Integrating Weather Data with GIS: the draft OGC WCS Application Profile for MetOcean

5th Workshop on the use of GIS/OGC standards in meteorology

2014-oct-28, DWD, Offenbach, Germany

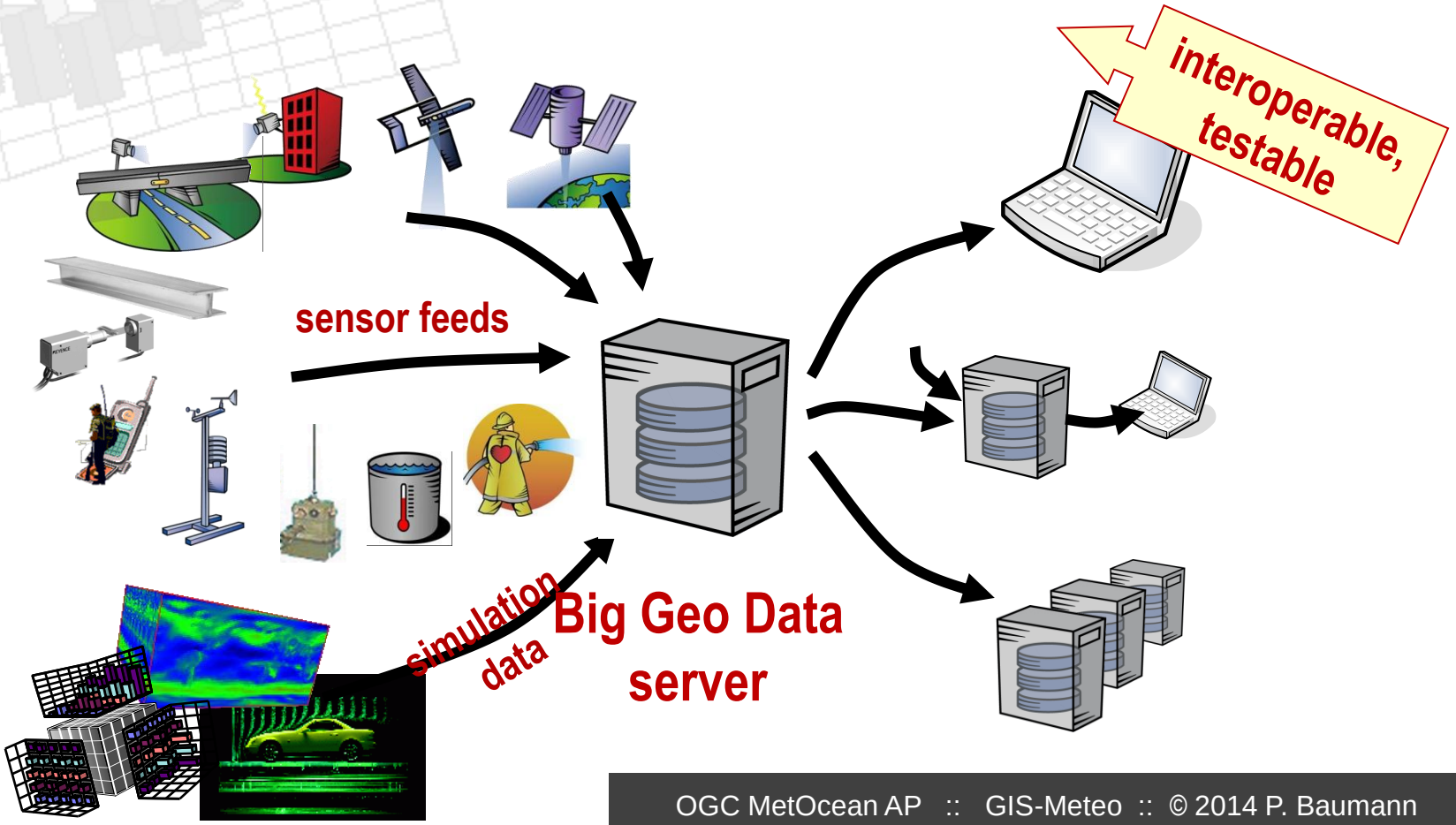
Peter Baumann

Jacobs University | rasdaman GmbH

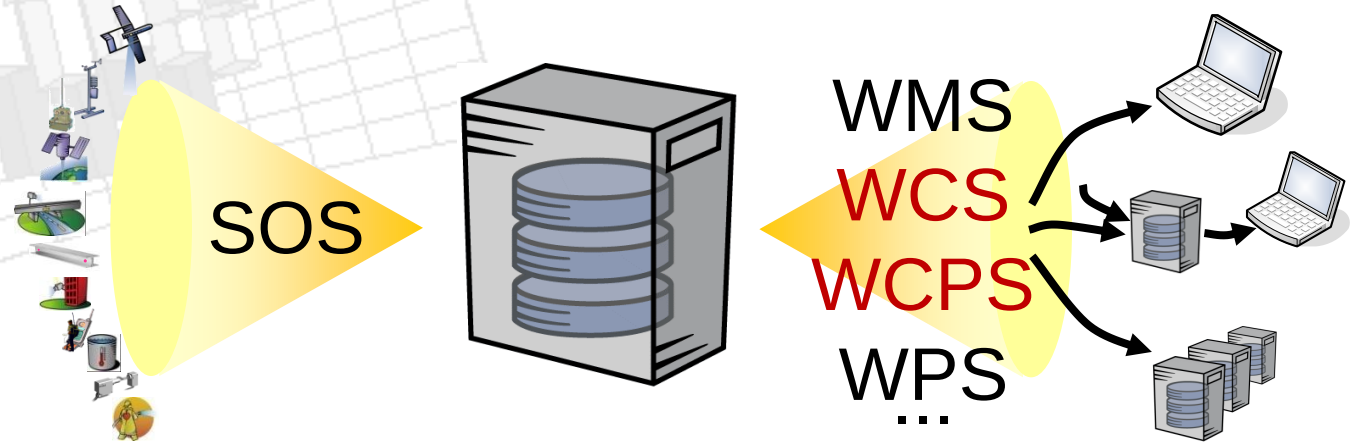
baumann@rasdaman.com

Big Geo Data: Typically, Coverages

= spatio-temporal sensor, image, simulation, statistics data



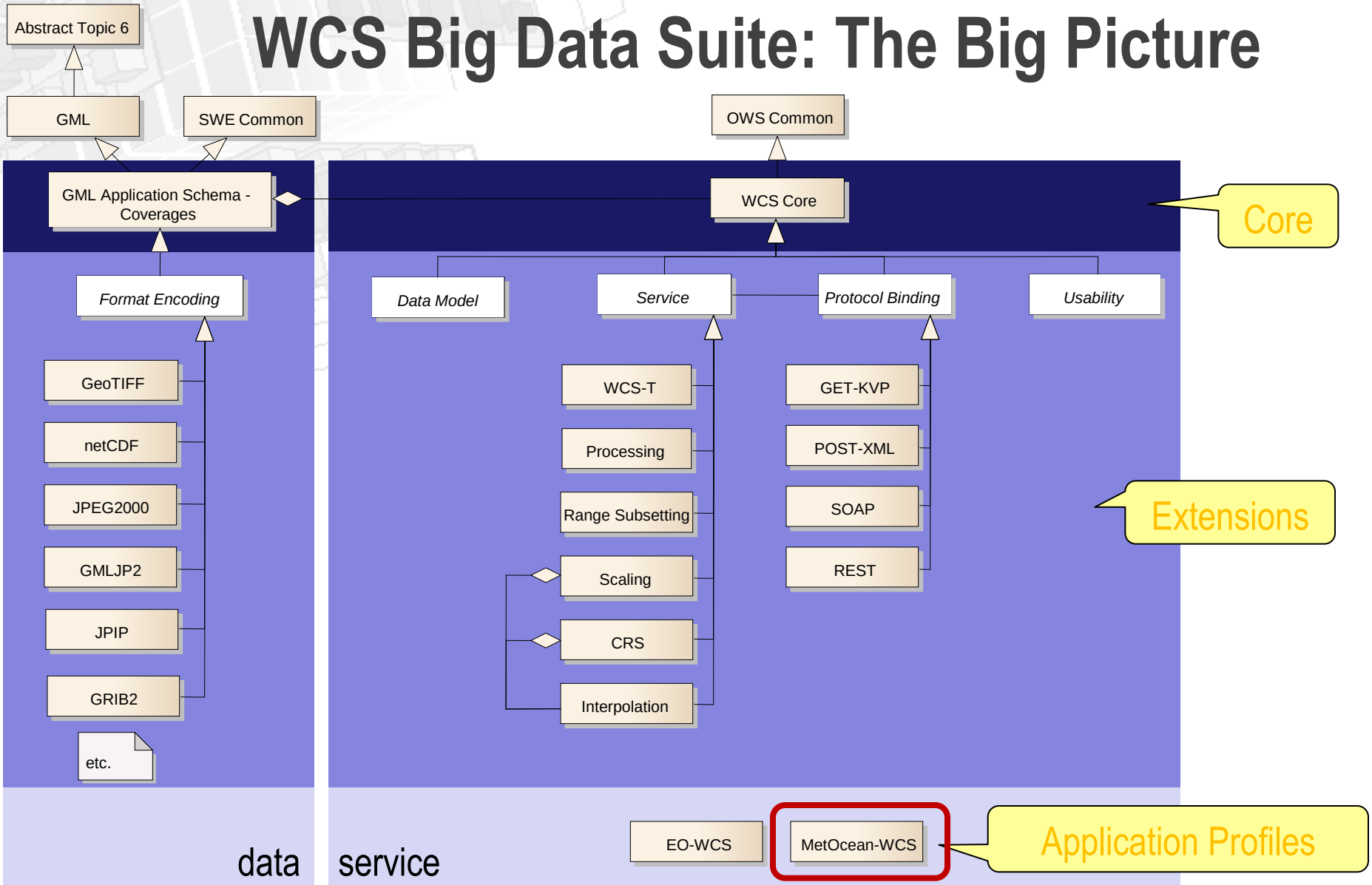
Serving Coverages: the OGC Mash-Up



SWE, SOS: upstream
sensor data capturing

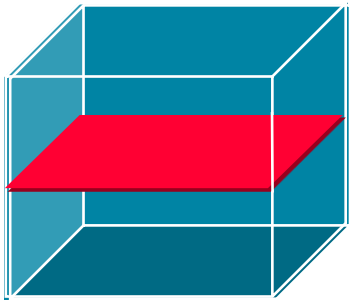
W*S: downstream
download, processing, visualization

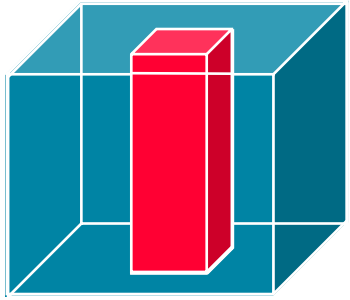
WCS Big Data Suite: The Big Picture

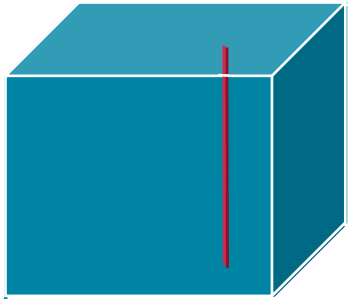


WCS *GetCoverage*: Subsetting

- subset = trim | slice





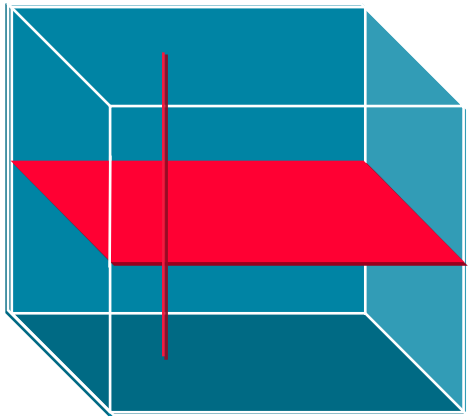


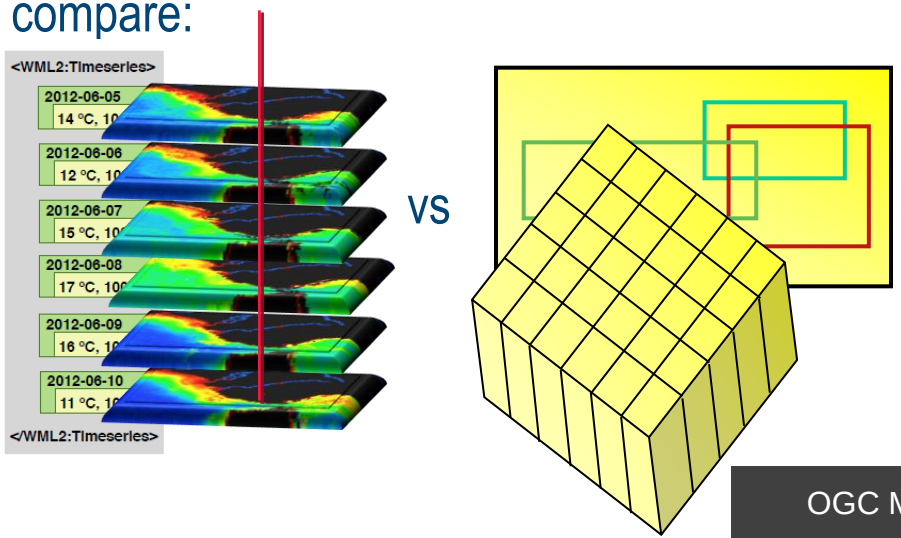
- For now: rasters & point clouds
  - Further coverage types need more investigation

demo on www.earthlook.org

Inset: Timeseries? Naturally, Coverages

- GMLCOV: simple paradigm - data cubes
  - time just another axis / axes
- WCS: modular, function-rich service suite
  - From simple subsetting to complex analytics
- Efficient implementations existing
  - 130+ TB timeseries cubes, 1 query → 1,000+ nodes
  - compare:

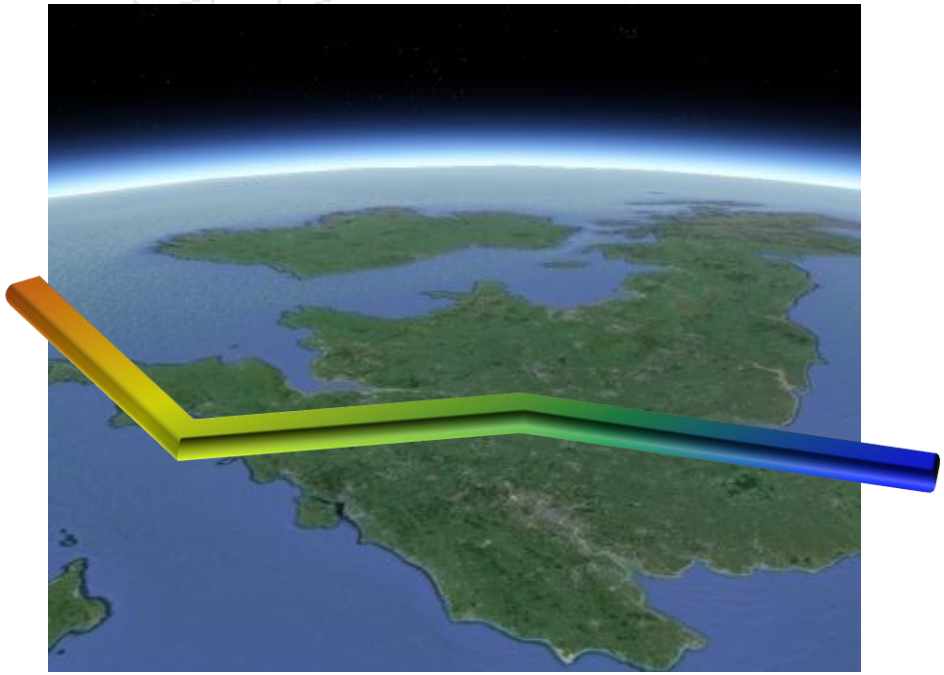


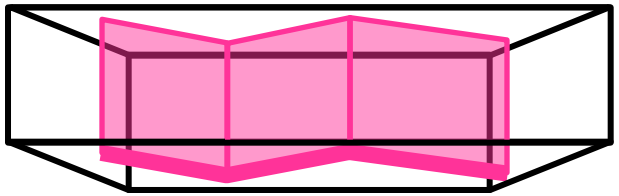


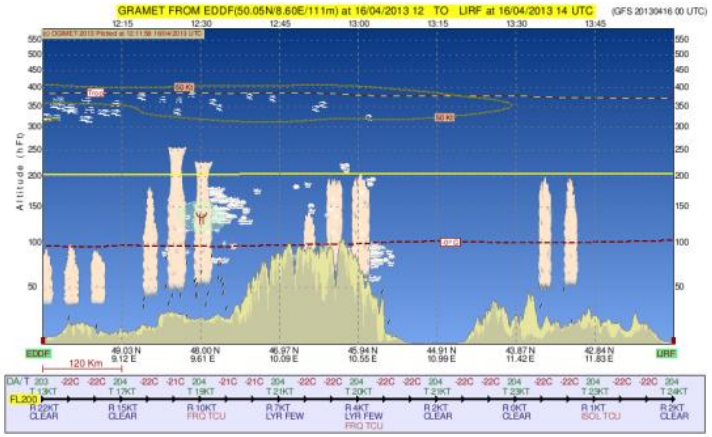
MetOcean-WCS

= OGC WCS Application Profile – MetOcean [OGC 14-052]

- Meteo / ocean / aviation data cubes = 4D x/y/z timeseries + groupings
  - curtain queries, corridor queries = polygon clipping
  - Central use case: weather along flight path

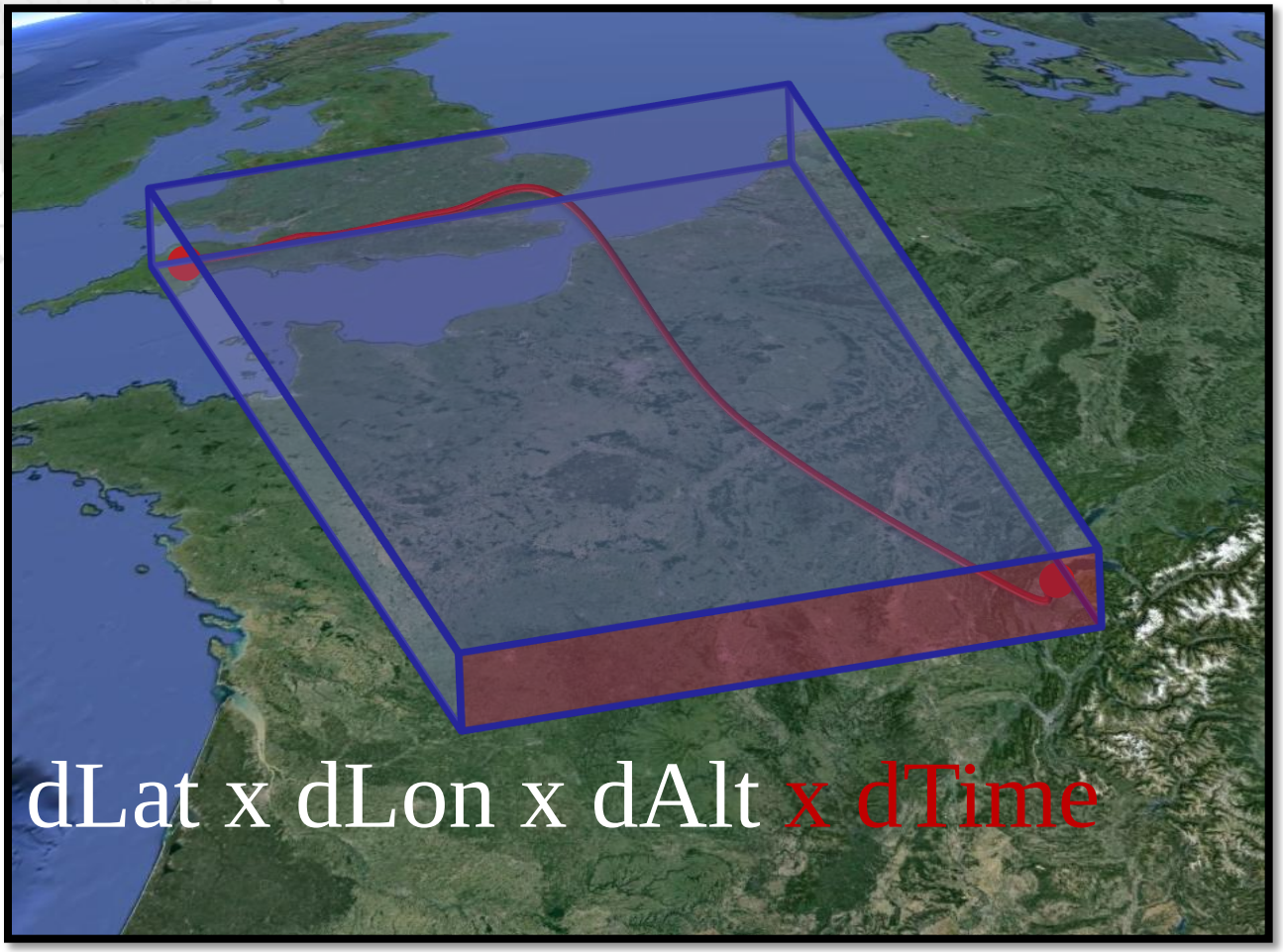






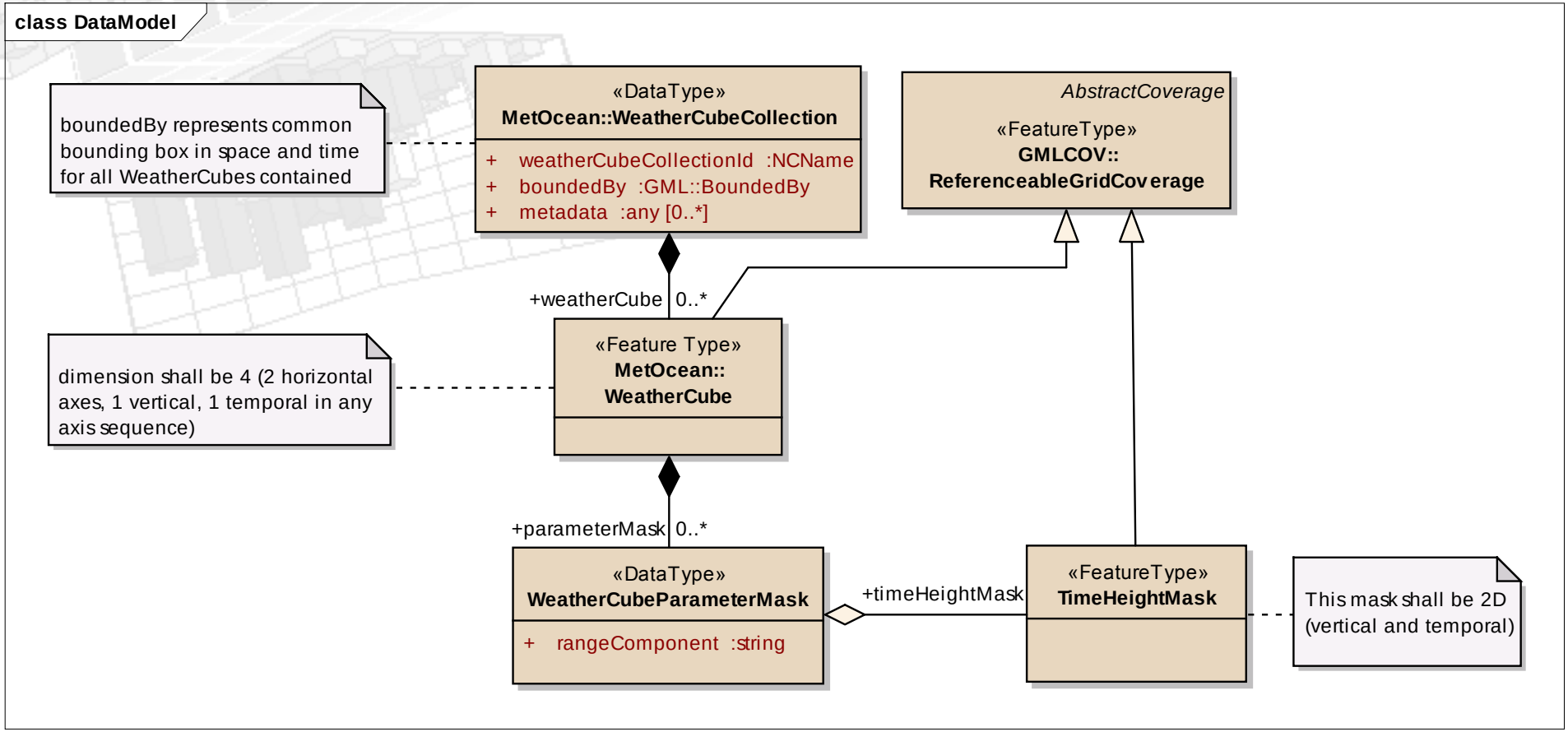
[pics: Dave Dixson, UK MetOffice; DWD]

Big Data in Action: Reducing Transport



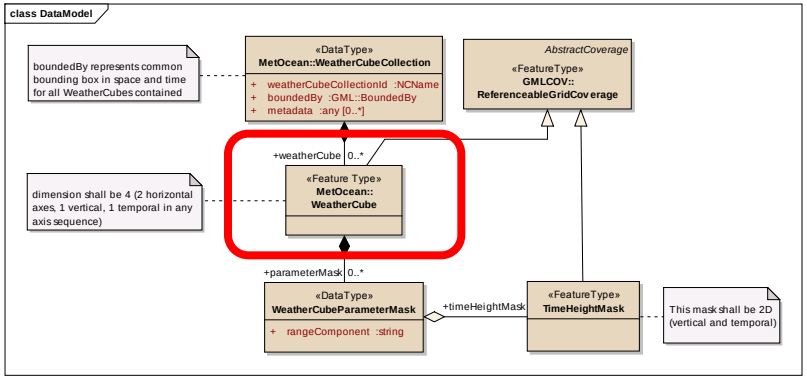
[pics: Dave Dixson, UK MetOffice]

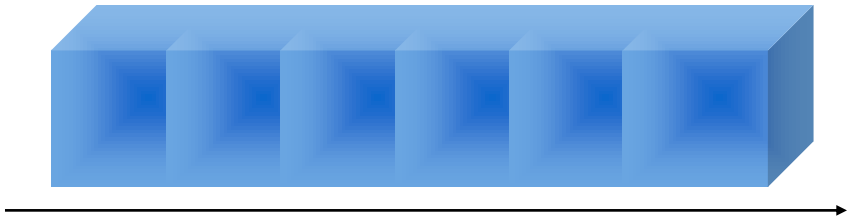
MetOcean Data Model



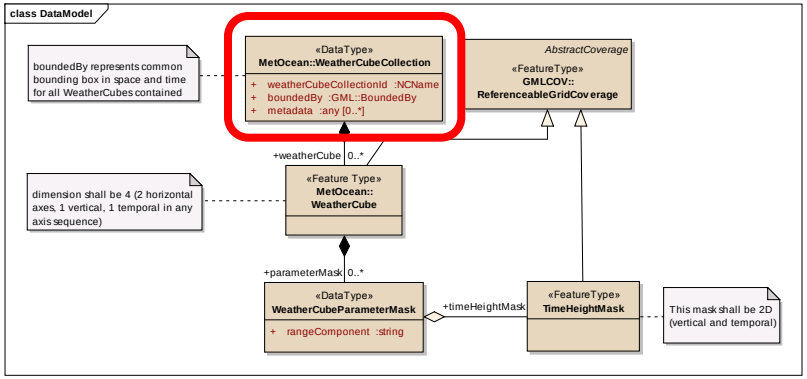
WeatherCube

- ReferenceableGridCoverage
  - Horizontally regular,
    height & time generally irregular
- Domain set: 4D x/y/z/t
  - horizontal CRS not fixed (EPSG or other)
- Range type: record of climate variables
  - Implementation choice
- NB: all output files of a simulation run together make up 1 cube
- ...plus all possible slicings:
  - x/y/t, x/y/z, x/t, y/t, x, y, t, z





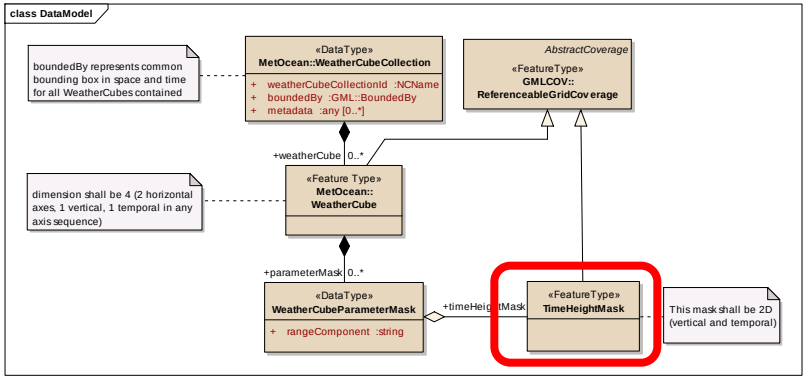
WeatherCubeCollection

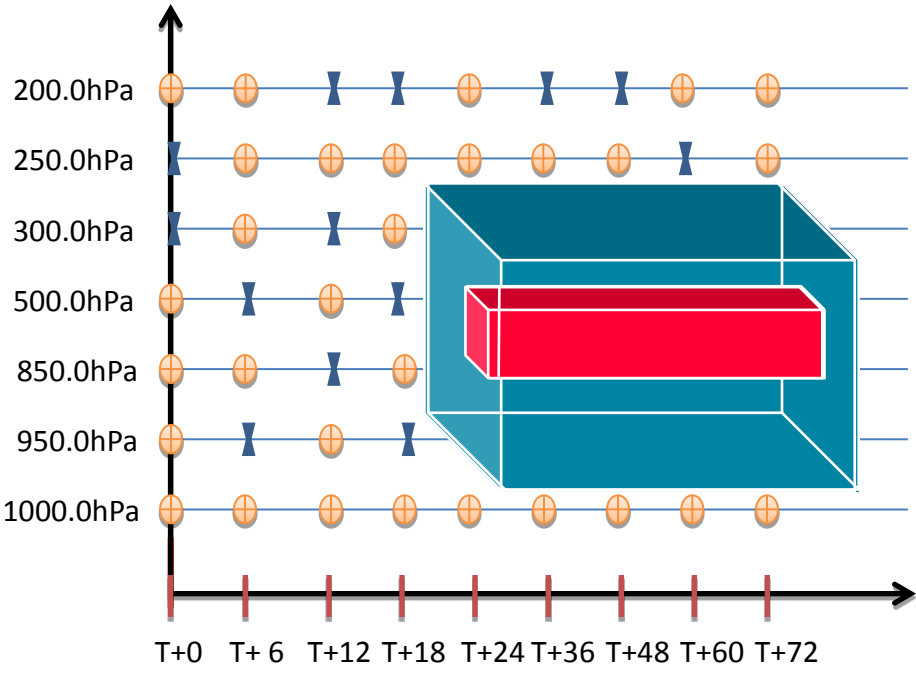


- = set of WeatherCubes
  - Share same x/y/z/t
- Collections are
  disjoint & homogeneous

Time-Height Mask

- = 2-D height + time axes
  - Boolean
- Goal: flag empty subcubes
  - Mask to indicate h/t locations where all range values, across whole horizontal extent, contain only nil values
  - = hint to applications: areas of no interest
- Weather Cube may contain 1 mask per range component
  - physical parameters, “variables”





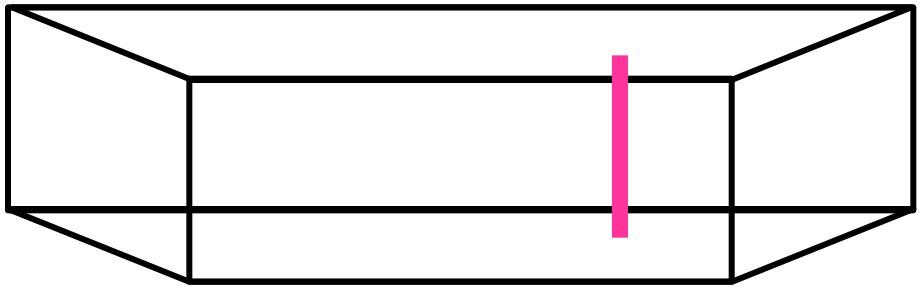
[pic: Dave Dixson, UK MetOffice]

MetOcean-WCS Service Model

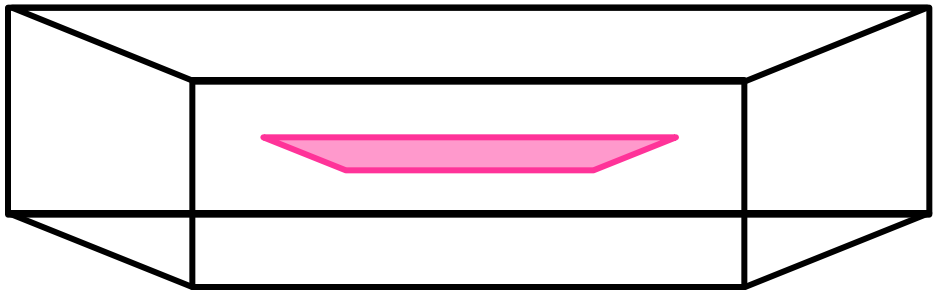
- WCS Core → Subsetting
- WCS CRS → ...in different CRSs
- Coverage clipping → curtains & corridors

WCS Core: *GetCoverage* Trim & Slice

- Ex 1: height profile
  - Slice X, Slice Y, Slice T
  - Result is 1D Z



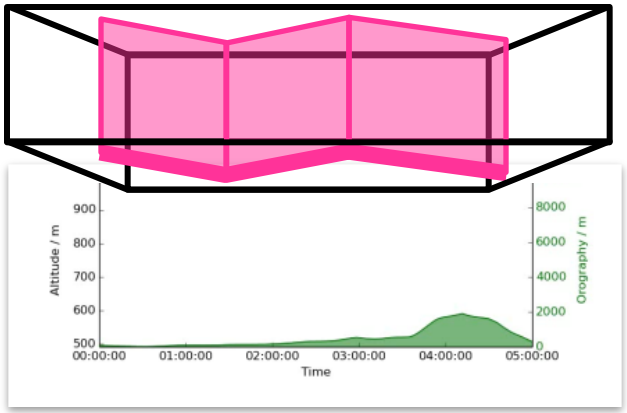
- Ex 2: horizontal plane
  - Trim X, Trim Y,
    Slice Z, Slice T
  - Result is 2D x/y



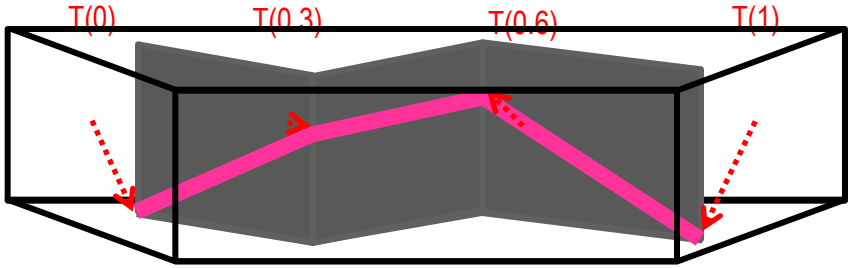
[pics: Dave Dixson, UK MetOffice]

MetOcean-WCS: Curtains & Corridors

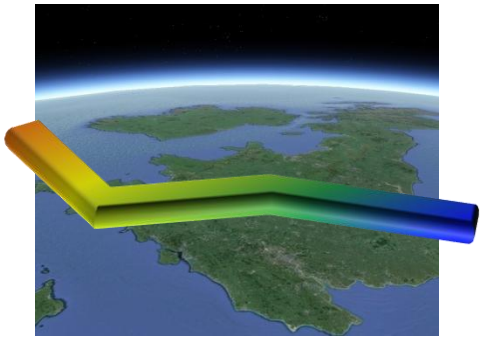
- Ex 1: Curtain along x/y polygon
  - BUFFER=h:ALL
  - Result is 2D



- Ex 2: Corridor along x/y/z/t polygon, no BUFFER
  - No BUFFER
  - Result is 1D



- Ex 3: Corridor along x/y/z/t polygon
  - BUFFER=lat:3,long:3,h:10
  - Result is 3D

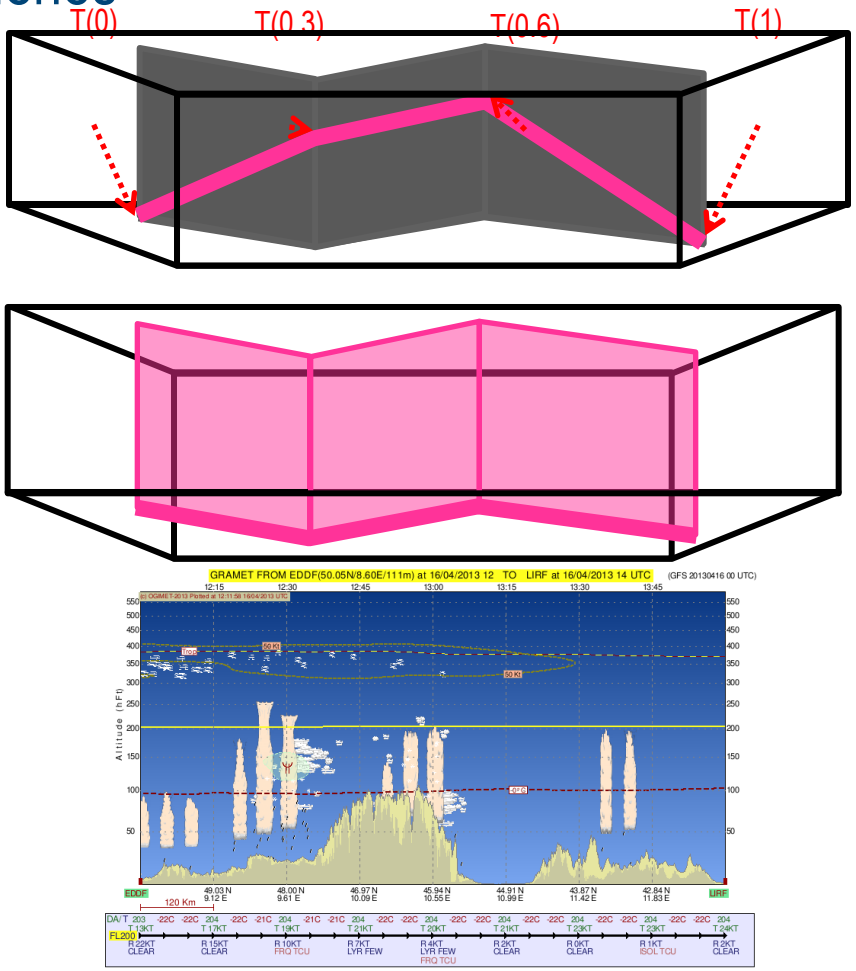


[pics: Dave Dixson, UK MetOffice]

MetOcean-WCS: *ClipCoverage* Request

= Generalization of Curtain & Corridor queries

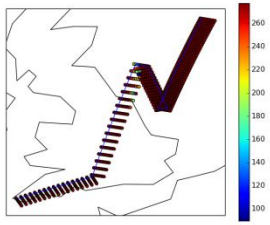
- Input:
  - weatherCubeId
  - path polygon
  - Optional:
    buffer extent control parameter:
    BUFFER=axis:buf,axis:buf,...axis:buf
- Output:
  - ReferenceableGridCoverage

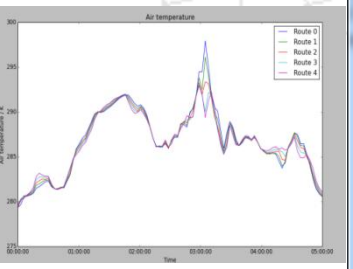


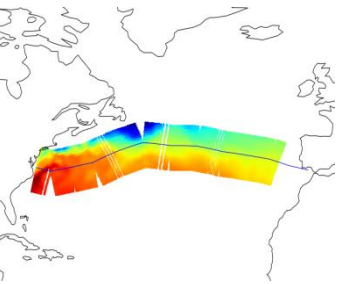
[pics: Dave Dixson, UK MetOffice; DWD]

Implementation: IBL, IRIS [UK MetOffice]

http://scitools.org.uk/







http://scitools.org.uk/

GISTeam Technology T...

SciTools

Home | Governance | Iris | Cartopy | About | Collaboration | Roadmap

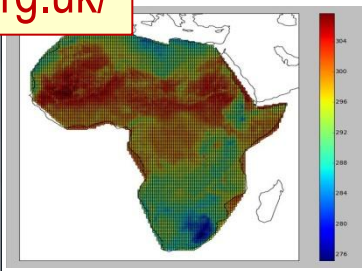
Iris and Cartopy are open source Python libraries initially created by the Met Office to enable the visualisation of weather and climate data. Both libraries are actively developed in collaboration with the scientific community.

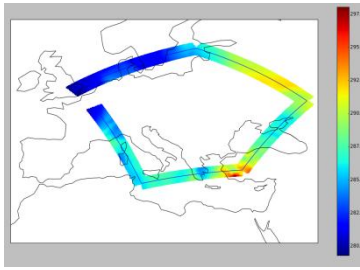
Iris is a Python package for analysing and visualising meteorological and oceanographic data sets.

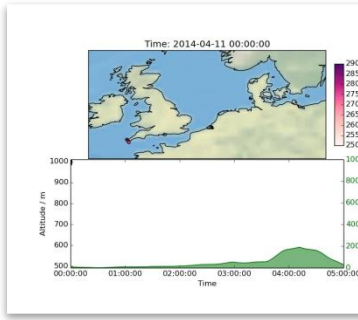
Cartopy is a Python package for advanced map generation with a simple matplotlib interface.

W3C HTML 4.01

100%





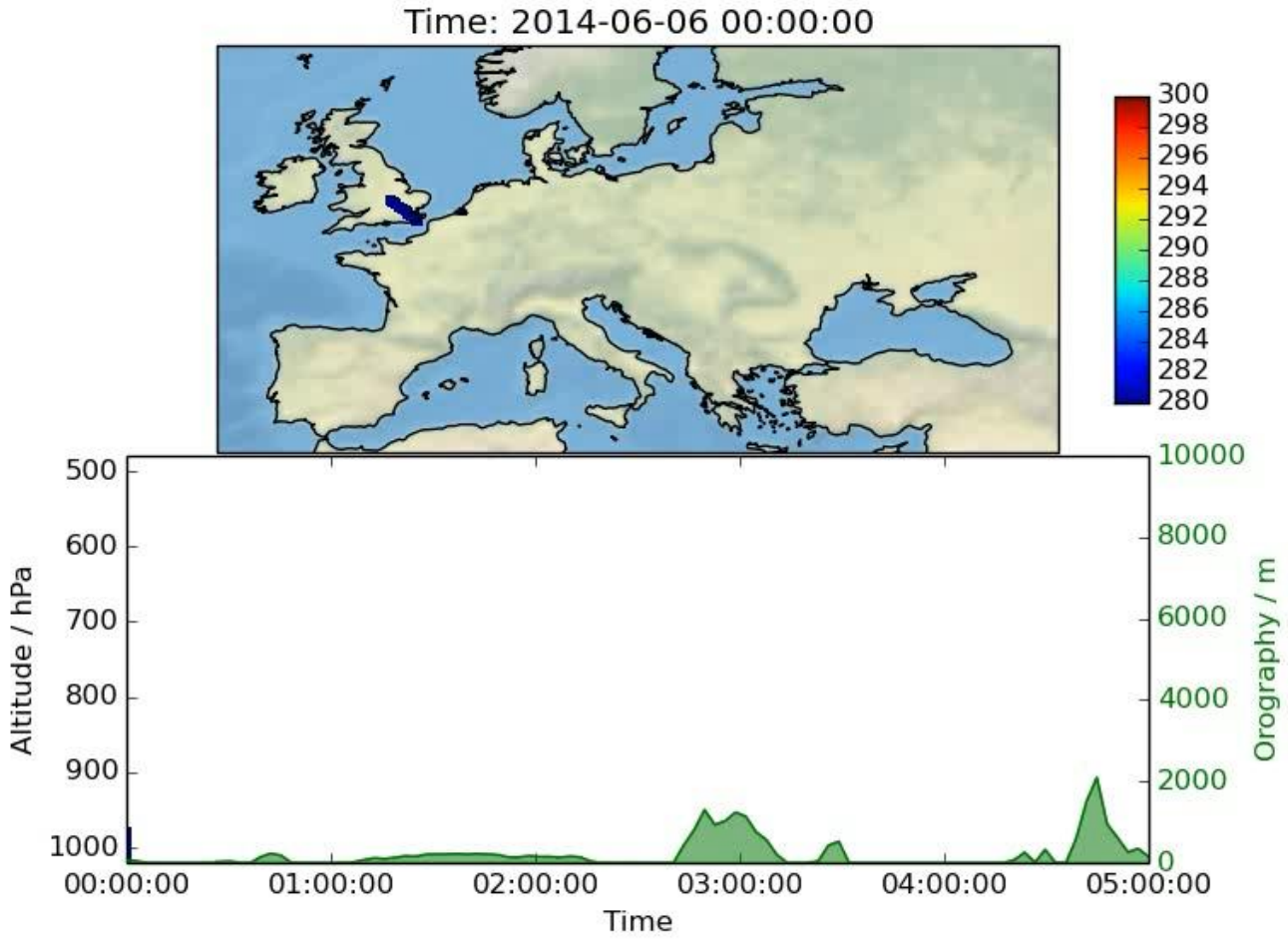


[Dave Dixson, UK MetOffice]

Ex: Aerial Trajectory

[Dave Dixson, UK MetOffice]

Trajectory: Alternative Visualisation



[Dave Dixson, UK MetOffice]

MetOcean-WCS: Summary & Status

- MetOcean-WCS = WCS tailored for met / ocean / aviation
  - 4D x/y/z/t cubes + metadata + optimizations
  - Path clipping: corridors, curtains
- Status: Successfully discussed at Sep-2014 OGC TC Meeting
  - Issue 1: naming ☺: MetOceanCube? WeatherCube? ClimateCube!
  - Issue 2: Coverage groupings & polygon clipping generally useful functionality
    - consider for WCS extensions
- Next steps:
  - finalize specification + implementation
  - Progress into adoption