



XML for Seismological Data Exchange and Resource Metadata Description

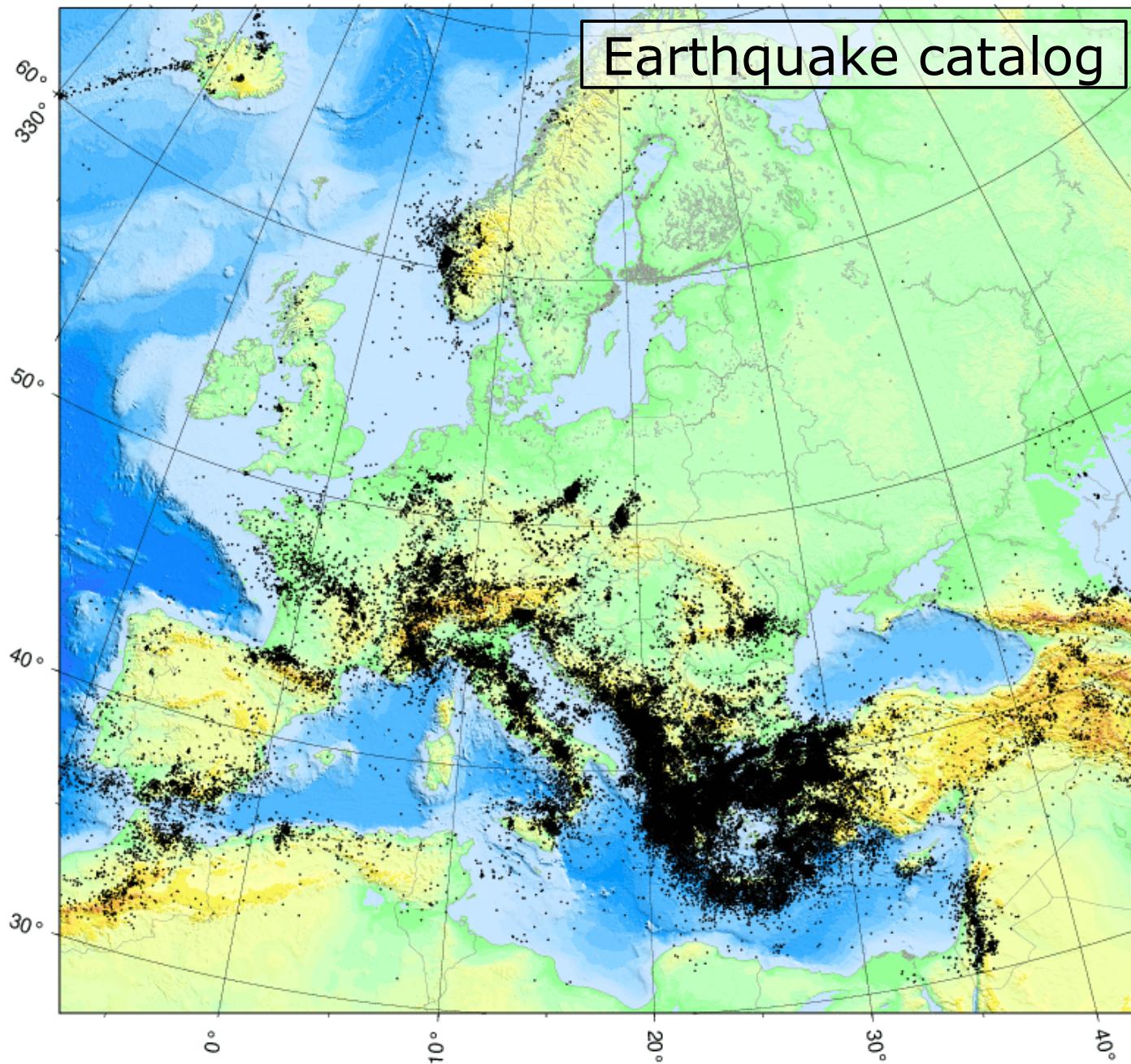
F. Euchner (ETH), D. Schorlemmer (USC),
J. Becker (GFZ), A. Heinloo (GFZ), P. Kästli (ETH),
J. Saul (GFZ), B. Weber (GFZ),
and the QuakeML working group

What is QuakeML?

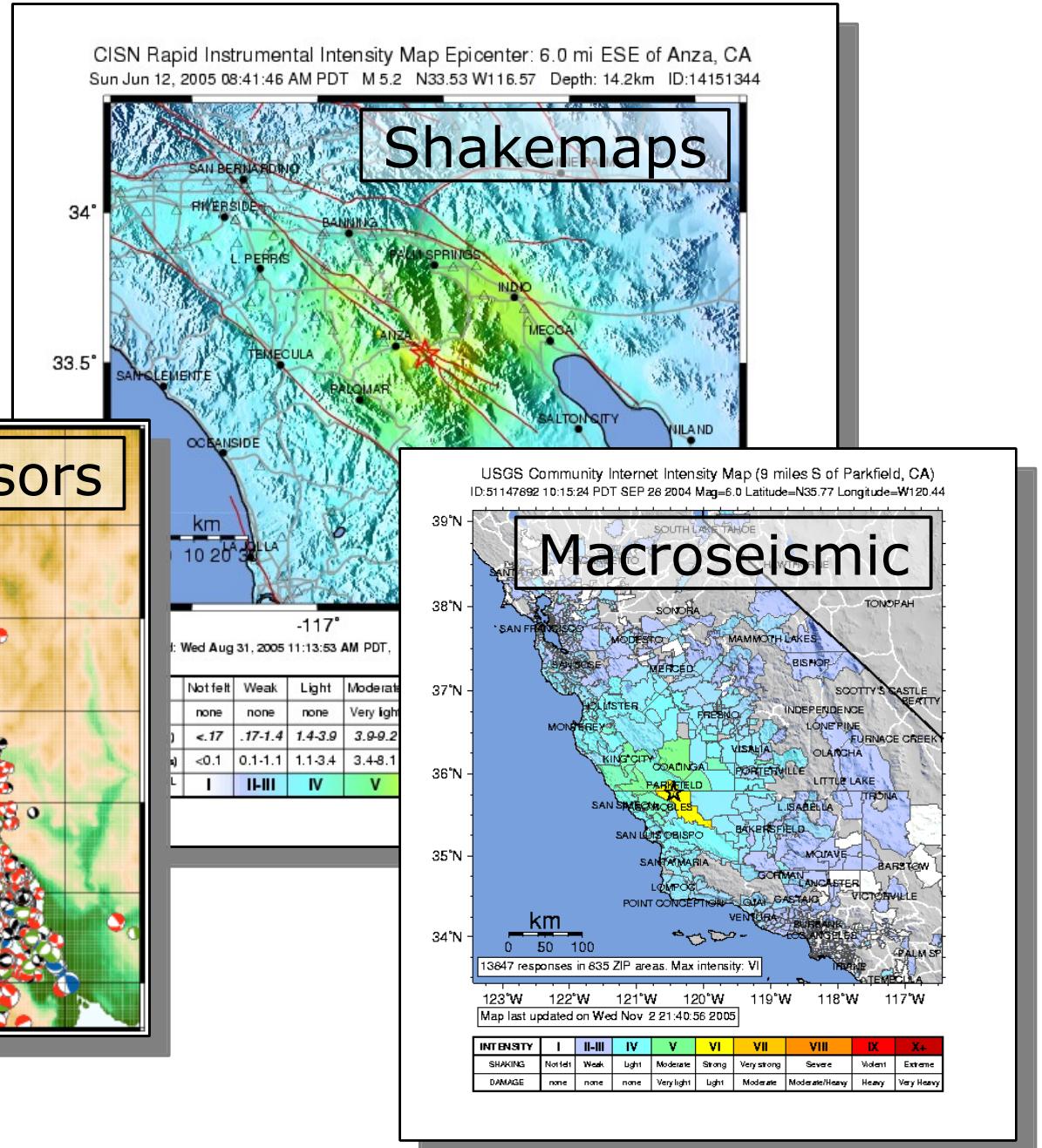
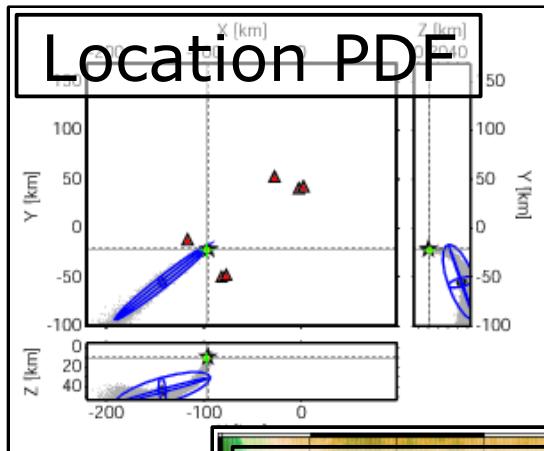
- Need for unified data exchange format in seismology
 - Existing formats are heterogeneous, not suited for modern IT needs (web services, metadata inclusion)
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- [QuakeML](#) is a data model for earthquake catalogs and related information
 - Exchange format (XML serialization)



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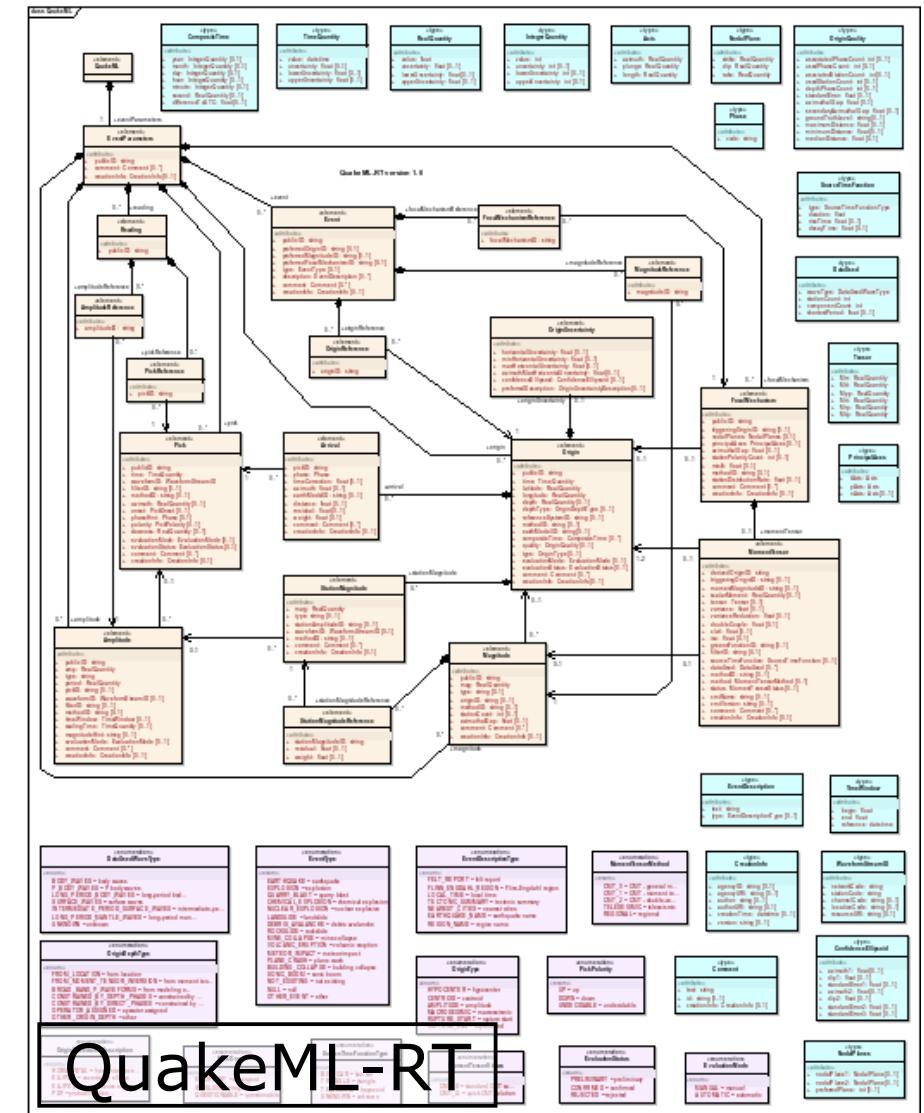
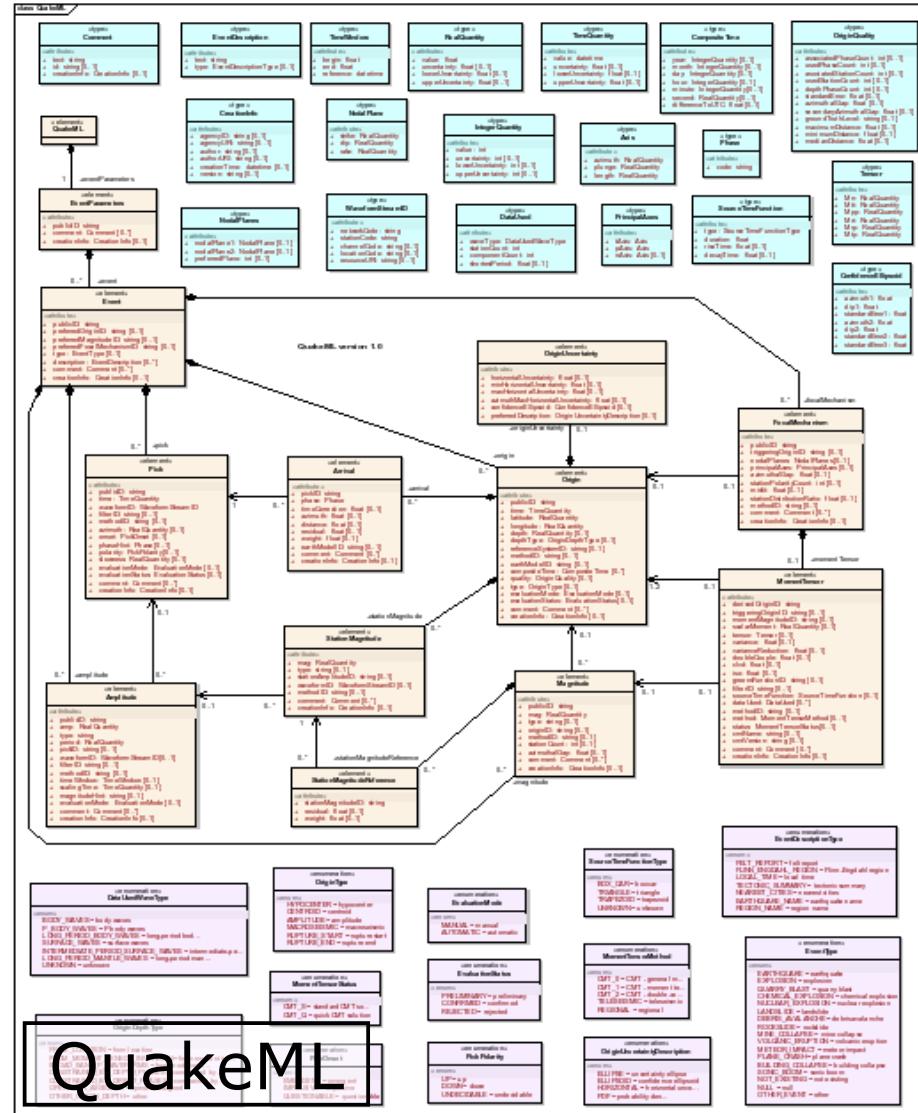


What is QuakeML?

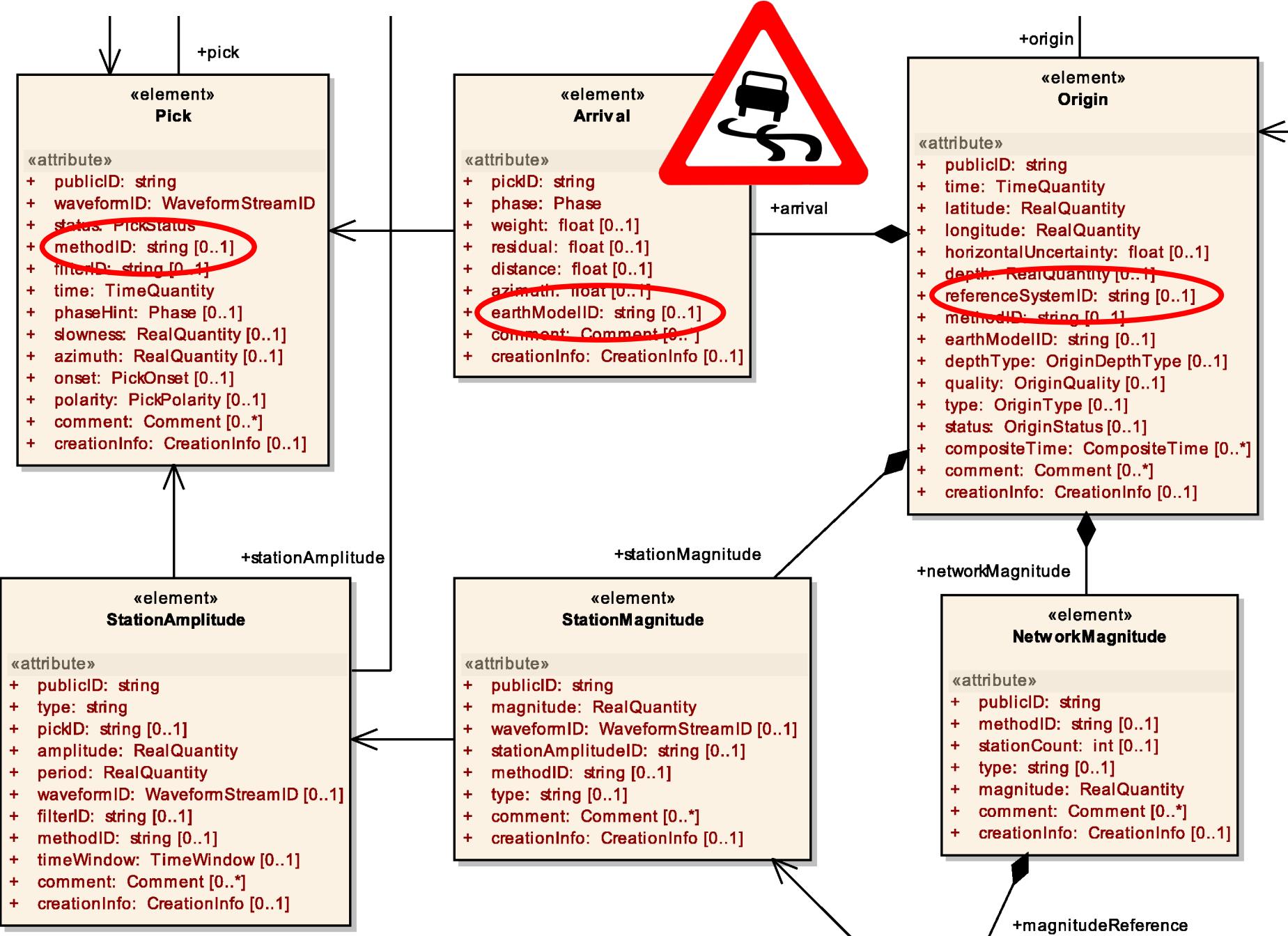


QuakeML – QuakeML-RT

- QuakeML Earthquake catalogs (hierarchical)
- QuakeML-RT Flat, uses references



Metadata Problem



Metadata and Resource Identifiers

QuakeML uses **resource identifiers** in URI format:

`smi:<authority-id>/<resource-id>[#<local-id>]`

Planned for next version of QuakeML:

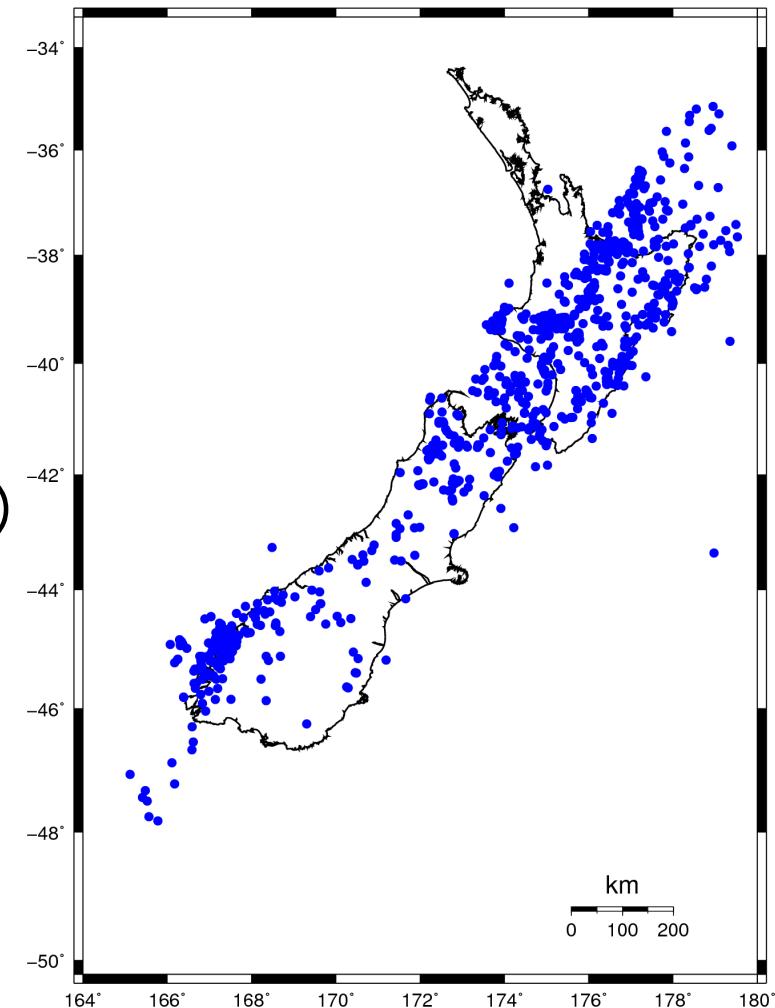
- Authorities assign unique identifiers to resources
- Identifiers are resolved by registry web services
- Registries return associated set of resource metadata
- Metadata description based on RDF / Dublin Core
- RDF vocabulary will be developed for next QuakeML version
- Development under way @ ORFEUS Data Center
(Alessandro Spinuso)



QuakePy



- Python package for seismicity analysis
- Based on QuakeML data model
- www.quakepy.org (under construction)
- GNS (NZ) has already experimental QuakeML catalog web service



```
fab@desdemona:~/prog/pyprog/quakepy> python
>>> import quakepy as qp
>>> import qpseismicityplot as qps
>>> cat = qp.QPCatalog('http://app-dev.geonet.org.nz/services/quake?startDate=2007-10-10T13:00:00&outputFormat=quakeML')
>>> plot = qps.QPSeismicityPlot().plot_gmt(cat, 'nz-seismicity.eps')
```

QuakeML & NDK (Global CMT Catalog)

Global CMT moment tensor format - ndk

```
PDE 2005/01/01 01:20:05.4 13.78 -88.78 193.1 5.0 0.0 EL SALVADOR
C200501010120A B: 4 4 40 S: 27 33 50 M: 0 0 0 CMT: 1 TRIHD: 0.6
CENTROID: -0.3 0.9 13.76 0.06 -89.08 0.09 162.8 12.5 FREE S-20050322125201
23 0.838 0.201 -0.005 0.231 -0.833 0.270 1.050 0.121 -0.369 0.161 0.044 0.240
V10 1.581 56 12 -0.537 23 140 -1.044 24 241 1.312 9 29 142 133 72 66
```

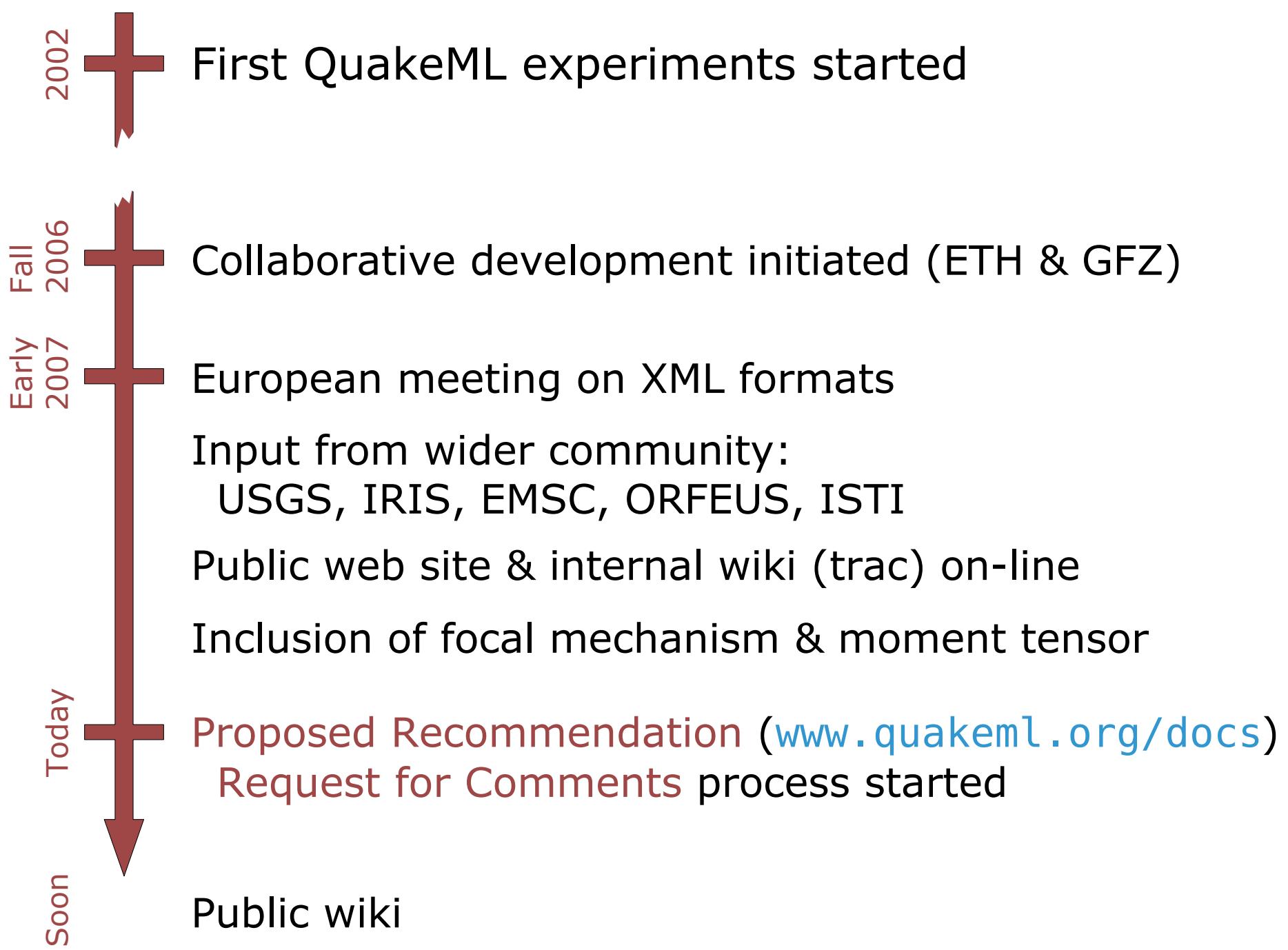
QuakeML representation (excerpt)

```
<quakeML xmlns="http://quakeml.org/xmlns/quakeml/1.0">
  <eventParameters publicID="smi:org.globalcmt/catalog">
    <event publicID="smi:org.globalcmt/event/C200501010120A">
      <focalMechanism publicID="smi:org.globalcmt/fm/C200501010120A">
        <momentTensor>
          <derivedOriginID>smi:org.globalcmt/origin/C200501010120A</derivedOriginID>
          <scalarMoment>
            <value>1.312e23</value>
          </scalarMoment>
          <tensor>
            <Mrr>
              <value>0.838e23</value>
              <uncertainty>0.201e23</uncertainty>
            </Mrr>
            ...
            </tensor>
            <method>CMT - moment-tensor with constraint of zero trace</method>
            <cmtName>C200501010120A</cmtName>
          </momentTensor>
        </focalMechanism>
      </event>
    </eventParameters>
  </quakeML>
```

Conversion tool will be provided in QuakePy



Community Aspects



QuakeML @ CSEP Testing Center

- CSEP: Collaboratory for the Study of Earthquake Predictability
- Prospective testing of earthquake forecasts
www.cseptesting.org
- Developed at SCEC/USC
- Several test centers running (California, New Zealand) and upcoming (ETH Zurich)
- Implementation of QuakeML for catalog retrieval underway
- **QuakeML** data model / **QuakePy** used for pre-processing of earthquake catalog



Summary

- QuakeML version 1.0 Proposed Recommendation
- Documents ready for download (www.quakeml.org/docs)
- RFC process started
- Experimental QuakeML-based web services already existing
- QuakePy package under active development,
comments/suggestions are welcome



Contact the QuakeML Group

- Visit our websites

<http://www.quakeml.org>

<http://www.quakepy.org>

- Write us

quakeml@sed.ethz.ch

- for participating in the request for comments process: Send us your email-address and you will receive the RFC documents
- for questions
- for suggestions



Why not GML?

- Has to be hands-on ("scientists don't like XML")
- Already high level of complexity
- Describes physics, not geography
- Uses concept of properties: encapsulation of value and uncertainty

