
Julie Pullen^c, Christ

10th International Conference on Hydroinformatics
HIC 2012, Hamburg, GERMANY

DISTRIBUTION OF FIELD SURVEY DATA AND “MIKE” MODEL RESULTS - AN APPROACH WITH SQL AND THREDDS

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^c Servizio IdroMeteorologico-ARPA Emilia Ro

^d Rudjer Boskovic Institute, Center for Marine and Enviro

^e Naval Research Laboratory, 7 Cress

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that are already part of
DDDS data server with
CDF files. The same
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Knowledge discovery in large model datasets in the marine environment: the THREDDS Data Server example

A. Bergamasco^a, A. Benetazzo^a, S. Carniel^{a*}, F.M. Falcieri^a, T. Minuzzo^a,
R.P. Signell^b and M. Sclavo^a



La ricerca italiana per il mare

5 different actions, all sharing large output modeling products

***Most UO agreed on delivering at least NetCDF output file
and delivering final model products on a distributed TDS system***

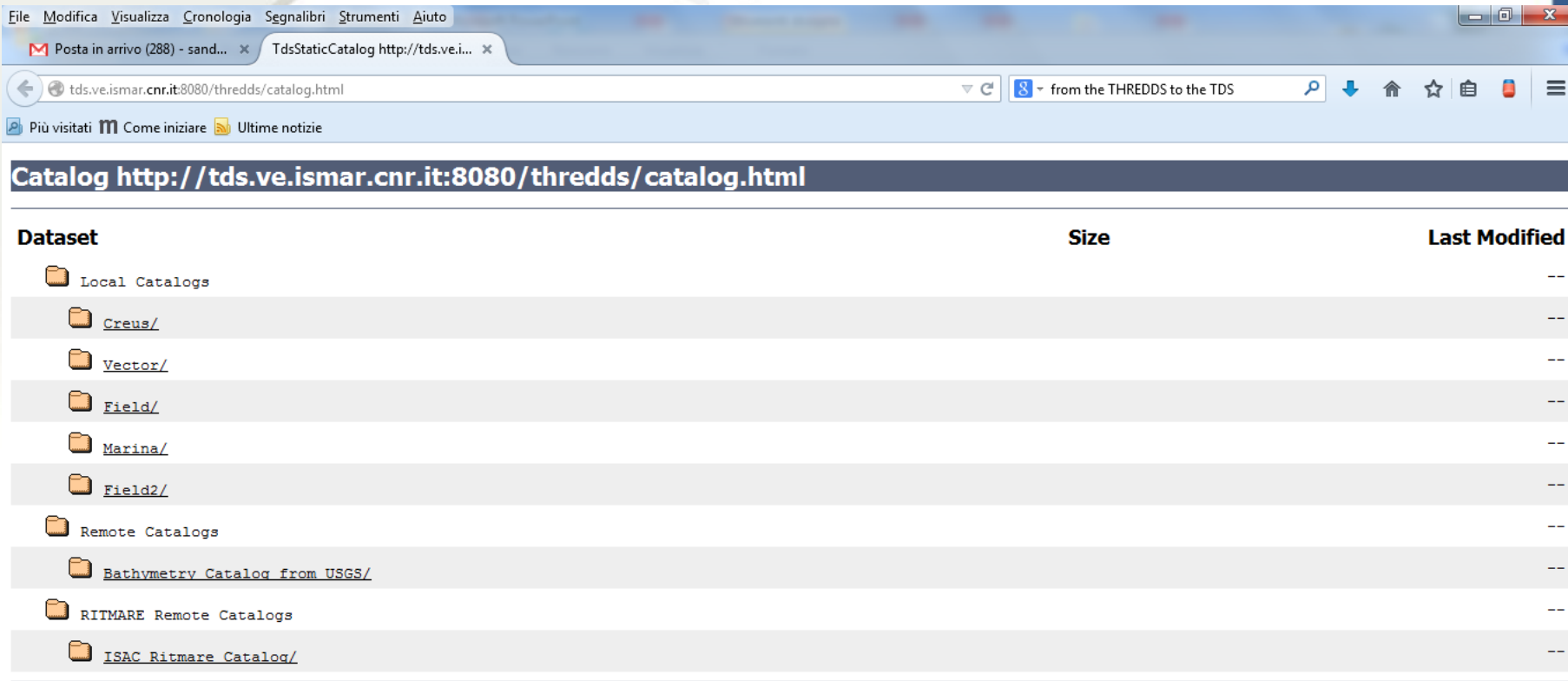
Action 1	NetCDF	TDS	(1/2 TDS)
Action 2	NetCDF	TDS	
Action 3	NetCDF	TDS	(3/5 NetCDF, 1/5 TDS)
Action 4	NetCDF	TDS	(1/3 NetCDF, 0/3 TDS)
Action 5	NetCDF	TDS	(1/3 TDS)
Action 6	NetCDF	TDS	



La ricerca italiana per il mare

<http://tds.ve.ismar.cnr.it:8080/thredds/catalog.html>

<http://utmea.enea.it:8080/thredds/catalog/RITMARE/catalog.html>



File Modifica Visualizza Cronologia Segnalibri Strumenti Aiuto

Posta in arrivo (288) - sand... x TdsStaticCatalog http://tds.ve.i... x

tds.ve.ismar.cnr.it:8080/thredds/catalog.html

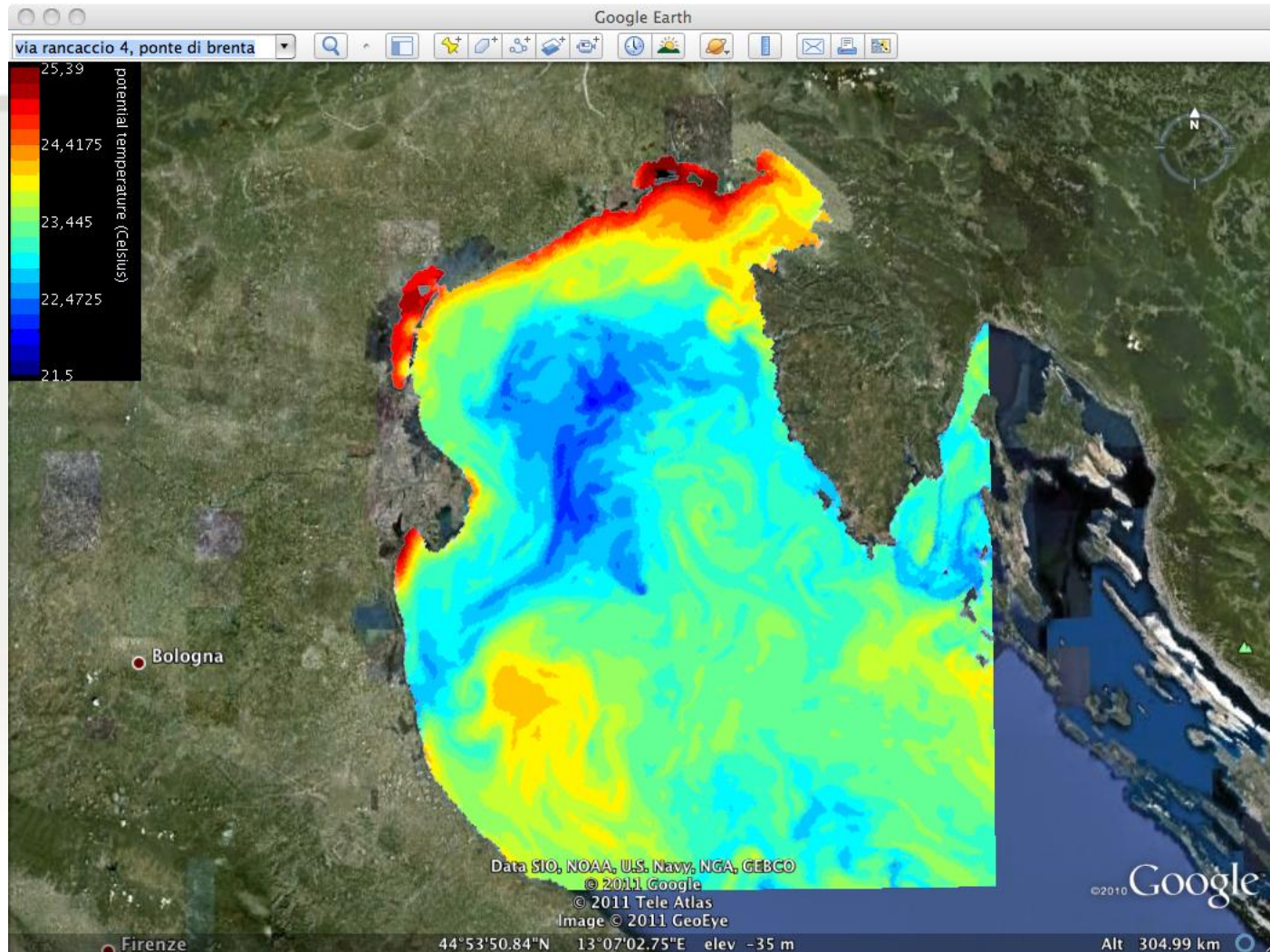
from the THREDDS to the TDS

Più visitati m Come iniziare U ultime notizie

Catalog <http://tds.ve.ismar.cnr.it:8080/thredds/catalog.html>

Dataset	Size	Last Modified
Local Catalogs		--
Creus/		--
Vector/		--
Field/		--
Marina/		--
Field2/		--
Remote Catalogs		--
Bathymetry Catalog from USGS/		--
RITMARE Remote Catalogs		--
ISAC Ritmare Catalog/		--

back to top level at ISMAR



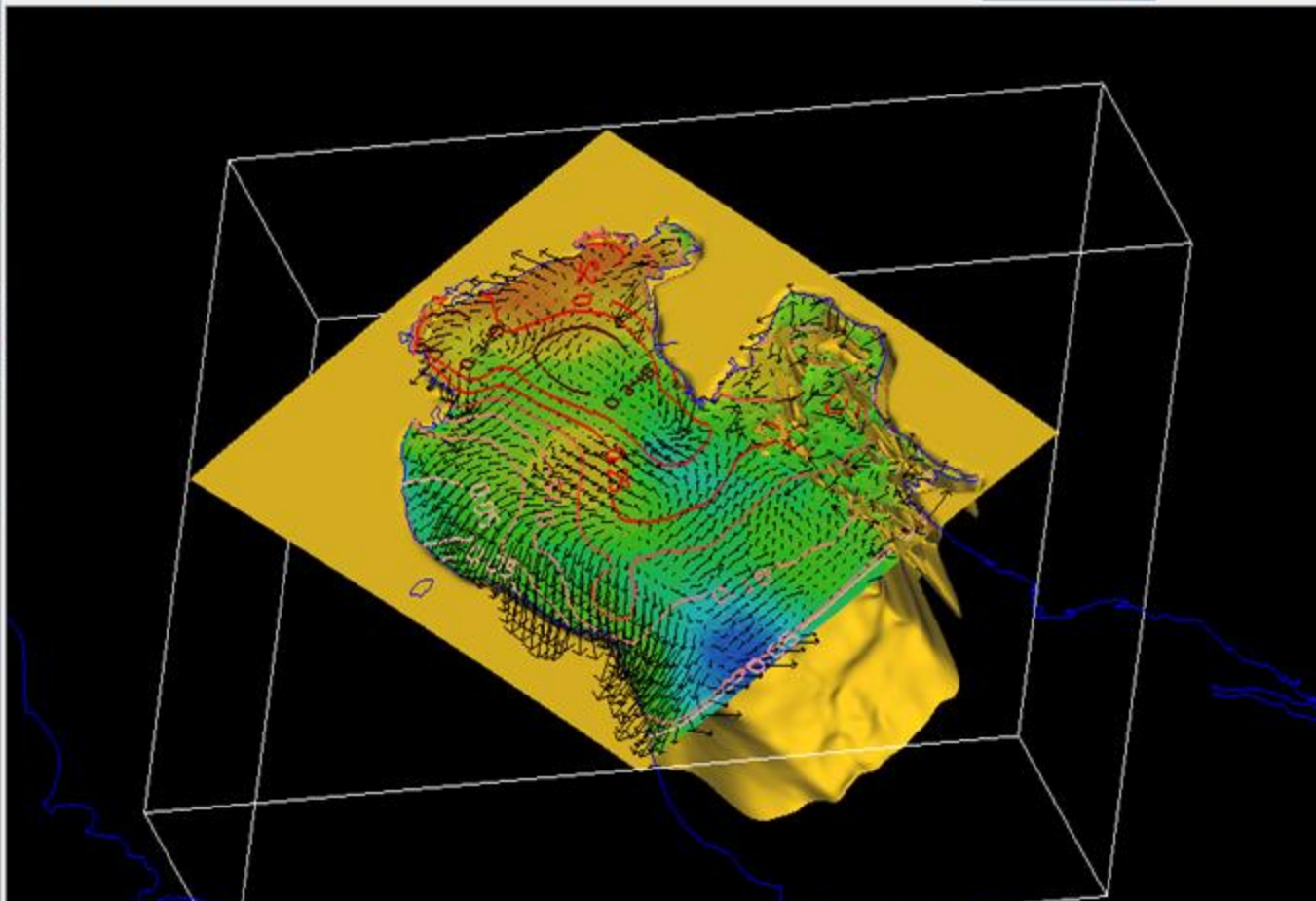
Unidata IDV - Map View - One Pane

File Edit Displays Data Tools Help



View Projections

2007-05-28 03:00:00Z



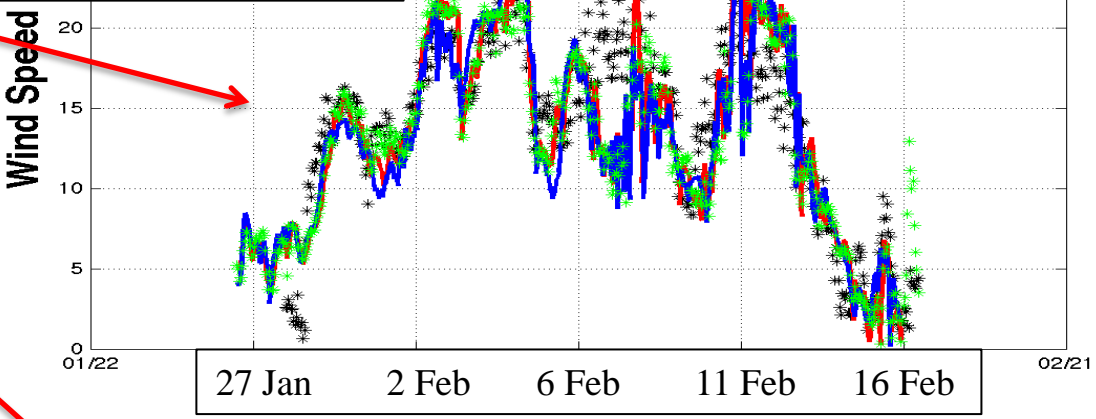
Legend

- Maps
 - Default Background Maps
 - World Coastlines
- 3D Surface
 - negateField - Topography
 - 92,6
 - 2
- Plan Views
 - Hwave - Contour Plan View
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 - temp - Color-Filled Contour Plan View
 - Level: -,125
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 - 24
 - Flow Displays
 - trueFlowVectors - Vector Plan View
 - Color: ■

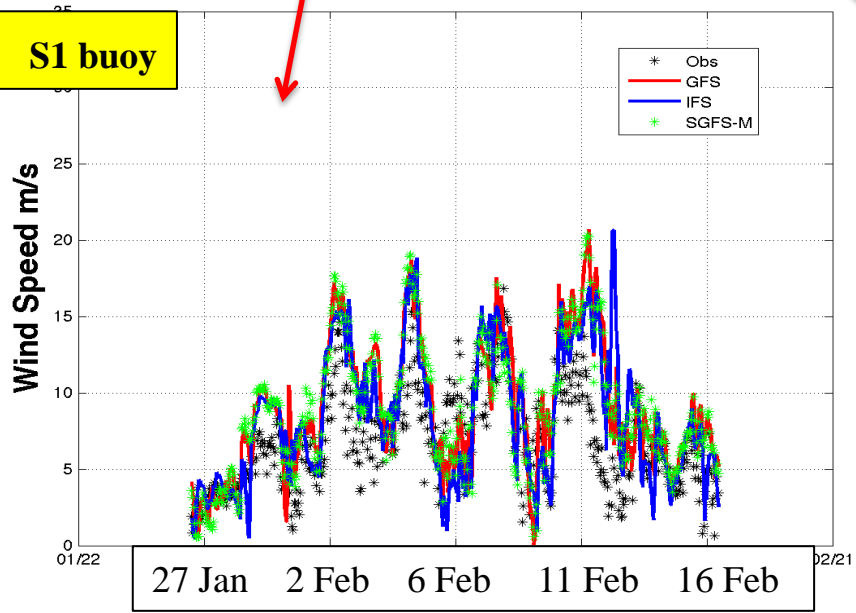
negateField - Topography
Hwave - Contour Plan View 2007-05-28 06:00:00Z
temp - Color-Filled Contour Plan View 2007-05-28 12:00:00Z

- OBS
- MOLOCH GFS
- MOLOCH IFS
- MOLOCH GFS+SAT

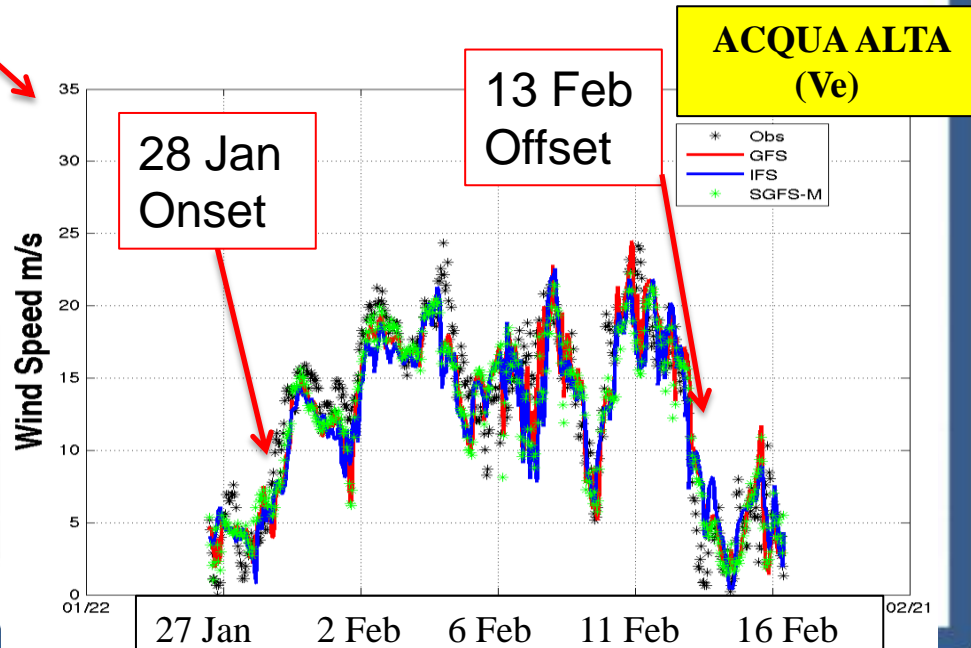
VIDA

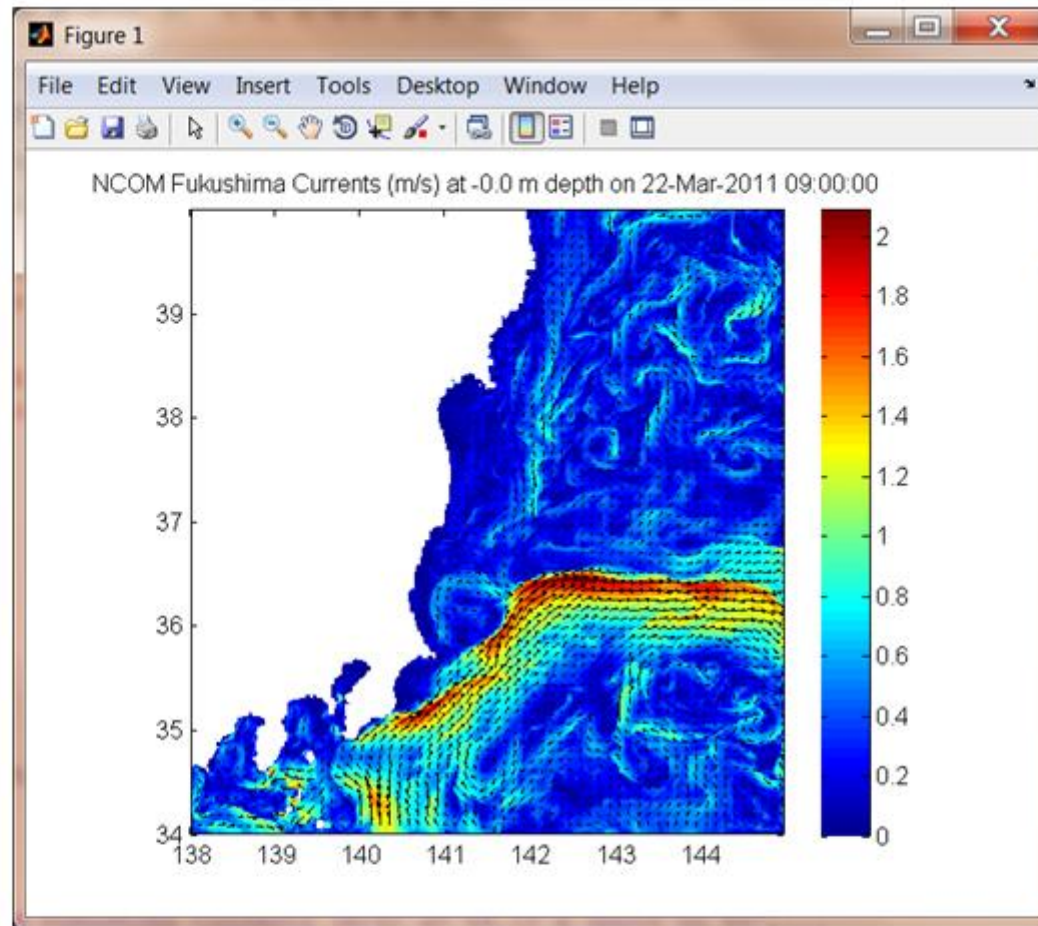


S1 buoy



ACQUA ALTA (Ve)





```
url=['http://edac-dap3.northerngulfinstitute.org/'...
    'thredds/dodsC/ncom_fukushima_agg/Fukushima_best.ncd'];
nc=ncgeodataset(url);
u=nc{'water_u'}(100,1,1:2:end,1:2:end);
v=nc{'water_v'}(100,1,1:2:end,1:2:end);
g=nc{'water_u'}(100,1,1:2:end,1:2:end).grid;
w=double(squeeze(complex(u,v)));
pcolorjw(g.lon,g.lat,abs(w))
colormap('parula');
```

We have a standard-based, distributed and robust framework that allows ocean model assessment for everyone (“Reproducible Science”)

This framework has been promptly and smoothly adopted in existing projects (e.g. RITMARE SP3-WP4-AZ2)

Results: within RITMARE Project, this allowed:

- a real model interoperability,**
- a better use of existing models,**
- a much easier output exchange,**
- an easier visualization and analysis,**

...overall, positive feedback for better models!

Problems:

different work approach,
real attitude to open data policy,
need to enforce the procedure,
data vs paper relevance in our scientific context,
technical: structured/unstructured grids...
 performances...

Ongoing efforts: Ipython Notebook -the user interface is the browser, but the notebook server can run anywhere (free!), and can be placed close to the data (e.g. on your cluster) enabling much more efficient data access for analysis and visualization

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