EPOS volcano data and products FDSN SEED format

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Volcano data and products in EPOS-WP11

- EPOS-WP11 TCS Volcano : overview

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- EPOS-WP11 TCS Volcano : standards and challenges

- A timeseries format : FDSN SEED

- More about miniSEED

- Metadata : stationXML

- Webservices : FDSN dataselect and station

- Future of miniSEED

EPOS-WP11 TCS Volcano : overview

- Volcano community is scattered in multiple ways :

    – Geographically (Iceland, Italy, Portugal, Spain, France, UK ...);

    – By discipline (geochemistry, geophysics, geology, geography, petrology, satellite remote sensing …)

- Mainly composed by volcano observatories and research institutions

- Community under construction since a few years with the help of several European projects (EPOS, MED-SUV, FutureVOLC, EuroVOLC)

EPOS-WP11 TCS Volcano : data and products

- Geophysics :
    - Seismology (seismometer, accelerometer, infrasound);
    - Geodesy (GNSS, tiltmeter, strain-meter);
    - Products (displacement vectors, events catalogue, RSAM).

- Geochemistry :
    - Gas analysis (samples and real-time);
    - Ground and spring water analysis (samples and real-time);
    - Rock analysis (lava samples, volcanic products).

- Remote sensing :
    - Satellite data (SO_2 flux, heat maps, ash cloud maps);
    - UAV data (lava field maps, gas analysis).

EPOS-WP11 TCS Volcano : data and products

- Geology :
  - Rock samples;
  - Stratigraphy.

- Reports and publications :
  - Probabilistic volcanic hazard maps;
  - Activity reports.
  - Ash, gas forecasting.

- Environmental data :
  - Weather data;
  - Images from camera (visible, IR);

....

EPOS-WP11 TCS Volcano : standards and challenges

- *Seismology* : well standardized worldwide for data, metadata, products and webservices.

- *Geodesy* : well standardized worldwide for data and metadata, european webservice under development.

- *Geochemistry* : initial work toward the use of EarthChem datamodel.

- *Satellite data* : data standards but home-made webservices.

- Maybe an opportunity to use OGC standards of data, metadata and webservices for geographic data ?

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FDSN SEED timeseries format

- FDSN : Federation of Digital Seismic Networks, funded in August 1986.

- SEED : Standard for Exchange of Earthquake Data, first version introduced in 1987.

- Can be decomposed in miniSEED for the timeseries and dataless SEED for the metadata. It's a lossless compressed format.

- Widely use worldwide since the 2000's.

- Lots of data converters exists to and from other formats (SAC, SEGY, GSE, IMS)

- Not a working format, geared toward data exchange

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More about miniSEED

- Stream identification :
    - Network (worldwide unique);
    - Station (unique in a network);
    - LocationCode (together with the channel, must be unique in a station);
    - Channel (basic information about instrument, orientation, sample rate).

- Can be used for most of regularly sampled, continuous, geophysical timeseries (seismometer, tiltmeter, barometer, temperature, bolometer …)

- Compressed format independent from the file structure (made of independent, fixed size blocks)

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Metadata : stationXML and DOI

- Translation and evolution of the dataless SEED

- Holds information about :

  - Network (description, DOI);

  - Station geographical location and affiliation;

  - Instrumentation to recover physical data (poles and zeros, gain, analog filters, FIR and IIR filters, polynomial response);

  - Full history of the instrumentation for each data stream,

- Converters exists from and to dataless SEED and to extract response result in ASCII (amplitude and phase)

- DOI : permanent identifier used to cite and identify data from a Network, associated with a detailed landing page

FDSN webservices

- Three webservices standardized by FDSN :

    - **Station** to serve metadata;

    - **Dataselect** to serve data;

    - **Event** to serve earthquake events.

- Other webservices not yet standardized, under development in EPOS :

    - **Wfcatalog** for data quality indicators;

    - **Federator** for seamless data query addressing several data centers;

    - **Mediator** for data queries mixing informations from several webservices (ie 1h data with a minimum quality from a set of stations at a given distance from an epicenter starting from 30s before the event).

- Standards webservices implemented in SeisComP3

Future of miniSEED

- High density temporary seismometer deployments achieve SEED limits :

  – Fixed size of network, station, location and channel codes (2-5-2-3);

  – Some informations are gathered with heuristic checks;

  – High resolution timing indication not nicely implemented.

- Need of NGF agreed at Kobé IASPEI meeting 2017

- FDSN Working group 2 has collected the requirements

- A technical review has been conducted by FDSN members on each requirement

- Next step : work on an implementation proposal, with delivery of standard definitions, library and converters

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Thank you