

Meeting participants:

- From ÍSOR, Reykjavík: Gylfi Páll Hersir, Þorbjörg Ágústsdóttir, Egill Árni Guðnason and Rögnvaldur Líndal Magnússon.
- From IG CAS, Prague: Josef Horálek, Jana Doubravová, Pavla Hrubcová, Jakub Klicpera.
- From IRSM CAS, Prague: Jiří Málek, Lucia Fojtíková.
- From Charles University, Prague: Tomáš Fischer, Ali Ibrahim Salama, Josef Vlček.
- Through Teams: Bohuslav Růžek, Petra Adamová, Jan Šílený, Veronika Turjaková

Chair: Gylfi Páll Hersir.

Minutes: Egill Árni Guðnason.

1. Opening of the meeting by Gylfi Páll Hersir (ÍSOR) and Josef Horálek (IG CAS).
2. Introduction of the meeting participants, both those attending in Reykjavík and those in Prague attending through Microsoft Teams.
3. Josef Horálek reported on discussion and decisions from the steering committee meeting on the 7th of September:
 - a. A data sharing agreement with the Icelandic Meteorological Office (IMO) has been agreed upon by the steering committee. The agreement has been sent to IMO and now awaits comments from IMO.
 - b. Josef Horálek went through the main tasks, objectives and work packages of the NASPMON project – the institutions involved and leaders of each work package. Also, the project timeline, the TACR agency monitoring, the data management plan and the partnership agreement.
4. Egill gave a presentation of the current status of the eruption in Geldingadalir / Fagradalsfjall.
5. The WPs, status and perspectives – running through each package:
 - a. **WP2:**
 - i. Egill: The different tasks and milestones discussed. All stations from the REYKJANET network have been maintained, both last year and early this year when they were put online – earlier than expected due to the volcanic unrest. Milestone M2: *REYKJANET data stations streaming in real time by April 2021*, has already been achieved. Data from different seismic networks have been archived at ÍSOR, but some minor things are unfinished. This milestone M1: *Seismic data archive and structure complete by March 2021* – will be accomplished prior to the TACR meeting on October 5th, 2021. However, it remains to settle an agreement with IMO on data sharing.

- ii. Data from the different networks available:
 1. **REYKJANET** since 2013: 99% in archive.
 2. **IMO** since 2013: in archive, except data from station KRI. Waiting for approval of data sharing agreement with IMO.
 3. **HS Orka / ÍSOR** network 2013-2019: in archive, perhaps not available due to the data sharing policies of HS Orka.
 4. **IMAGE** project 2014-2015: in archive.
 5. **ON / ÍSOR** network since 2016: in archive.
 6. **Cambridge University** network since 2020: not in archive, perhaps available – pending data sharing agreement.
 7. Two stations from **Eva Eibl / University of Potsdam**: in archive.
- b. **WP3**:
 - i. Þorbjörg: The milestones and deliverables discussed. Some have been accomplished and some delayed, both due to the kick-off delay of the project but also the unexpected massive seismic activity / volcanic unrest.
 - **M1**: *Set up QuakeMigrate test and tune by February 2021* – already set up but needs further tuning.
 - **M2**: *Set up SeisComP for REYKJANET by March 2021* – already achieved.
 - **M3**: *Tune SeisComP for REYKJANET by April 2021* – will be finalized prior to the TACR meeting on October 5th, 2021.
 - **M4**: *Tuning of detection algorithms (SeisComP, SLRNN, QuakeMigrate, comparison of their performance by July 2021* –discussed at the meeting.
 - **M5**: *Implementation of the formula for routine local - magnitude estimation of by September 2021* – already achieved.
 - **Deliverable for WP3: D1**: *Deliver phase picks from all earthquakes in WP2 of $M_L > 1.25$ by October 2021* - discussed at the meeting.
 - ii. 500 manually reviewed earthquakes by IG, from February and March 2021 are available. Also, manual revisions by IG from both 2017 and 2019.
 - iii. The participants agreed that the automatic earthquake location techniques must be compared. A fixed testing time period will be selected in further email/teams communication.
 - iv. Rögnvaldur: A quick intro to SeisComP, ÍSORs routine. Manually reviewed events needed for further tuning of the SeisComP routine.
 - v. Rögnvaldur: A comparison of three different location methods for an earthquake swarm on 2021-05-03, west of Kleifarvatn; a preliminary QuakeMigrate (Python package for automatic earthquake detection and location) automatic catalog,

SeisComP automatic catalog and IMO manual catalog. Comparison is promising, but both SeisComP and QuakeMigrate need further tuning.

c. **WP4:**

- i. Jana: Seismic activity, time and space analysis. Deliverables discussed - the first one an EGU presentation next year. Current state a processing of data from Feb. and Mar. 2021 - manual processing of stronger events + automatic processing of all events. *Manual locations:* Based on IMO catalog, P- and S-wave onsets and amplitudes. Classification, local magnitude and NLLoc location. Complete down to $M_L \sim 3.0$, ca. 500 events. *Automatic locations:* Pepin algorithm, improved by "jackknife" test (worst pick left out). Stronger events supplied from manual catalog. Only "good" events selected, results in ~8500 events. NLLoc using SIL model, relocated by hypoDD. *Next steps:* Finalize and provide the dataset decided, as a starting point for other WPs.
- ii. Tomáš Fischer: Some results presented from the 2021 pre-eruption Fagradalsfjall swarm, time period processed 23. Feb. - 21. Mar. Pepin detector and picker, 50 largest events picked manually. Relocation of 8500 events using NLLoc (min. 8 picks and $RMS < 0.15$ s). Cross-correlation and relocation using hypoDD, both i) only catalog data and ii) catalog + cross-correlation data. Non-linear behaviour between Pepin automatic magnitudes and SIL manual magnitudes - perhaps saturation of Pepin magnitudes due to 4 Hz high-pass filter? Some very nice results, showing the dyke propagation. Also results from Pavla showing 2017 and 2019 swarms and missing foci interpreted as a ductile zone, correlating with the zone of eventual eruptive activity in 2021. The tectonic understanding discussed. Median tremor / seismic noise from FAF shown for frequencies up to 32 Hz - start of eruption clear and some of the new fissure openings.

d. **WP5:**

- i. Josef: Earthquake source mechanisms and stress analysis - the different tasks and deliverables. Two examples of full moment tensor inversions shown: West-Bohemia and Soultz-sous-Forêts - the necessary preconditions discussed. Two problems: 1) REYKJANET not dense enough for sufficient coverage of the focal sphere - data from other seismic networks will help, e.g. data from Cambridge University. 2) Unreliable velocity models for the Reykjanes Peninsula. The main emphasis in WP5 will be on developing a new, reliable velocity model for the study area.

e. **WP6:**

- i. Slavek (through Teams): Anisotropic seismic tomography, model parametrization, synthetic examples etc. Real inverse problem and results shown from the Reykjanes Peninsula.

f. **WP7:**

- i. Jiří: Ground motion models (GMM): preliminary results and expected results. Software to be developed to estimate ground motion from local earthquakes. For determination of GMM are needed: i) seismograms ii) velocity model iii) precise earthquake locations iv) magnitudes etc. An example shown of a velocity model from the Reykjanes Peninsula, using surface waves. Improved velocity model in preparation, derived from local earthquakes from Dec. 2019 - Oct. 2020, surface waves and Vs30 measurements. Model showing lower velocities (P and S) shallower than 1 km depth, and higher velocities below 1 km depth, compared to the SIL model. Attenuation of rays in the Krýsuvík volcanic system / geothermal area - partial melting? Two new stations mentioned, installed this summer - BLF in Bláfjöll and SVH in Selvogsheiði.

g. **WP8:**

- i. Gylfi: Multi-disciplinary interpretation: the objective, tasks and deliverables. Interpretation of all WPs with all existing geophysical and geological information at ÍSOR and submitting a paper. A lot of data from different disciplines available, but within NASPMON we want to add geophysical data in the study area. The history of utilization of the different geothermal systems reviewed, as well as some results of data.

6. Scientific discussion and future publications:

- i. Prior to the meeting, Tomáš Fischer shared a poster for the ESC conference about the Fagradalsfjall swarm with the project members. The poster is a result of common work of Tomáš, Jana, Ali and Pavla, and was initially supposed to be uploaded to the ESC site, but later cancelled and withdrawn to be rather discussed at the project meeting.
- ii. Tomáš gave the poster presentation and initiated a scientific discussion on the results. The results were discussed in detail, and will serve as an input for future work within the NASPMON project.

Decisions:

- Next project meeting will be held in Prague next year, in May/June.