



EarthServer Ahead!

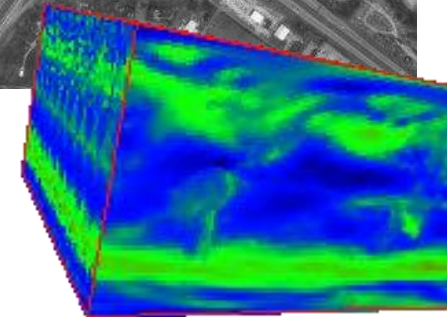
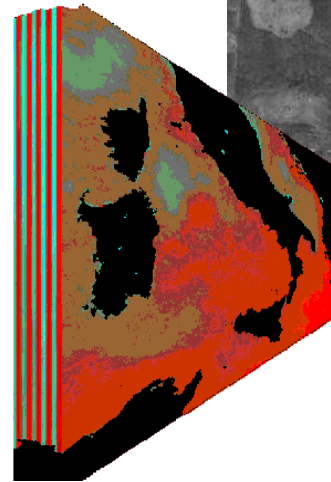
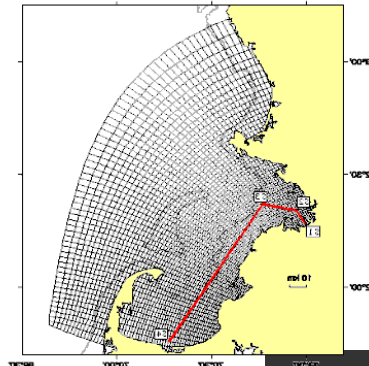
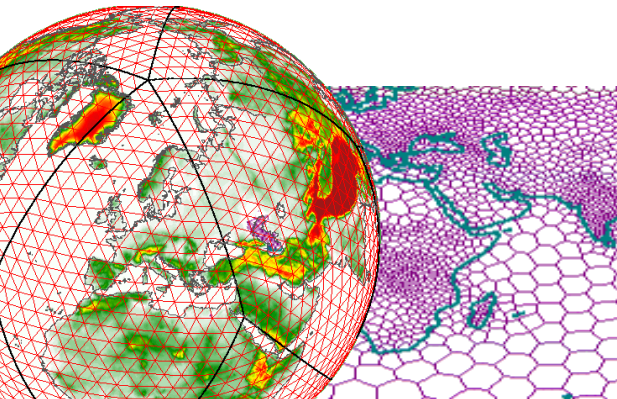
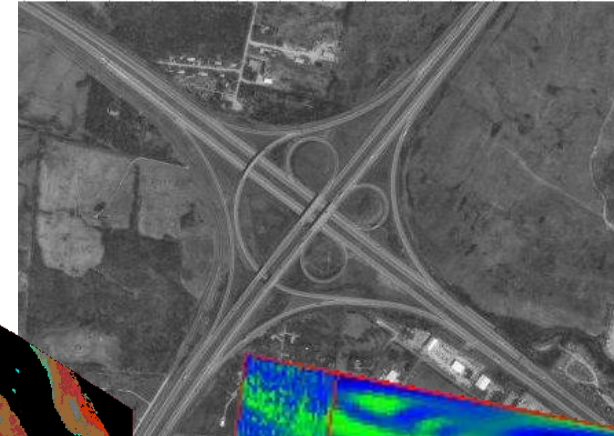
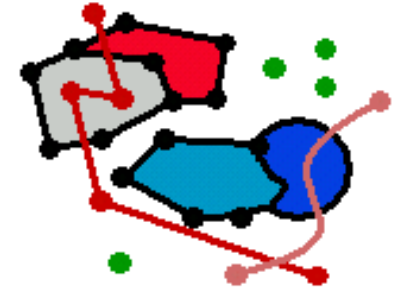
Open Source Park, INTERGEO 2013

Peter Baumann

Jacobs University | rasdaman GmbH

A Bit of OGC: Features & Coverages

- The basis of all: geographic **feature**
 - = *abstraction of a real world phenomenon* [OGC, ISO]
 - associated with a location relative to Earth
- Special kind of feature: **coverage**
 - = *space-time varying multi-dimensional phenomenon*
 - Classic: **2-D raster image**
 - *...but there is more!*
- Often **Big Geo Data** are coverages

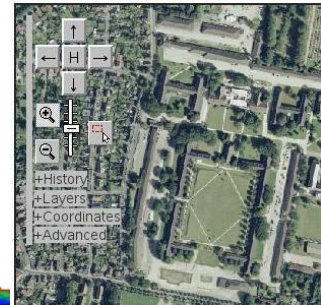
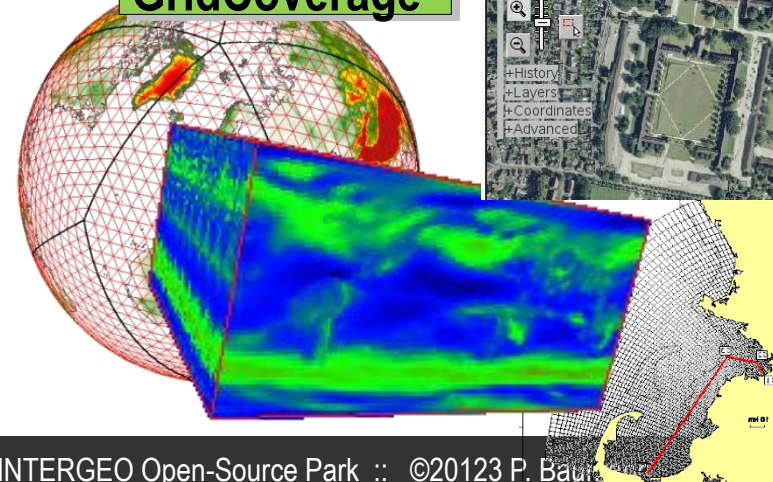
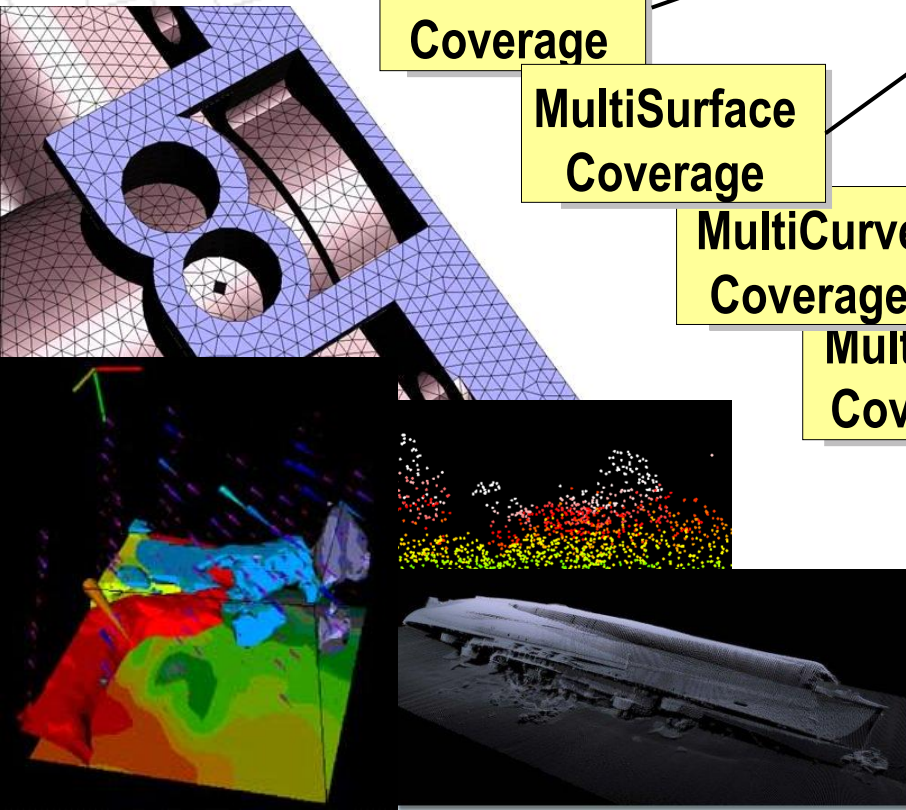
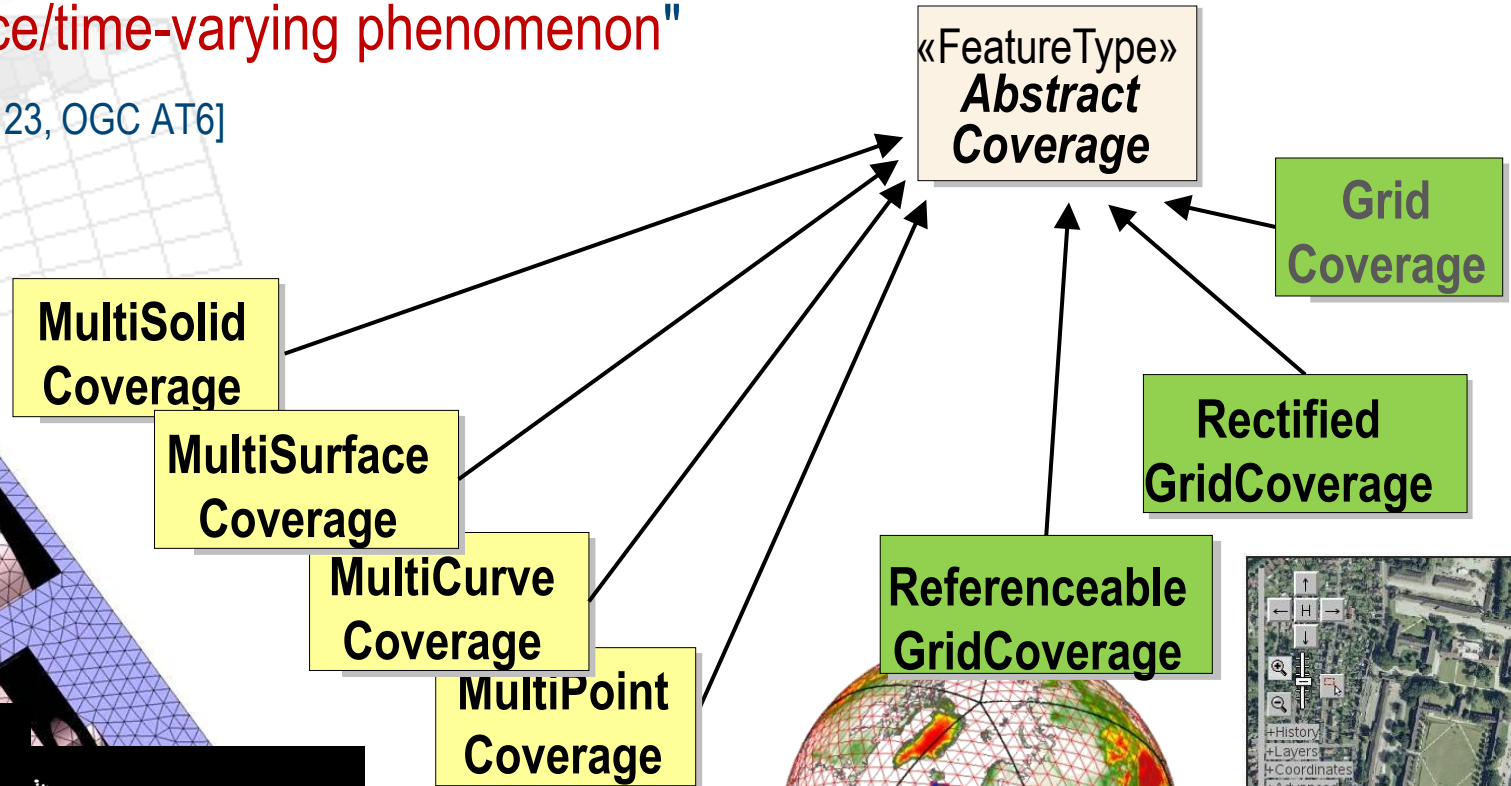


OGC Coverage

[OGC 09-146r1]

- n-D "space/time-varying phenomenon"

- [ISO 19123, OGC AT6]

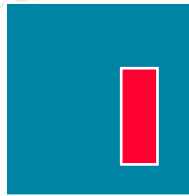


Web Coverage Service (WCS)

- **Core:** Simple & efficient access to n-D spatio-temporal coverages
 - plus format encoding

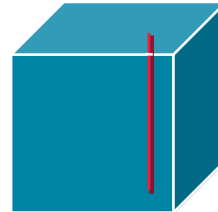
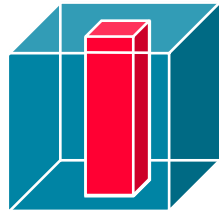
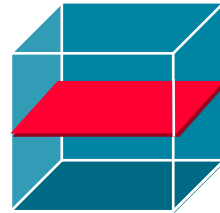
■ subset =

trim



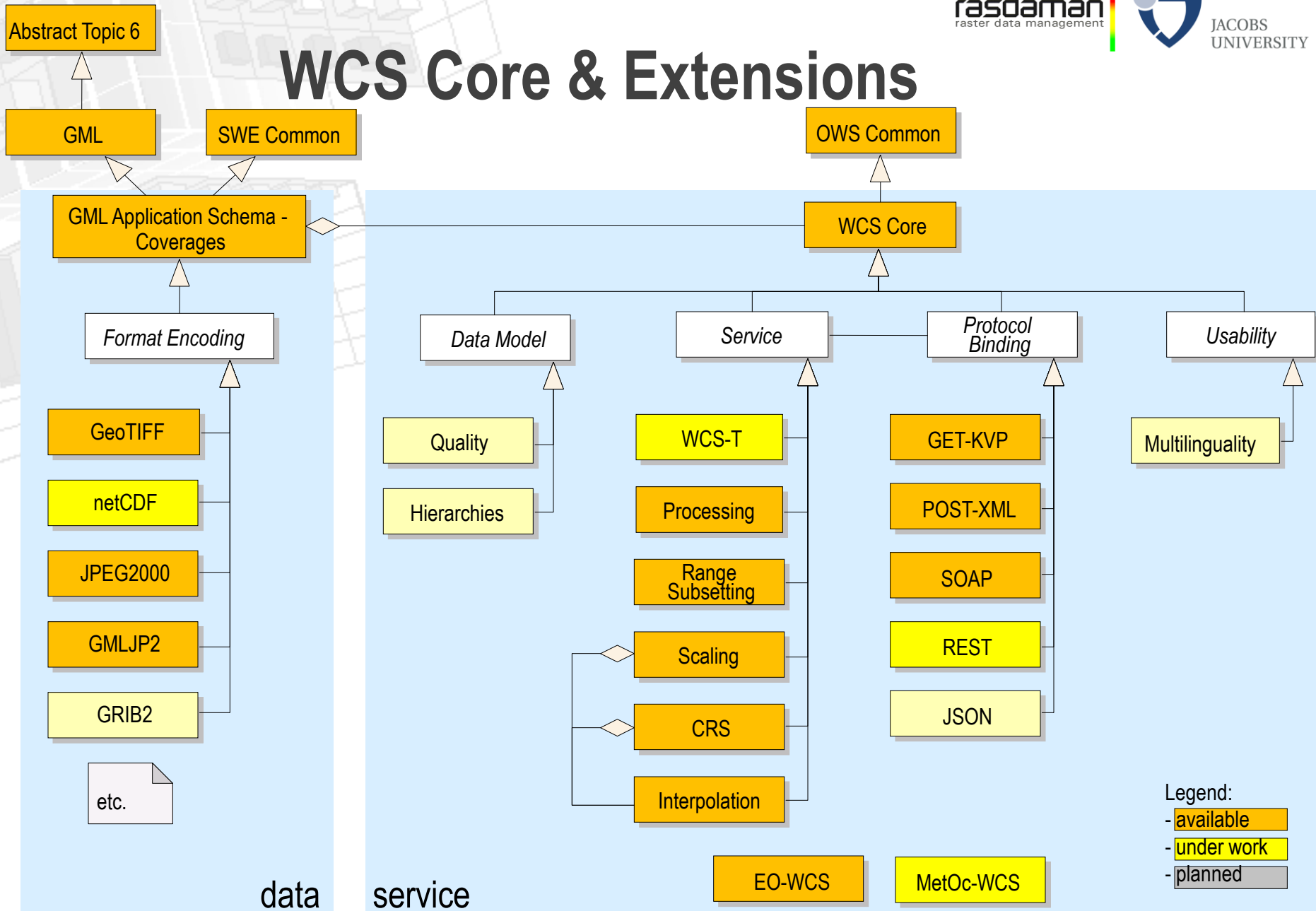
|

slice



- **Extensions** add functionality facets
 - Scaling, CRS transformation, ...up to ad-hoc analytics

WCS Core & Extensions



for illustration only – not normative!



EarthServer: *Big Earth Data Analytics*

- Scalable On-Demand Processing for the Earth Sciences
 - EU FP7-INFRA, 3 years, 5.85 mEUR
- 100+ TB databases for Earth & Planetary sciences
 - Platform: rasdaman; strictly open standards interfaces (OGC, W3C, X3D)

Cryospheric Science
landcover mapping

E O X

Airborne Science
high-altitude long-endurance drones

NASA

Atmospheric Science
climate variables

M E E O
Meteorological Environmental Earth Observation

Geology
geological models

B G S British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Oceanography
marine model runs + in-situ data

P M L PLYMOUTH MARINE LABORATORY

Planetary Science
Mars geology

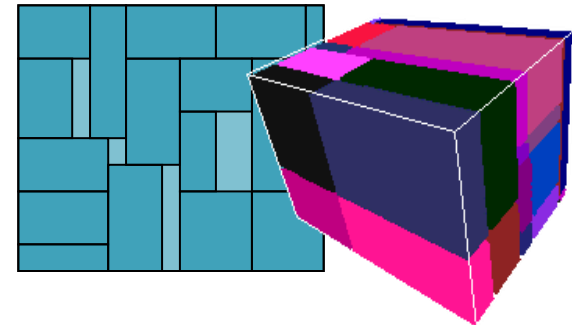
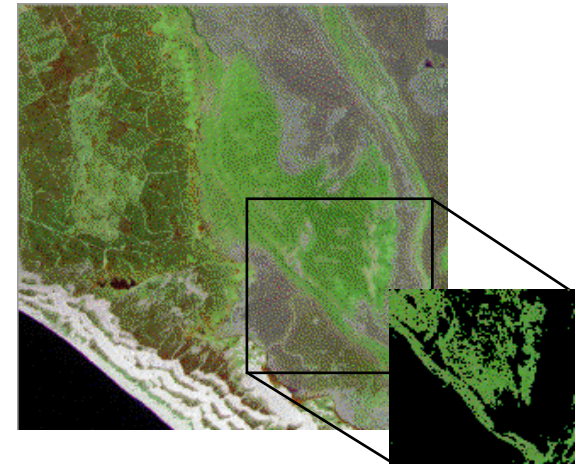
JACOBS UNIVERSITY

- raster data manager
= **Array DBMS** for massive n-D raster data

- SQL + imaging operators

```
select img.green[x0:x1,y0:y1] > 130
from LandsatArchive as img
where avg_cells( img.nir ) < 17
```

- **Flexibility** ← query language
- **Scalability** ← „tile streaming“ architecture, parallelization
- In use by DWD, VITO/BE, ...



EarthServer Anatomy

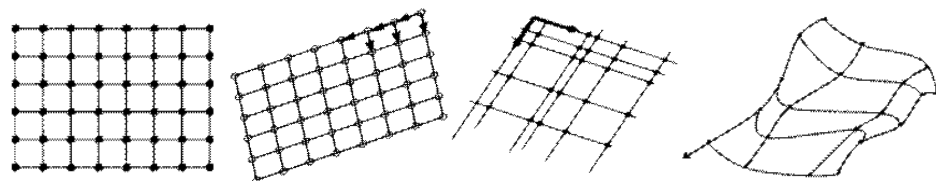
- RTD Activity: establish & extend operational service software
 - Lead: Jacobs Uni
- Services Activity: establish 6 operational Lighthouse Applications
 - Lead: EOX
- Networking Activity: outreach, standardization
 - Lead: CNR

WP320: Coverage Services

- Jacobs Uni, rasdaman, CNR, BGS
- WCS 2.0 service components (JacobsUni)
 - Done: WCS Core, protocols (KVP, POX, SOAP), range subsetting, CRS, ... plus manifold fixes & additions to rasdaman
 - TBD: WCS-T 2.0, WCPS 2.0; REST

- Extend WCPS to nonuniform grids (JacobsUni, RAS)

- Done: nonuniform grids in WCS



- Extend WCPS to nongridded data (JacobsUni, RAS)

- Done: point clouds in WCS

- Harmonize NetCDF and WCS/WCPS wrt. new coverage types (CNR-IIA)

WP330: QL Integration Data/Metadata

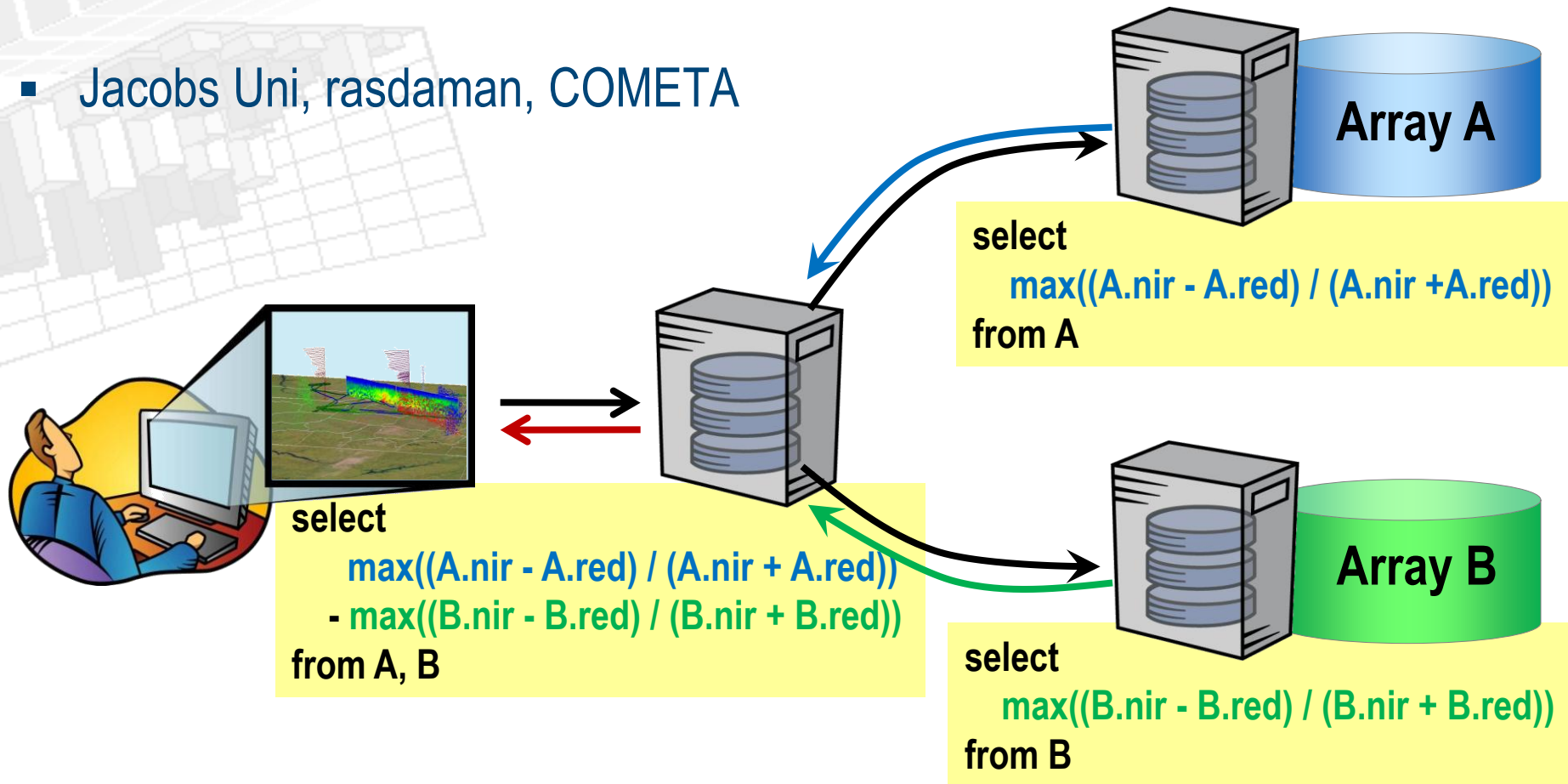
- ATHENA, Jacobs Uni
- WCPS 2.0 = WCPS + XQuery
 - Most metadata in XML – XPath/XQuery natural choice
- Advantages:
 - Convenience: integrated data + metadata search
 - Performance: less ping-pong between client and server(s)
- Implementation:
 - eXist + rasdaman

WP340: GIS Integration

- EOX
- MapServer accessing rasdaman as data source
- GDAL accessing rasdaman as data source
- Integration of existing archives
 - Traditionally: data imported into database
 - Problem: Large-scale data centers sometimes object to copying
 - Approach: reference external files, use as tiles

WP350: Scalability

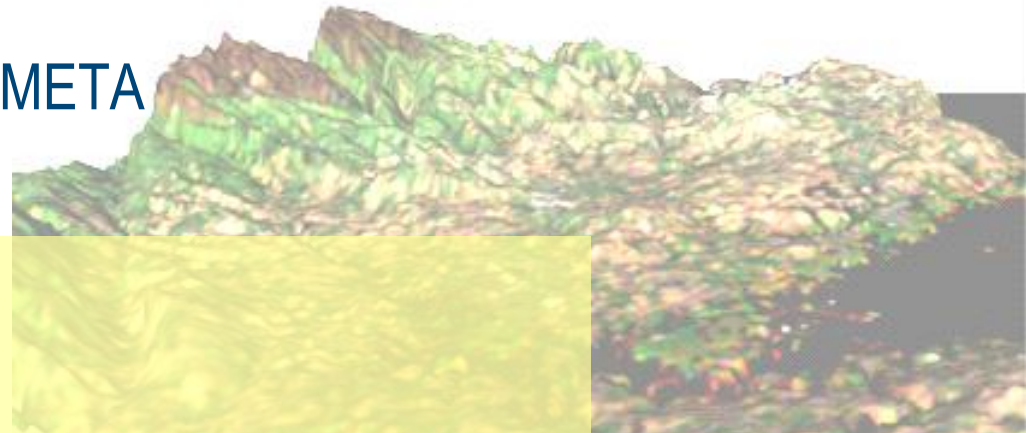
- Jacobs Uni, rasdaman, COMETA



WP360: 3D Database Visualization

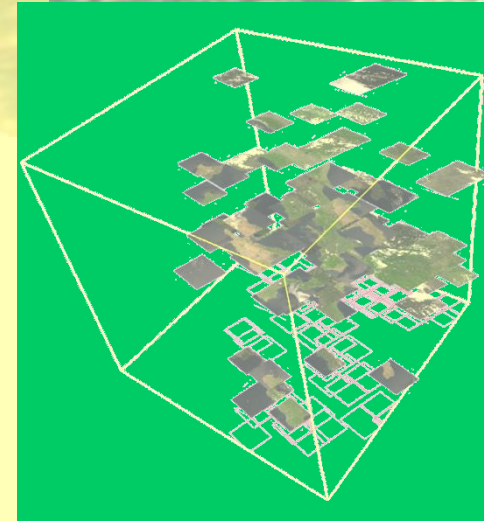
[data courtesy BGS, ESA]

- Fraunhofer IGD, Jacobs Uni, COMETA
 - Mobile WCS client, plus...

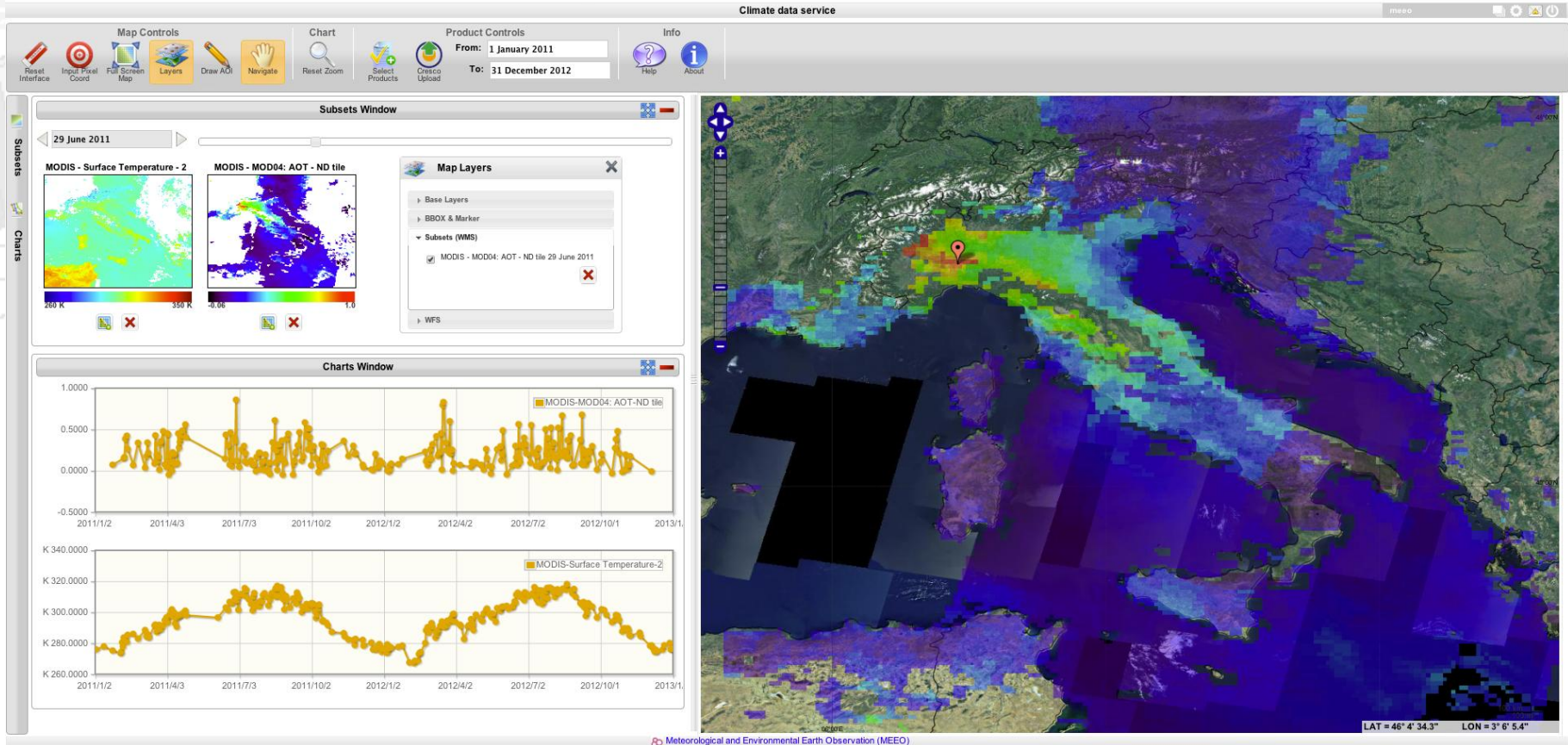


```

select
  encode (
    struct {
      red:   (char) s.b7[x0:x1,x0:x1],
      green: (char) s.b5[x0:x1,x0:x1],
      blue:  (char) s.b0[x0:x1,x0:x1],
      alpha: (char) scale( d, 20 )
    },
    "png"
  )
from SatImage as s, DEM as d
    
```

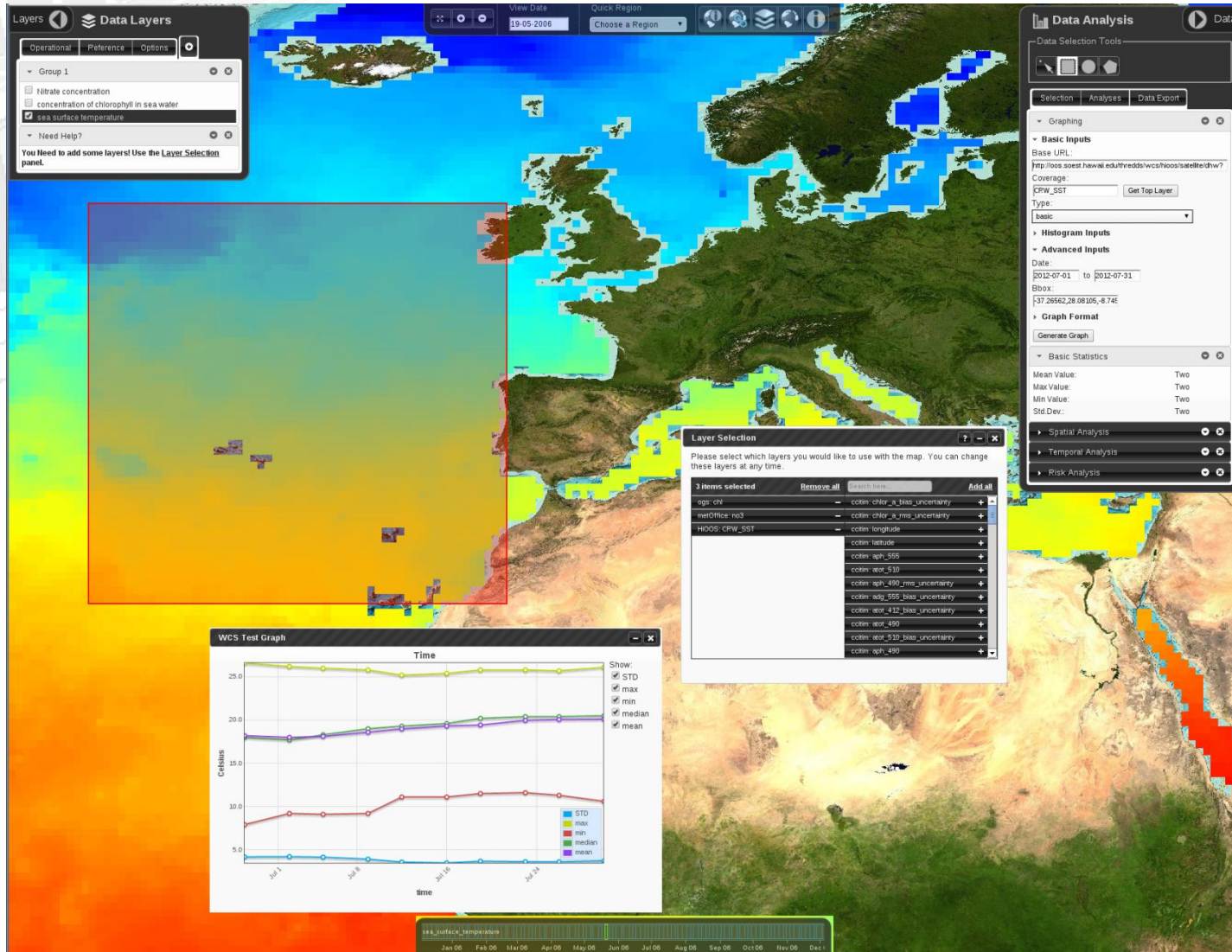


Ex: Climate Data Service, MEEEO



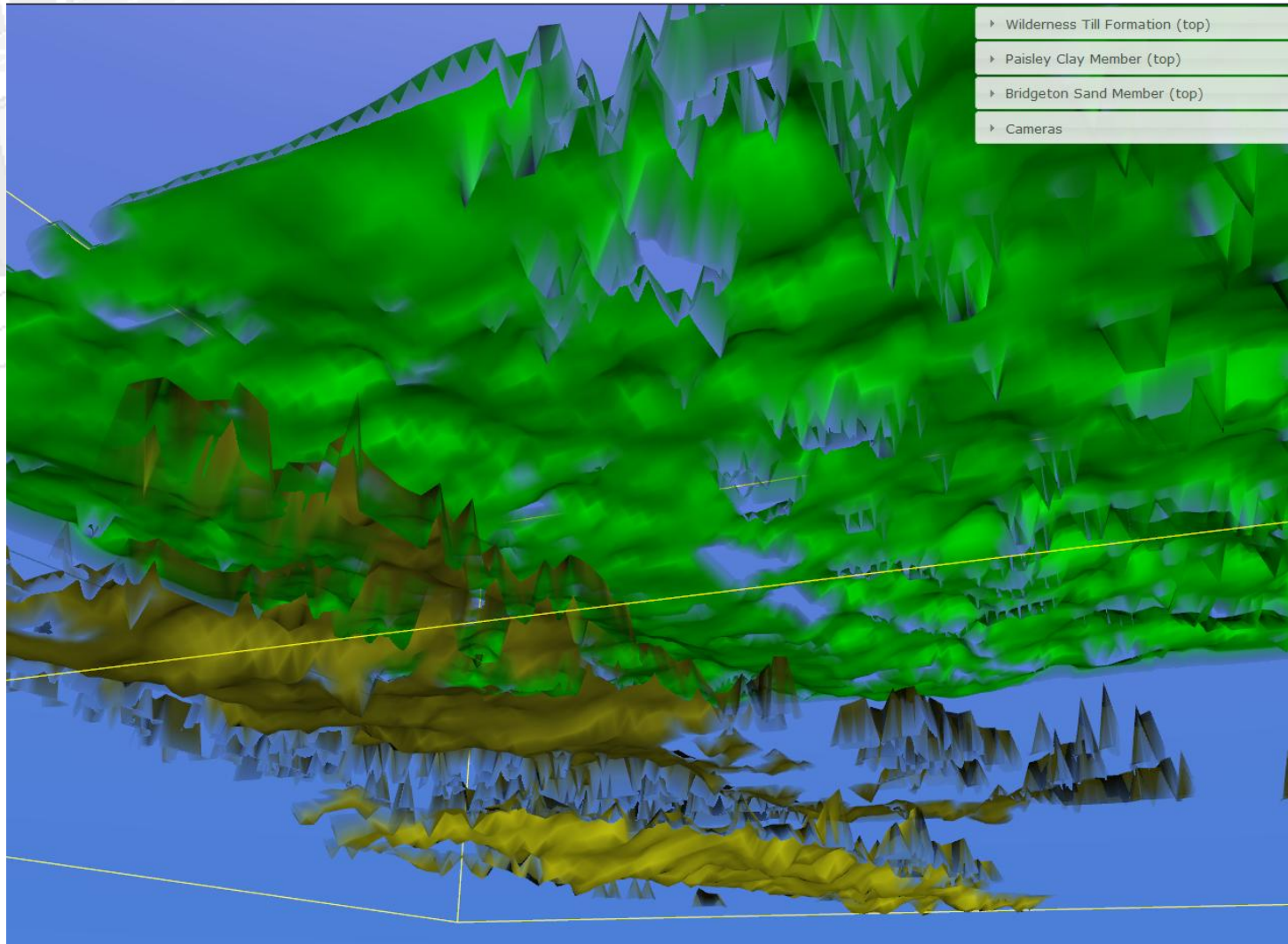
[MEEEO 2013]

Ex: Plymouth Marine Laboratory



[PML 2013]

Ex: British Geological Service



[BGS 2013]

Conclusion

- EarthServer establishing on-demand mix&match of Big Earth Data
 - Transatlantic – only FP7 project with NASA on board
 - Significant impact on standards
- rasdaman: flexibility, scalability, information integration, open source
 - GEOSS key component



vote for rasdaman!

