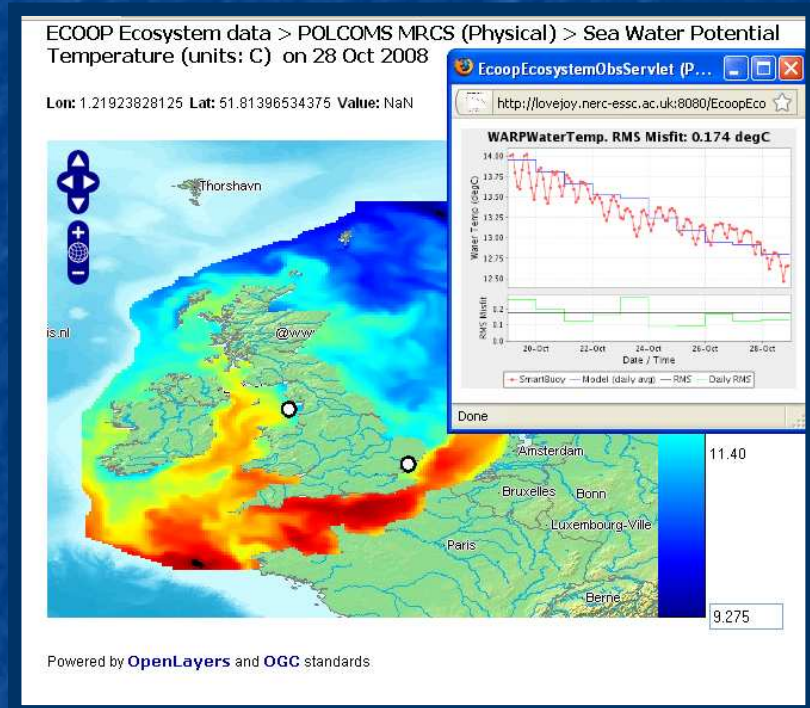


Online intercomparison of models and observations using OGC and community standards

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* **Jon Blower**
Keith Haines
Adit Santokhee

Reading e-Science Centre,
Environmental Systems Science Centre,
University of Reading, UK

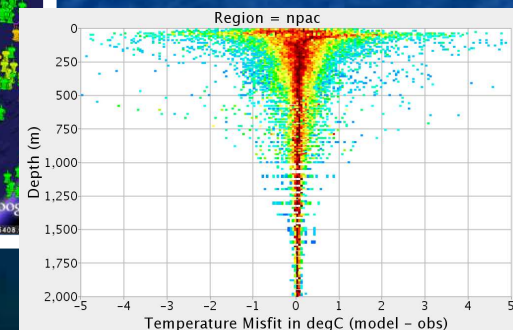
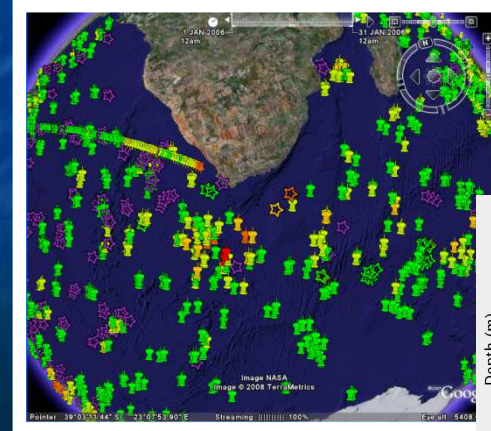
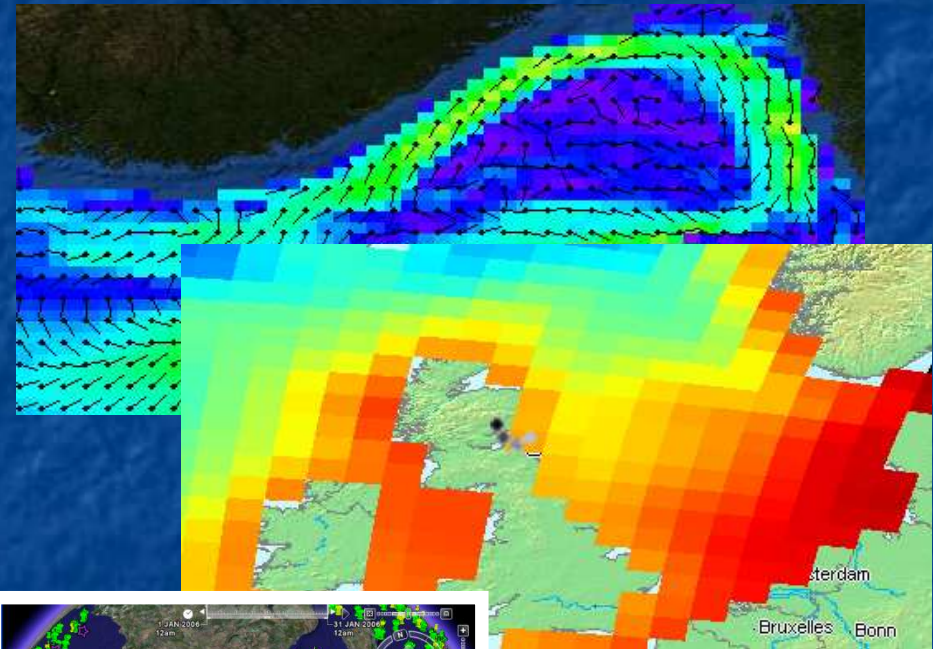
Plus lots of colleagues on ECOOP
project



OGC/GIS/Met meeting, Toulouse,
November 2009

Reading e-Science Centre

- Based in Environmental Systems Science Centre, University of Reading, UK
- Goal is to apply novel IT techniques to scientific research
- We are scientists and software engineers, not data providers
- We work with many kinds of data: model, in situ, remote sensing
- In many scientific areas (oceanography, meteorology, climate science, hydrology...)
- OpenGIS can help us to bring these datasets together



ECOOP Ecosystem Portal

- ECOOP: European COastal Sea Operational observing and forecasting system.
- Aim is to compare **in-situ observations** and **model analyses/forecasts** as a technology demo for predicting harmful algal blooms in the North Sea.
- Intercomparison gives users more confidence in bloom predictions if past observed and model data agree relatively well
- Physical data (temperature, salinity and velocity)
- Biological data (biomass, nitrate and silicate concentrations)
- Data distributed among the partners

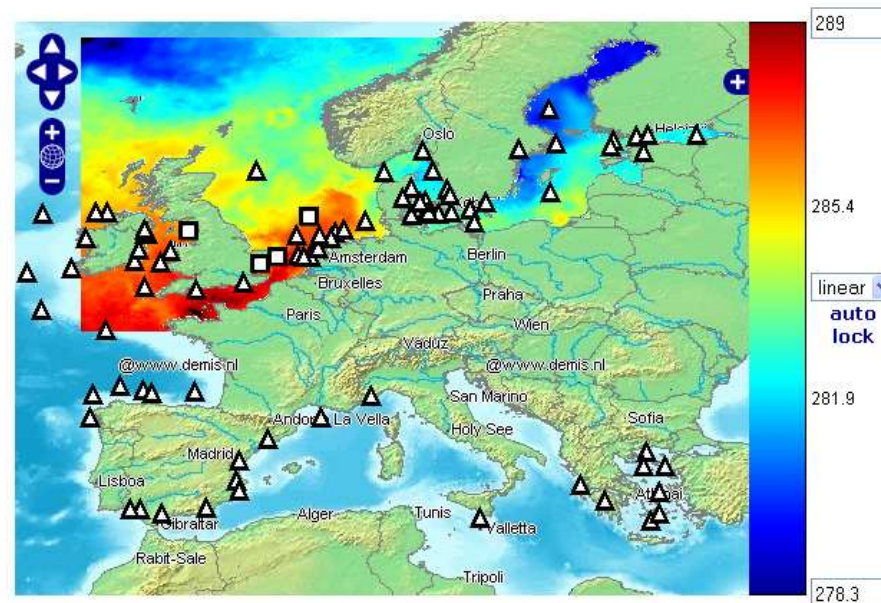
ECOOP Obs

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October, 2009						
Today						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
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4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
Select date						

ECOOP Obs Data > ECOOP BOOS (Baltic) > DMI Sea Surface Temperature > Sea Surface Temperature (units: kelvin) on 28 Oct 2009

Click on the map to get more information



- CEFAS SmartBuoy
- Pride of Bilbao Ferrybox (2008 data available, 2009 coming soon after a refit)
- ▲ SEPRIS Data

Powered by **OpenLayers** and **OGC** standards

- ECOOP Obs Data
 - ECOOP BOOS (Baltic)
 - DMI BALTIC BEST ESTIMATES
 - DMI Sea Surface Temperature
 - Sea Surface Temperature
 - BSH Best Estimates
 - ECOOP IBIROOS (Iberia-Biscay-Ireland)
 - ECOOP NOOS (North West Shelves)
 - ECOOP MOON (Mediterranean)
 - ECOOP BSGOOS (Black Sea)



ECOOP is funded by the European Commission's Sixth Framework Programme, under the priority Sustainable Development, Global Change and Ecosystems. Contract No. 36355.

To give feedback on the portal, please use this [enquiry form](#) on the National Centre for Ocean Forecasting website.

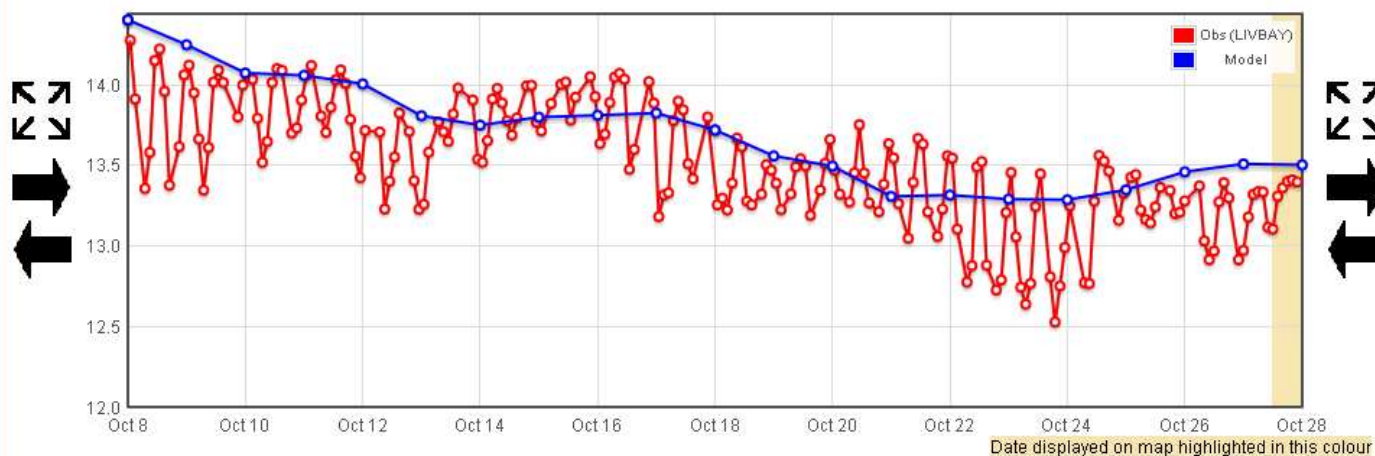


http://www.resc.reading.ac.uk/ecoop_ecosystem_portal



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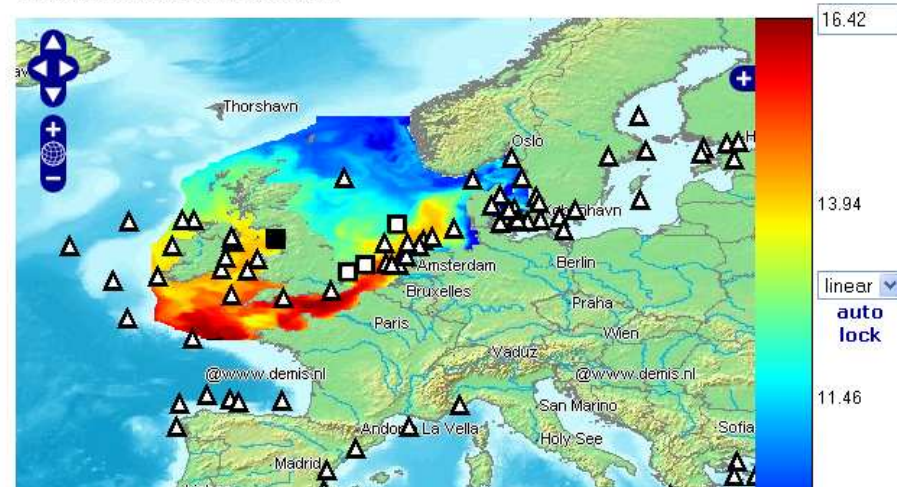
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Select date

ECOOP Obs Data > ECOOP NOOS (North West Shelves) > POLCOMS MRCS (Physical) > Sea Water Temperature (units: C) on 28 Oct 2009

Click on the map to get more information

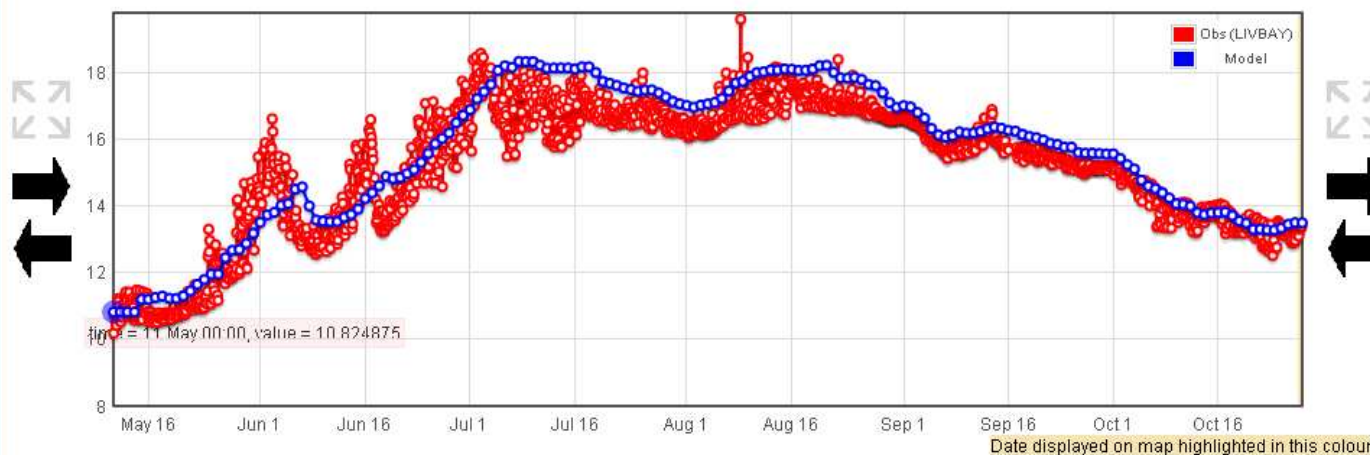
- ECOOP Obs Data
 - ECOOP BOOS (Baltic)
 - ECOOP IBIROOS (Iberia-Biscay-Ireland)
 - ECOOP NOOS (North West Shelves)
 - DMI Sea Surface Temperature
 - Mercator psy2v3 Best Estimate
 - POLCOMS MRCS (Physical)
 - Sea Water Temperature
 - Sea Water Salinity
 - Sea Water Velocity





ECOOP Obs

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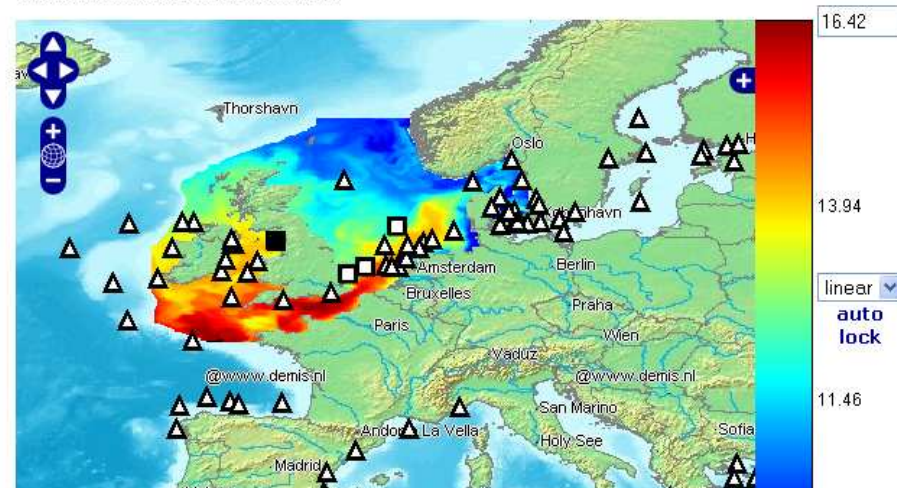
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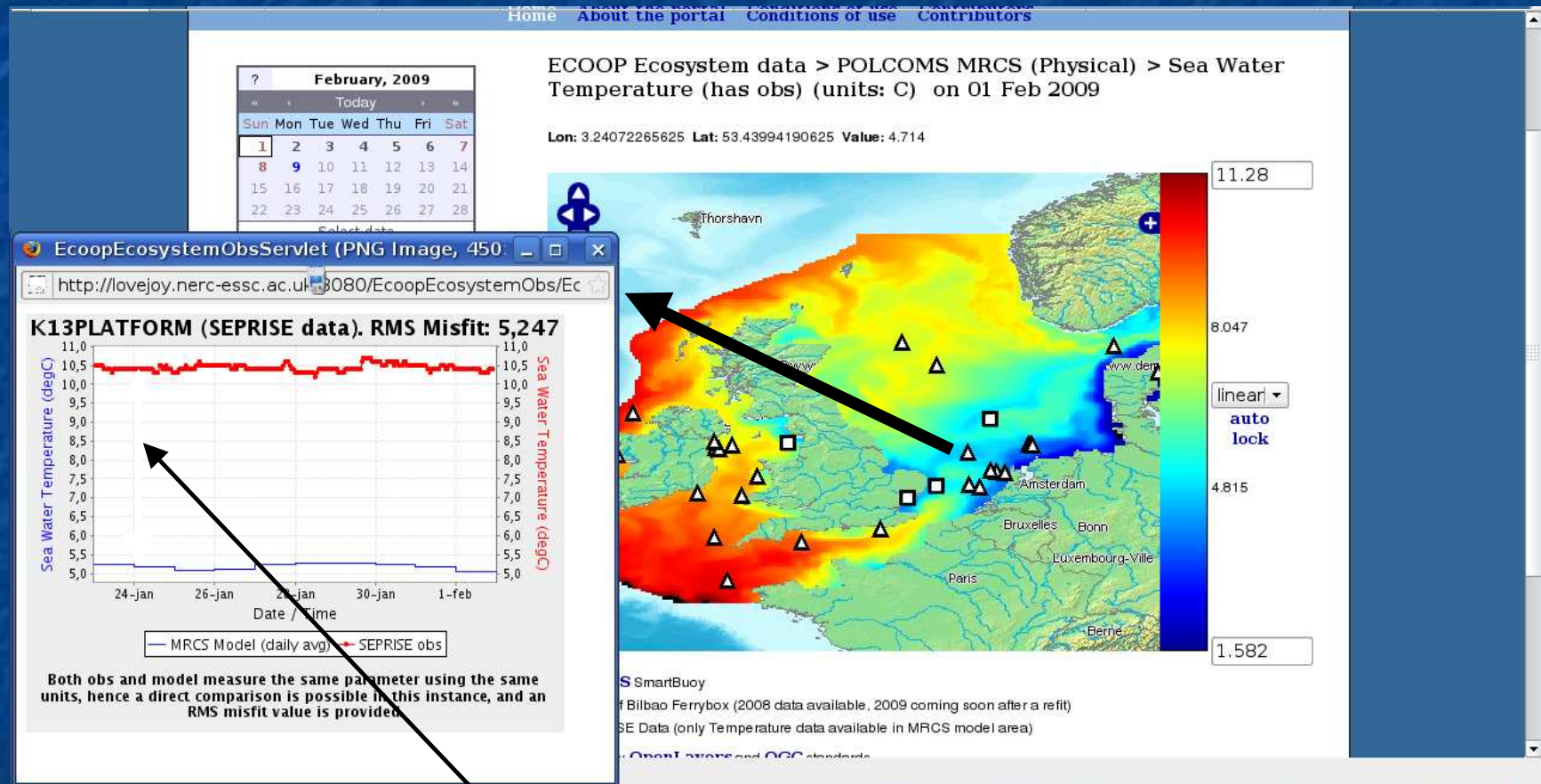
ECOOP Obs Data > ECOOP NOOS (North West Shelves) > POLCOMS MRCS (Physical) > Sea Water Temperature (units: C) on 28 Oct 2009

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- ECOOP Obs Data
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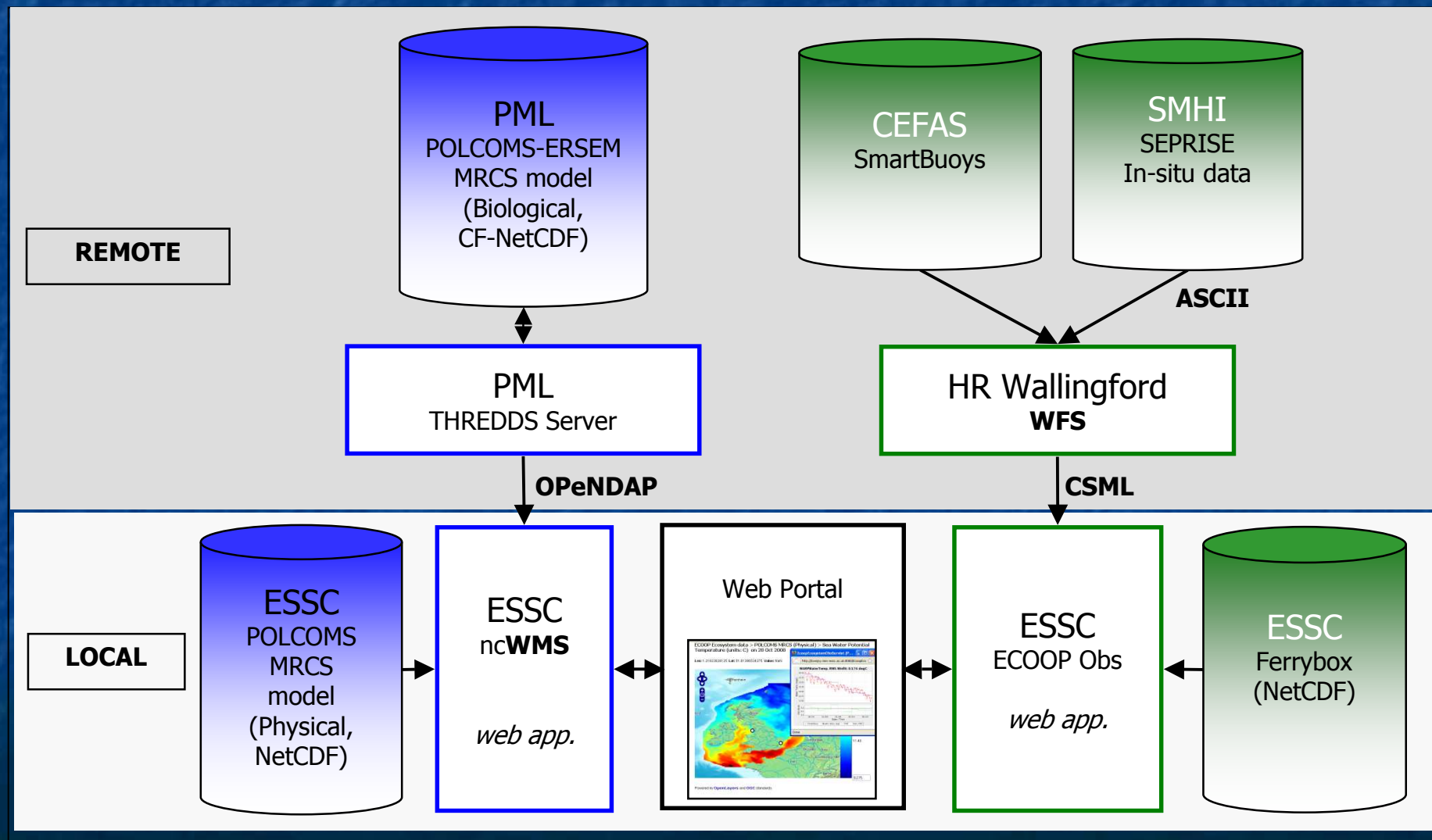


Comparing / co-plotting datasets can catch errors!



This looks like a suspiciously large and constant difference between obs and model

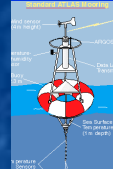
ECOOP Ecosystem Portal architecture



Representing data as CSML Features (selected)

PointSeriesFeature

(timeseries at a point)



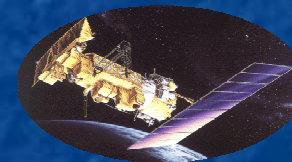
ProfileFeature

(vertical profile at a point)



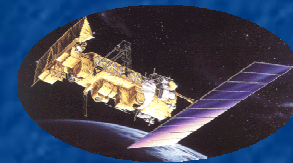
GridSeriesFeature

(series of multidimensional grids)



SwathFeature

(single satellite sweep)



SectionFeature

(vertical section)



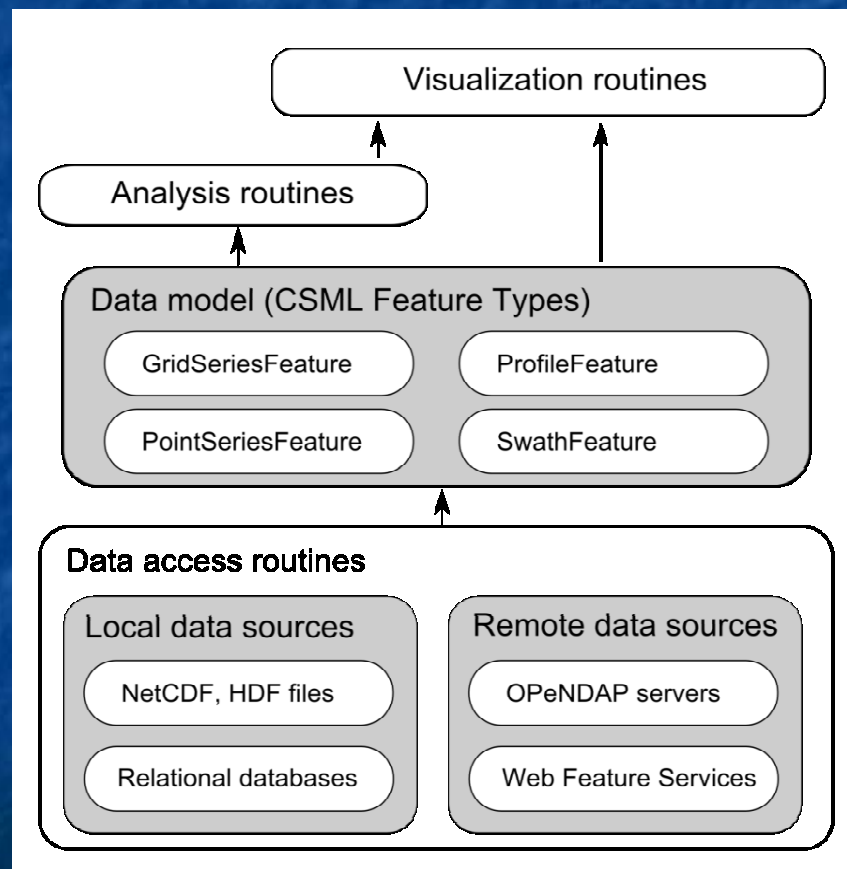
Feature Types are classified by their geometry

How it works

- Model data accessed through OPeNDAP and ncWMS
 - “pseudo-observations” extracted through WMS GetFeatureInfo
- In situ observations accessed through WFS and direct NetCDF file access
 - GeoServer, serving CSML documents
- Custom dynamic web interface based on OpenLayers

How would we like to improve this?

- Harmonize the data access layer (right)
- GetFeatureInfo should return CSML
- Bring in other data sources
- Allow data download
 - Output CSML data model in various formats, inc. NetCDF, XML, CSV
- Would SOS be more suitable than WFS?



Challenges in using CSMML for data exchange

- Multiplicities
 - Inheritance from GML gives large number of encoding options
 - Many ways of encoding “soft typed” quantities like units, phenomena, coordinate systems
- So we need a “cookbook” of recommended best practice to reduce the options to something manageable
 - A “profile of a profile” essentially
 - GeoSciML did this too

What **value** do we get from OGC for this kind of app?

- The input of a much wider community
- More robust domain modelling
- Software reuse
 - Mainly for “semantically light” services
 - WMS and simple-feature WFS
- Other domains will be familiar with terms and technology
- A warm fuzzy feeling
 - Sometimes, anyway ;-)

Where is the OGC approach less helpful?

- WFS 1.0 doesn't support feature subsetting
 - We invented a syntax for timeseries subsetting
- Serving gridded (model) data
 - WCS currently adds very little value above CF-OPeNDAP in practice for this app
- Not much "real" interoperability with third parties in terms of data
 - Interop of geospatial component much better
 - All OGC services need profiling for our use
 - ... But what does that mean for other communities with different profiles?

Suggestion for maximizing value of WFS approach

- First point of entry should be a simple-feature WFS
 - Serves observation *locations* only
 - Plus simple text attributes (e.g. Instrument type)
 - Accessible by most OpenGIS clients and communities
 - Allows reuse of lots of existing tools
- Clicking on obs location gives fully-specified complex feature
 - In “highly precise” formats for special clients, e.g. CSML
 - In less precise formats for general audience, e.g. HTML, CSV
 - Options to subset the feature through WFS 2.0
- Requires links between services
- Looks more like the Web

Conclusions and suggestions

- Combination of met-ocean community and OGC standards used to support online data intercomparison
- CSML data model is a very practical abstraction
 - (although we still need to specialize it further to be implementable)
 - Convergence with Unidata CDM will be very welcome
 - We are producing a FOSS Java library to abstract various kinds of data
- We need to understand how best to use our robust, proven, practical (note: not “legacy” technology)
 - CF, NetCDF, OPeNDAP
- Lots of others are developing this type of app
 - How about a Best Practices document for Web-GIS?