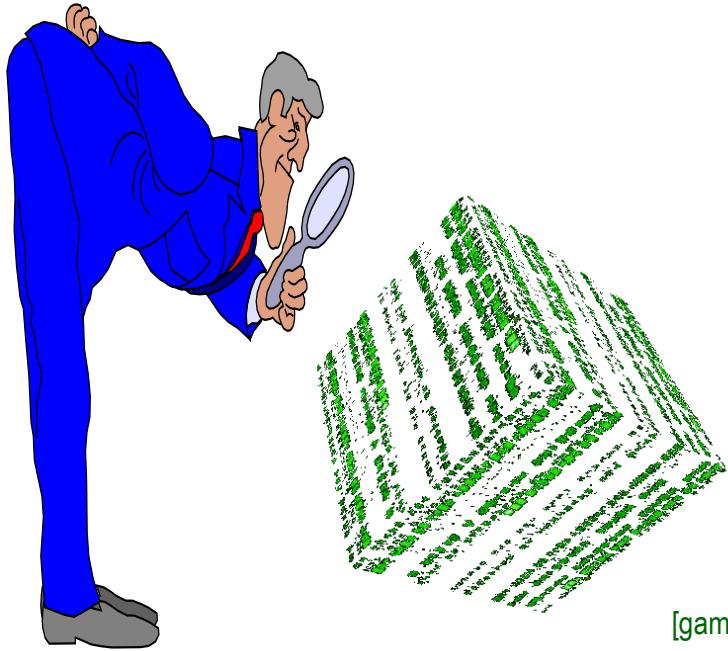


Rasterdaten und INSPIRE - endlich wirds einfacher

Mitteldeutscher Geotreff, Halle, 2018-sep-26

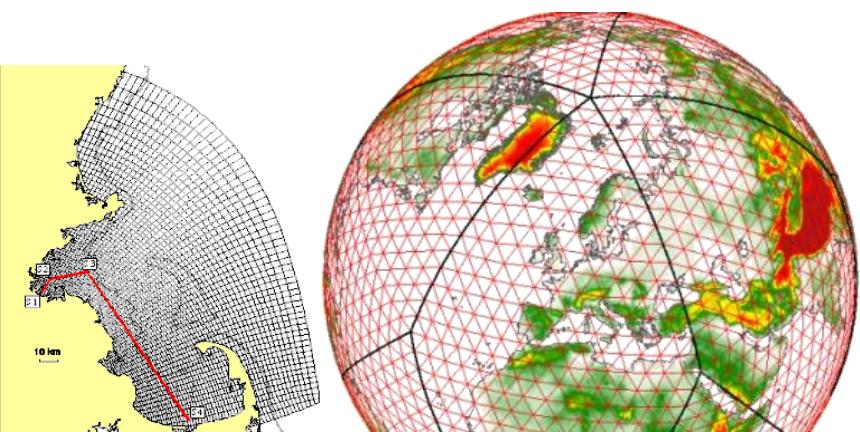
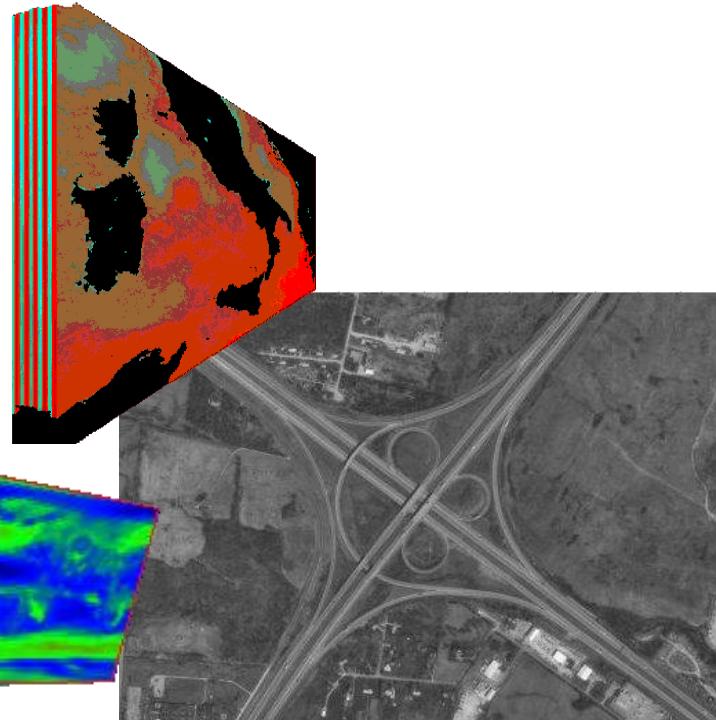
Peter Baumann

Jacobs University | rasdaman GmbH



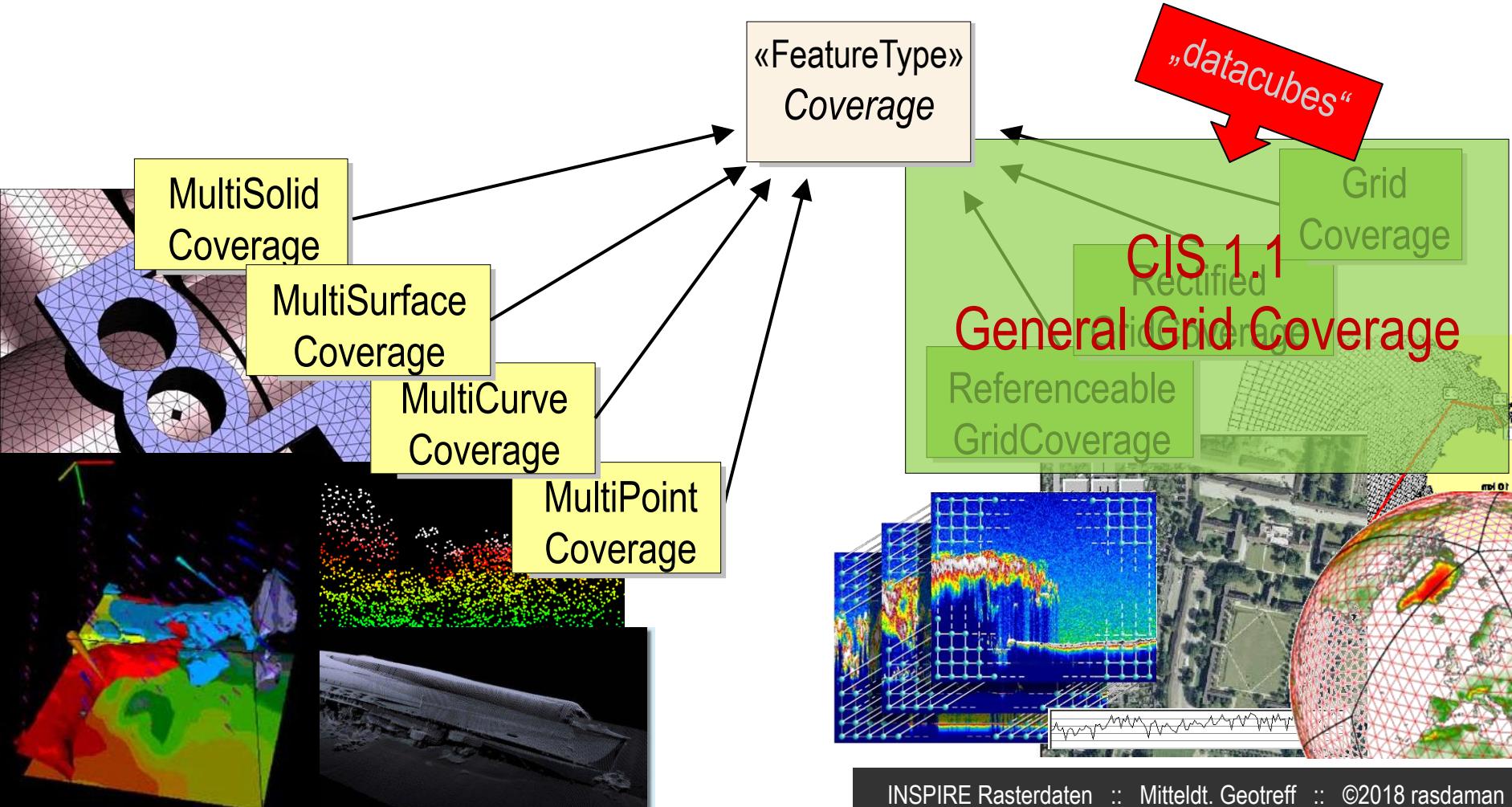
Features & Coverages [OGC, ISO]

- The basis of all: geographic **feature**
- Special kind of feature: **coverage**
 - regular & irregular grids, point clouds, meshes
 - Usually, coverages are Big Earth Data

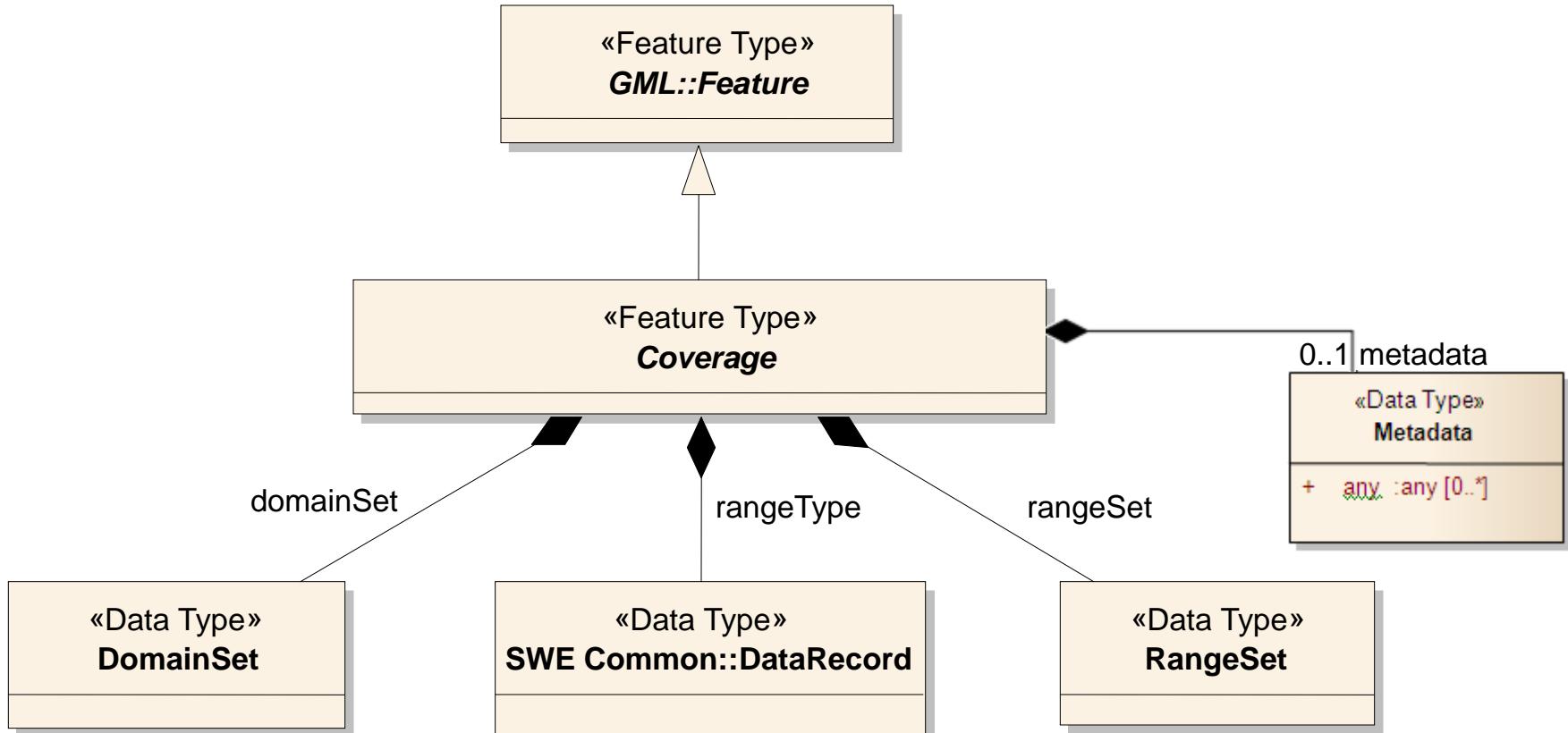


Coverages

- abstract: OGC Abstract Topic 6
- concrete, interoperable: Coverage Implementation Schema (CIS, aka GMLCOV)



Coverage Structure



A Simple Coverage, in XML

```

<generalGridCoverage ... gml:id="CIS_001">

  <domainSet>
    <generalGrid srsName="http://www.opengis.net/def/crs-compound?
      1=http://www.opengis.net/def/crs/OGC/0/4979
      &2=http://www.opengis.net/def/crs/OGC/0/AnsiDate"
      axisLabels="Lat Long h date">
      <regularAxis axisLabel="Lat" uomLabel="deg" lowerBound="40" upperBound="60" resolution="10"/>
      <regularAxis axisLabel="Long" uomLabel="deg" lowerBound="-10" upperBound="10" resolution="10"/>
      <irregularAxis axisLabel="h" uomLabel="m">
        <c> 0</c>
        <c>100</c>
      </irregularAxis>
      <irregularAxis axisLabel="date" uomLabel="d">
        <c>2015-12-01</c>
        <c>2015-12-02</c>
      </irregularAxis>
    <gridLimits srsName="http://www.opengis.net/def/crs/OGC/0/Index4D" axisLabels="i j k l">
      <indexAxis axisLabel="i" lowerBound="0" upperBound="2"/>
      <indexAxis axisLabel="j" lowerBound="0" upperBound="2"/>
      <indexAxis axisLabel="k" lowerBound="0" upperBound="1"/>
      <indexAxis axisLabel="l" lowerBound="0" upperBound="1"/>
    </gridLimits>
  </generalGrid>
</domainSet>

  <rangeSet>
    <dataBlock>
      <v>01</v> <v>02</v> <v>03</v> <v>04</v> <v>05</v> <v>06</v> <v>07</v> <v>08</v> <v>09</v>
      <v>01</v> <v>02</v> <v>03</v> <v>04</v> <v>05</v> <v>06</v> <v>07</v> <v>08</v> <v>09</v>
      <v>01</v> <v>02</v> <v>03</v> <v>04</v> <v>05</v> <v>06</v> <v>07</v> <v>08</v> <v>09</v>
      <v>01</v> <v>02</v> <v>03</v> <v>04</v> <v>05</v> <v>06</v> <v>07</v> <v>08</v> <v>09</v>
    </dataBlock>
  </rangeSet>

  <rangeType>
    <swe:DataRecord>
      <swe:field name="panchromatic">
        <swe:Quantity definition="http://opengis.net/def/property/OGC/0/Radiance">
          <swe:uom code="W.m-2.sr-1.nm-1"/>
        </swe:Quantity>
      </swe:field>
    </swe:DataRecord>
  </rangeType>
</generalGridCoverage>

```

A Simple Coverage, in JSON

```
{ "type": "CoverageByDomainAndRangeType",
  "domainSet": {
    "type": "DomainSetType",
    "generalGrid": {
      "type": "GeneralGridCoverageType",
      "srsName": "http://www.opengis.net/def/crs/OGC/0/Index2D",
      "axisLabels": ["i", "j"],
      "axis": [
        { "type": "IndexAxisType", "axisLabel": "i", "lowerBound": 0, "upperBound": 2 },
        { "type": "IndexAxisType", "axisLabel": "j", "lowerBound": 0, "upperBound": 2 }
      ]
    },
    "rangeSet": {
      "type": "RangeSetType",
      "dataBlock": { "type": "VDataBlockType", "values": [1,2,3,4,5,6,7,8,9] }
    }
  },
  "rangeType": {
    "type": "DataRecordType",
    "field": [
      { "type": "QuantityType",
        "definition": "ogcType:unsignedInt",
        "uom": { "type": "UnitReference", "code": "10^0" }
      }
    ]
  }
}
```

A Simple Coverage, in RDF

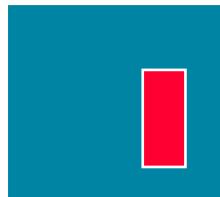
```
<http://www.opengis.net/cis/1.1/examples/CIS_05_2D>
<http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
<http://www.opengis.net/cis/1.1/CoverageByDomainAndRangeType> .

<http://www.opengis.net/cis/1.1/examples/CIS_05_2D>
<http://www.opengis.net/cis/1.1/domainSet>
<http://www.opengis.net/cis/1.1/examples/CIS_DS_05_2D> .
<http://www.opengis.net/cis/1.1/examples/CIS_DS_05_2D>
<http://www.opengis.net/cis/1.1/generalGrid>
<http://www.opengis.net/cis/1.1/examples/CIS_DS_GG_05_2D> .
<http://www.opengis.net/cis/1.1/examples/CIS_DS_05_2D>
<http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
<http://www.opengis.net/cis/1.1/DomainSetType> .
<http://www.opengis.net/cis/1.1/examples/CIS_DS_GG_05_2D>
<http://www.opengis.net/cis/1.1/axis>
<http://www.opengis.net/cis/1.1/examples/CIS_DS_GG_I_05_2D> .
<http://www.opengis.net/cis/1.1/examples/CIS_DS_GG_05_2D>
<http://www.opengis.net/cis/1.1/axis>
<http://www.opengis.net/cis/1.1/examples/CIS_DS_GG_J_05_2D> .
<http://www.opengis.net/cis/1.1/examples/CIS_DS_GG_05_2D>
<http://www.opengis.net/cis/1.1/axisLabels>
<http://www.opengis.net/cis/1.1/axisLabels0> .
<http://www.opengis.net/cis/1.1/axisLabels0> <http://www.w3.org/1999/02/22-rdf-syntax-ns#first> "i" .
<http://www.opengis.net/cis/1.1/axisLabels0> <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> <http://www.opengis.net/cis/1.1/axisLa
<http://www.opengis.net/cis/1.1/axisLabels1> <http://www.w3.org/1999/02/22-rdf-syntax-ns#first> "j" .
<http://www.opengis.net/cis/1.1/axisLabels1> <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> <http://www.w3.org/1999/02/22-rdf-sy
```

OGC Web Coverage Service (WCS)

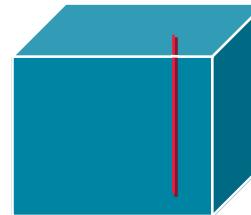
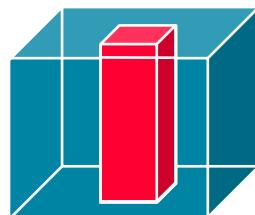
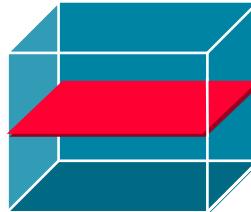
- WCS **Core**: access to spatio-temporal coverages & subsets

- Encoding on the fly
- subset = trim



|

slice



Large, growing implementation basis:
rasdaman, GDAL, QGIS, OpenLayers, OPeNDAP, MapServer, GeoServer, GMU, NASA WorldWind, EOx-Server; Pyxis, ERDAS, ArcGIS, ...

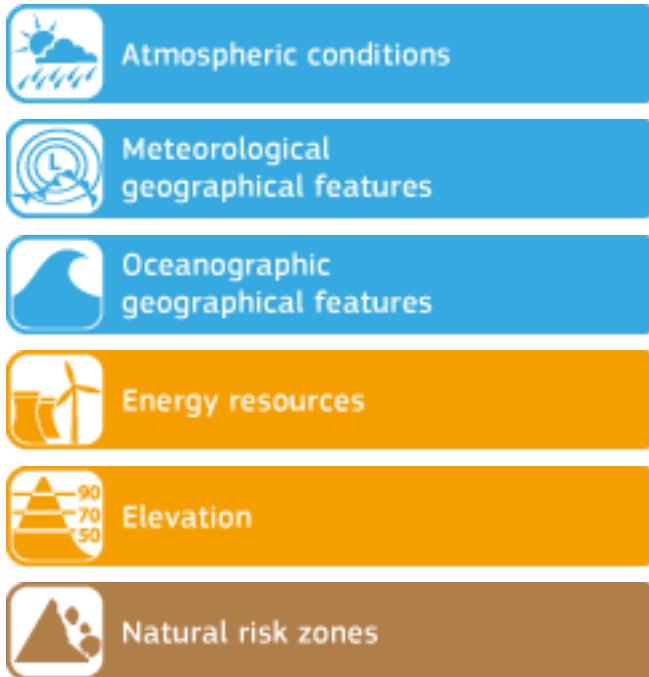
- WCS **Extensions**: optional functionality facets
 - from extraction up to flexible analytics

Coverage Standards

- Open Geospatial Consortium (OGC) :
 - Coverage data model: CIS 1.x
 - Coverage service model: WCS 2.x
- ISO TC211:
 - OGC CIS 1.0 → 19123-2
 - OGC AT 6 = 19123 → 19123-1
- PS:
 - ISO SQL 9075 Part 15 MDA („Multi-Dimensional Arrays“)



Use of Coverages in INSPIRE



- “Elevation & Orthoimagery data shall be provided using mainly the raster data spatial representation type – Coverages.
WCS is the natural way to serve coverages.”
- Jordi Escriu, Facilitator INSPIRE Thematic Cluster #3:
Elevation, Orthoimagery, Reference systems and Geographical grids

INSPIRE Coverages

- INSPIRE Conference 2017: analysis of coverage model → paper
 - Jordi Escriu, Peter Baumann
- INSPIRE Conference 2017: coverages from WCS & SOS perspective
 - Jordi Escriu, Peter Baumann, Kathi Schleidt
 - Proposal for
 - *(re-) harmonization with OGC & ISO*
 - *Correction of issues*
 - *Simplification* ☺
- rasdaman quickly chosen as platform
 - Only tool flexible enough to add INSPIRE information

A Thought on INSPIRE Coverages

- INSPIRE WCS = OGC WCS
- OGC WCS normatively references OGC CIS

Requirement 34 /req/core/getCoverage-response-structure:

The contents of the response to a successful *GetCoverage* request **shall** be a concrete subtype of *AbstractCoverage*.

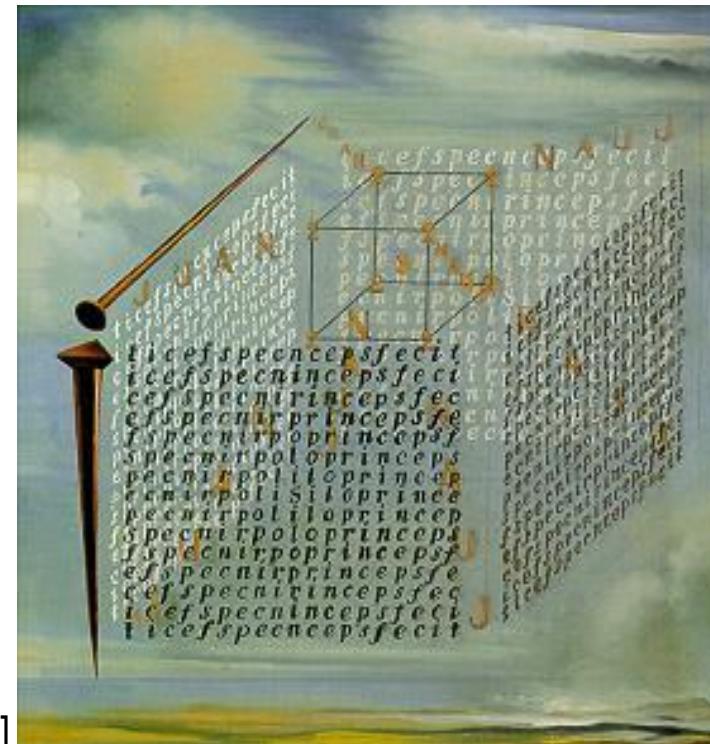
Dependency: <http://www.opengis.net/spec/GMLCOV/1.0/conf/gml-coverage>

- ...so INSPIRE WCS normatively references OGC CIS
 - Not INSPIRE coverages!

Hey, JRC...any thoughts? ☺

Conclusion

- OGC Coverages: **spatio-temporal raster data, point clouds, meshes**
 - Conformance tests down to pixel level
- **Convergence:** stds bodies, implementers
- **rasdaman** official OGC Reference Implementation
 - Most comprehensive implementation
 - INSPIRE analysis platform
 - Single tool supporting INSPIRE WCS
- ...see demo!



[Dalí]