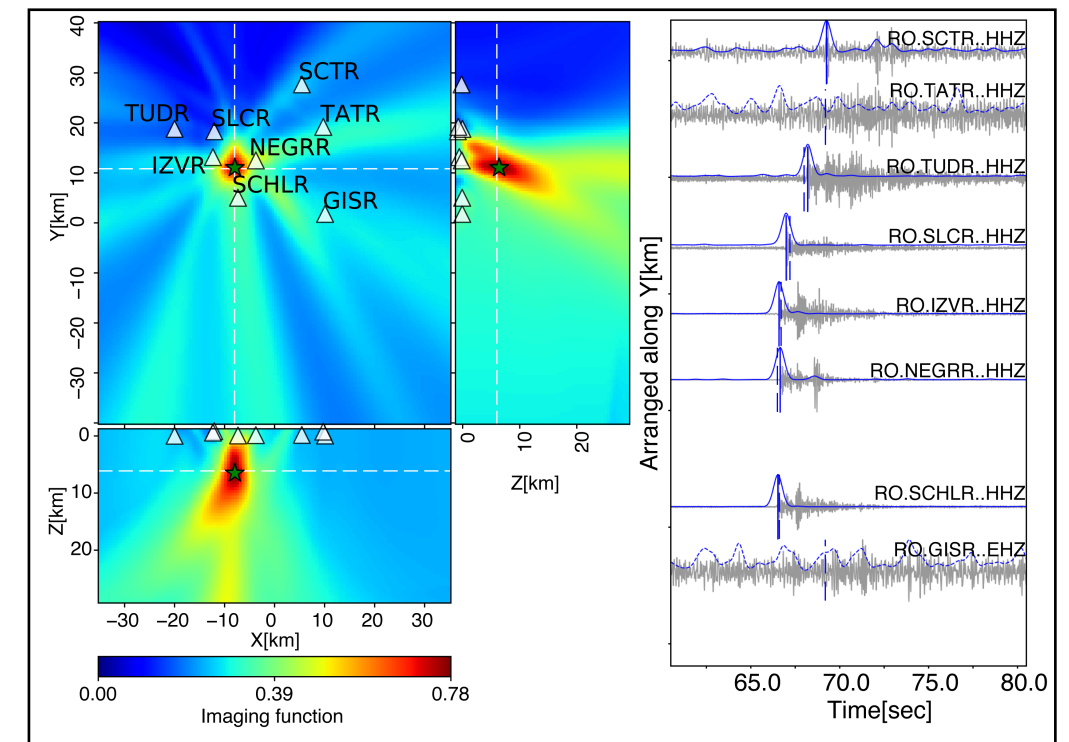
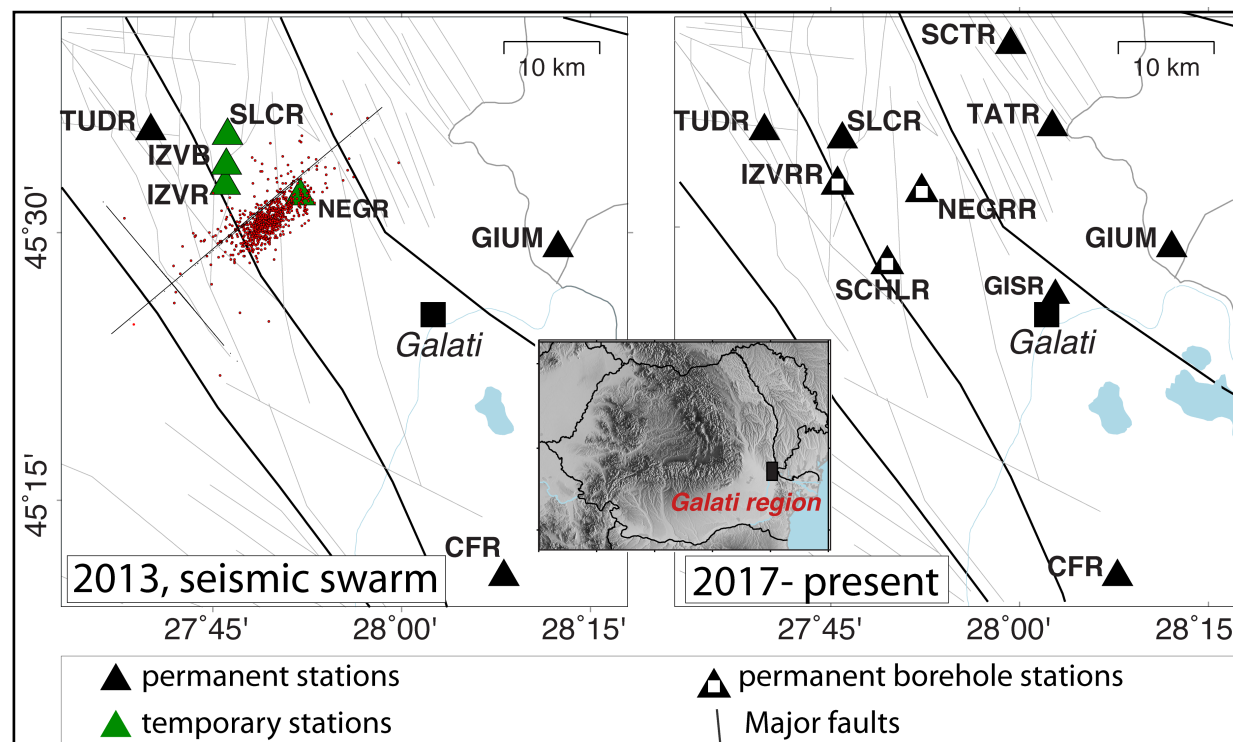


Automatic monitoring of crustal seismic activity in Galati region of southeastern Romania using full waveform-based approach

Dragos Tataru¹, Natalia Poiata^{1,2} and Bogdan Grecu¹

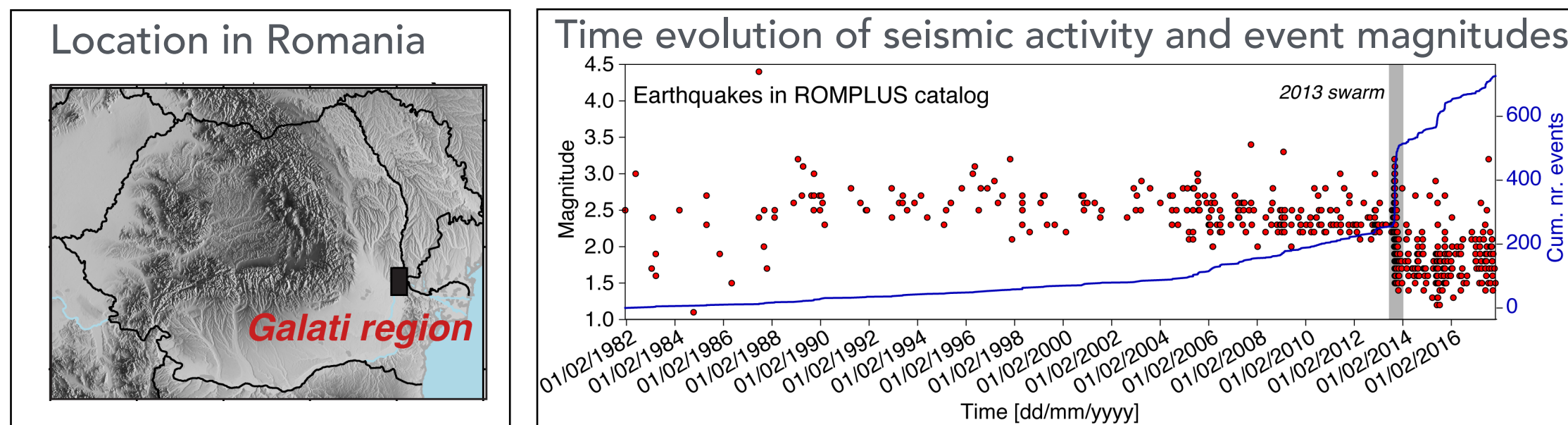
¹ National Institute for Earth Physics, Romania

² Institut de Physique du Globe de Paris, France



- 2013 Galati seismic swarm and seismic network in the area

Galati area of SE Romania - low & complex crustal seismicity; poorly monitored

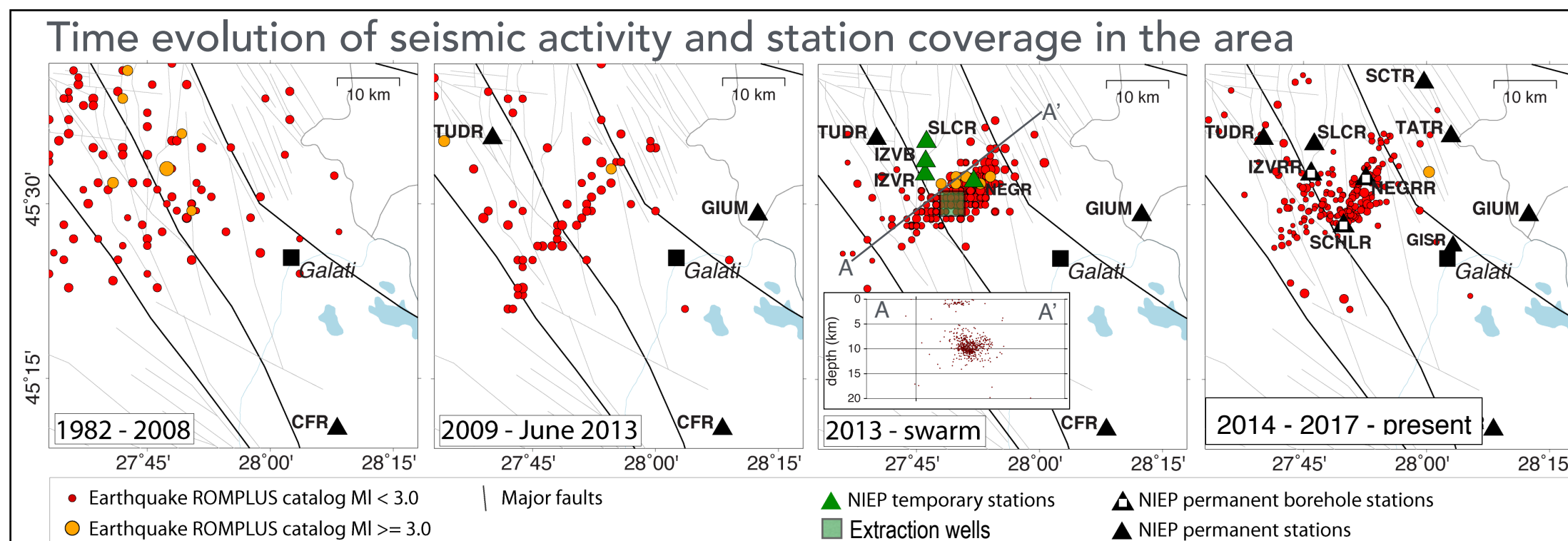


2013 seismic swarm - exceptional seismic activation of the region

Swarm characteristics: ~ 3 month long; > 800 events; MI 0.1-4.0 (>15 events, MI > 3.0)

Impact: felt by local population; proximity of oil exploitation wells - mass-media attention

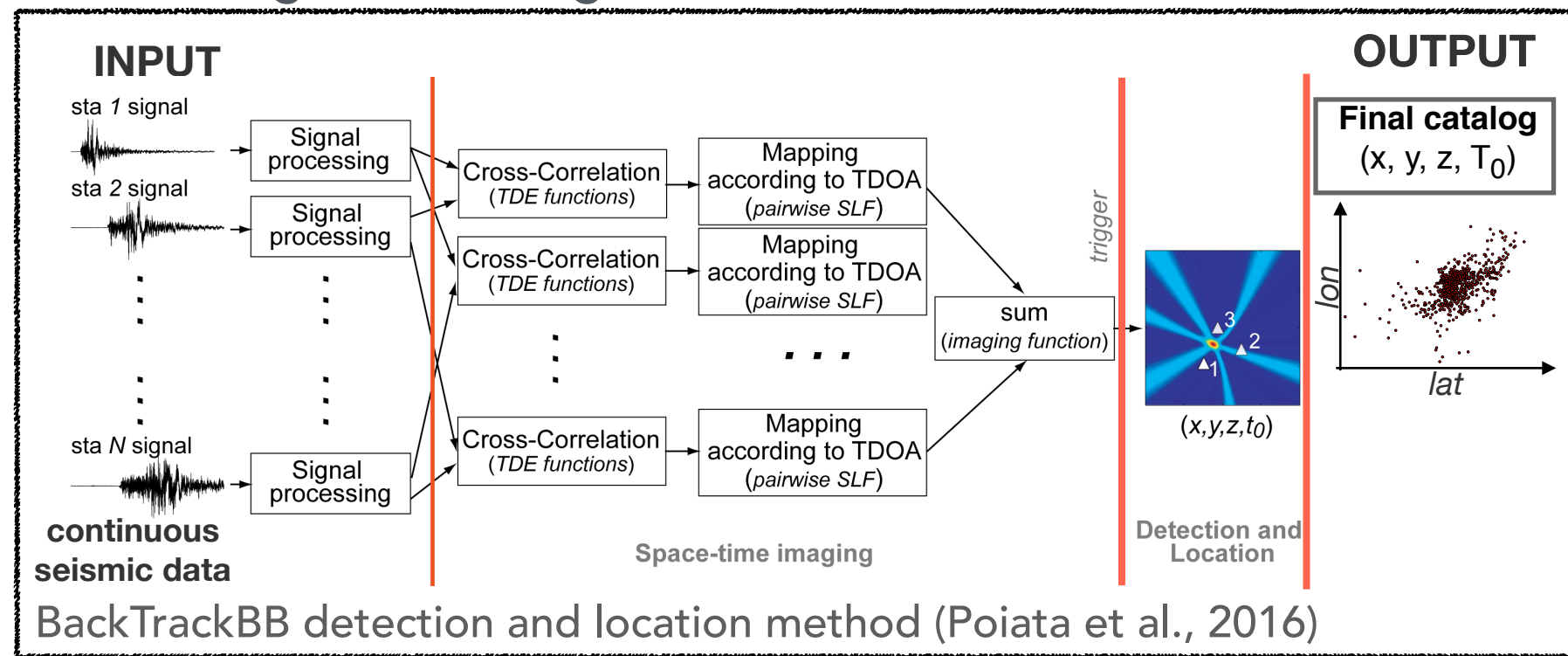
Installation of local seismic monitoring network (including borehole stations) - Nov. 2017



• Development of automatic seismic activity monitoring in Galati region

Methodology and workflow outline

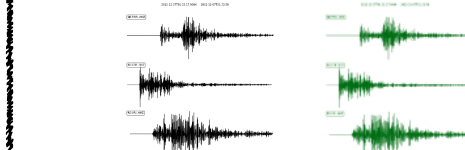
1. Extracting and locating seismic events from continuous data flow



2. Building event database

Event classification

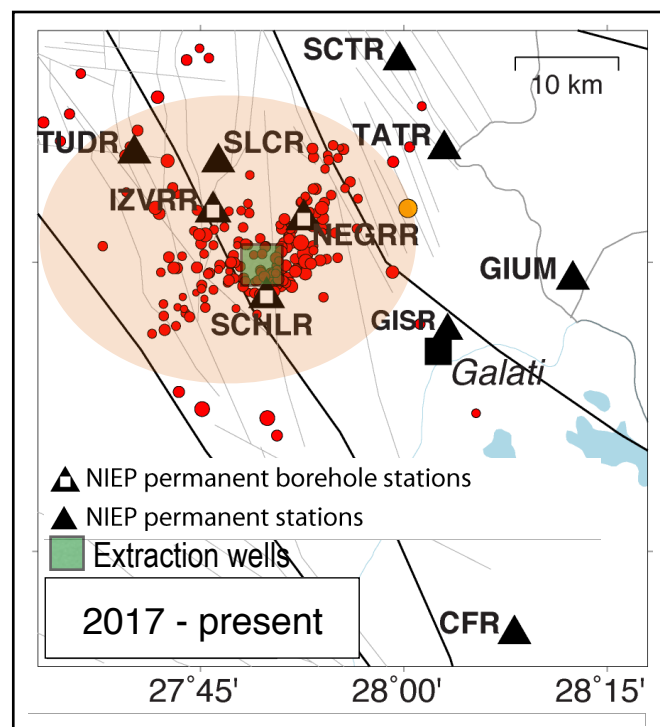
Similarity analysis
(multiplets and repeaters)



Event relocation

P & S relocation
Double difference relocation

Data and target area



Target area:

Region activated during 2013 seismic swarm

Data:

Continuous 3-C seismic recordings; closest 5 station; local 1-D velocity model

Time-period 2017-2019 including small region re-activation

Main goal:

Continuous data flow rapid and fully automated analysis

Detection/location and characterisation of local low-magnitude events

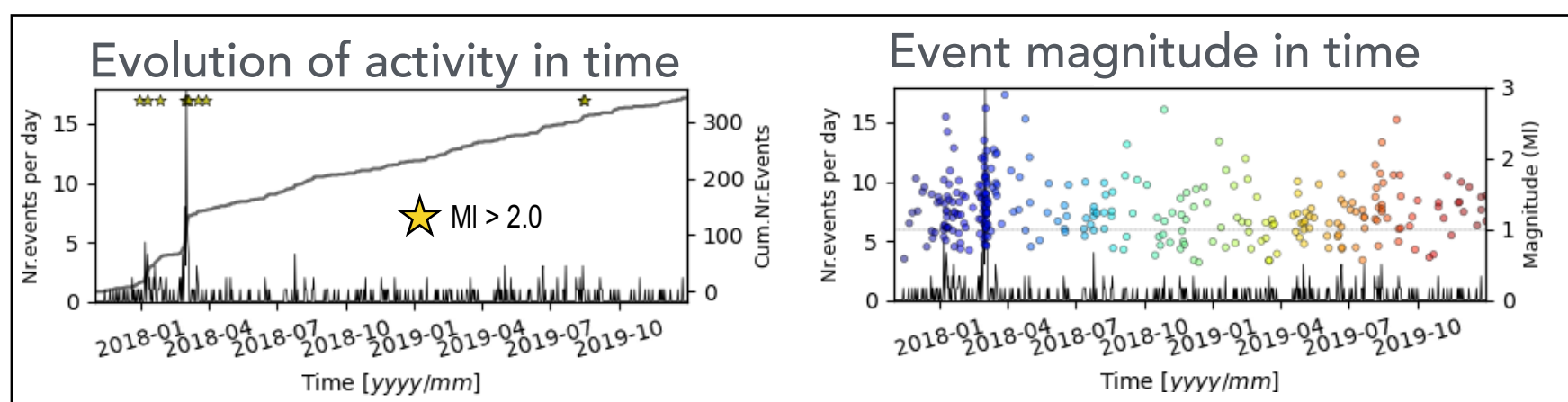
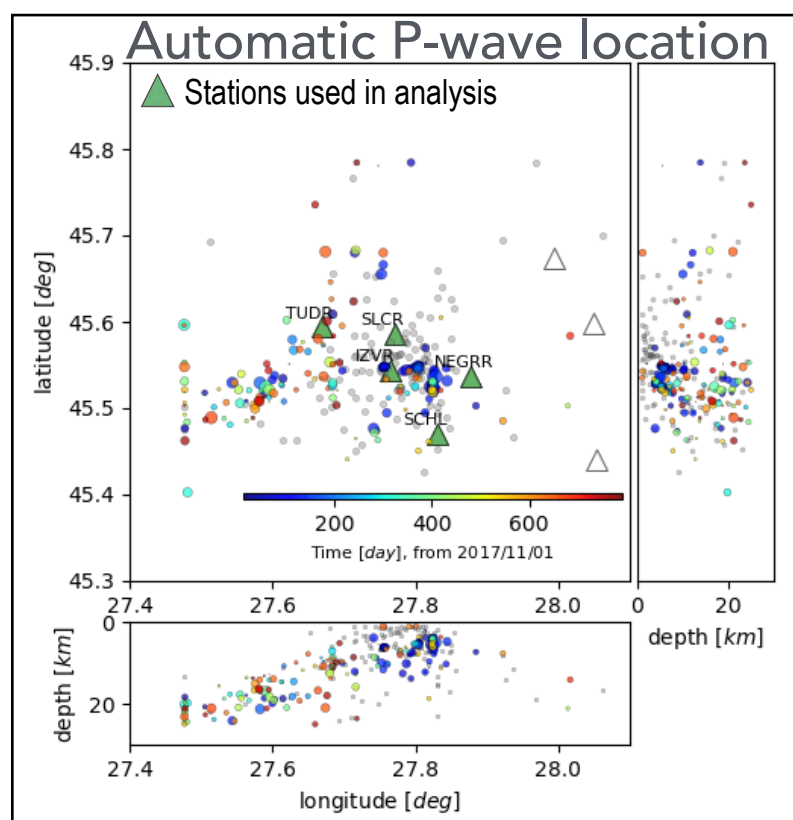
Potential of identifying seismic activation

Pseudo real-time setup (one-day delay data processing)

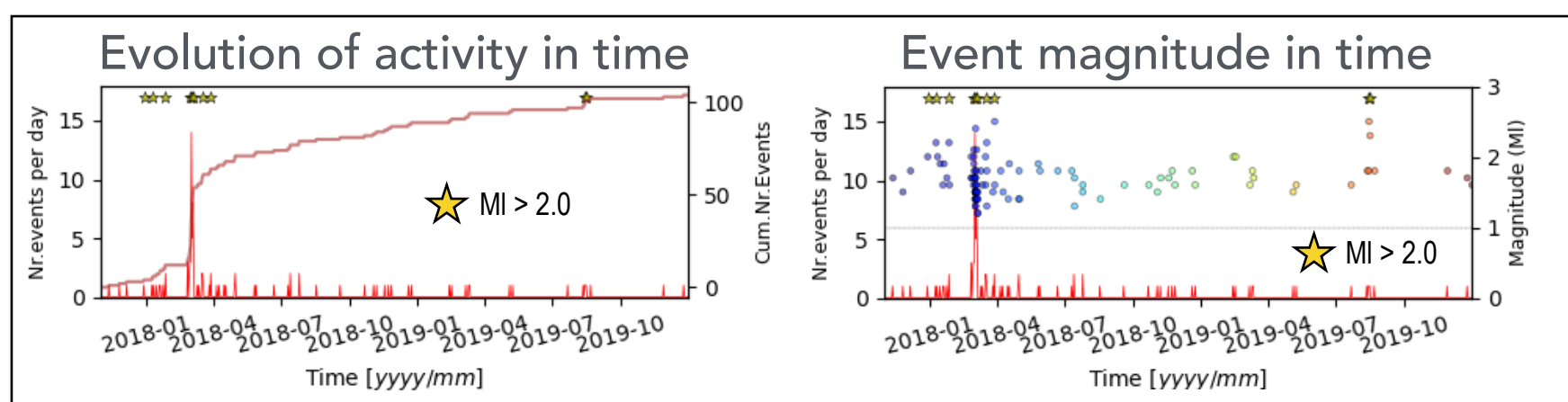
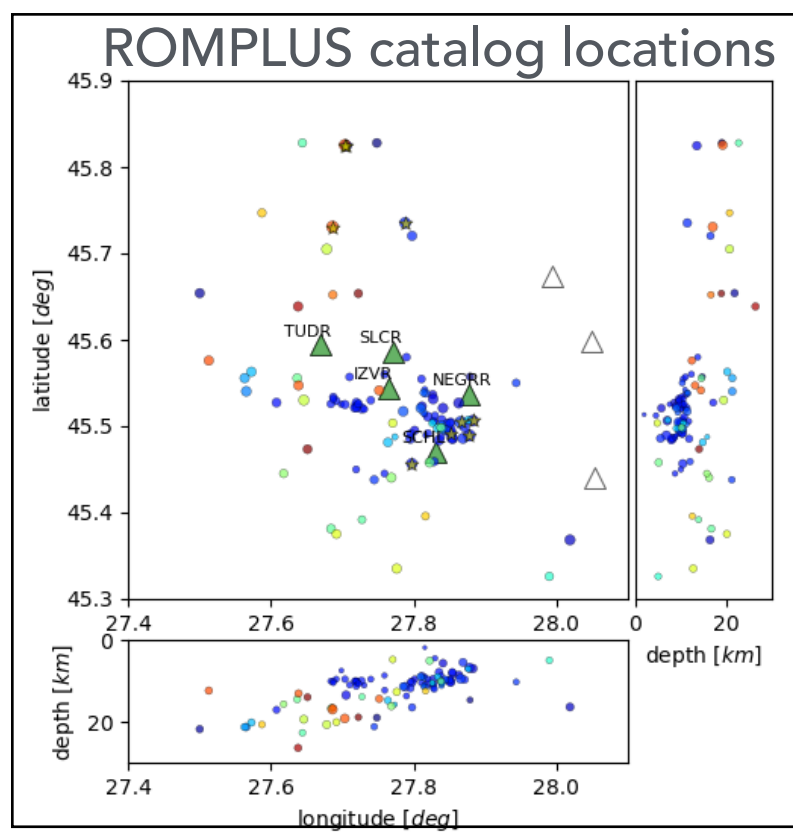
• Current stage and results; comparison with ROMPLUS catalog

Preliminary catalog of automatically located events for Galati region

Analysed time-period: November 2017 - December 2019 - workflow & parameter setup



- BackTrackBB-based continuous data processing: ~400 events
- > 350 true detection
- Allows detecting smaller-magnitude event
- More details about activity evolution in time

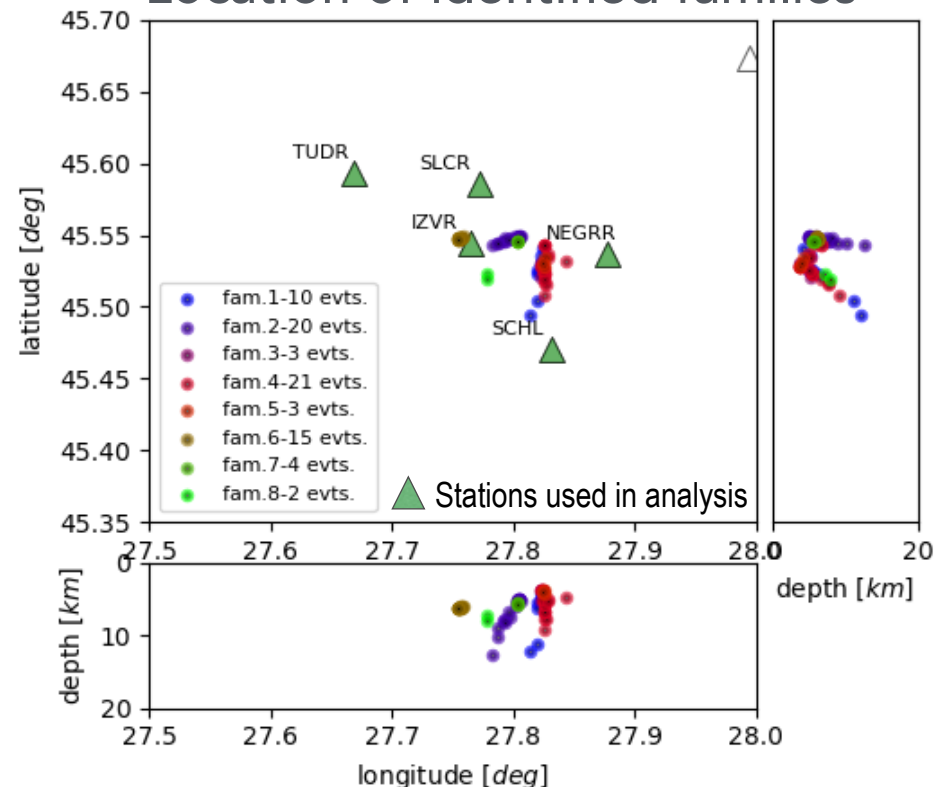


- ROMPLUS revised catalog: ~ 120 events
- Mostly larger events with good SNR

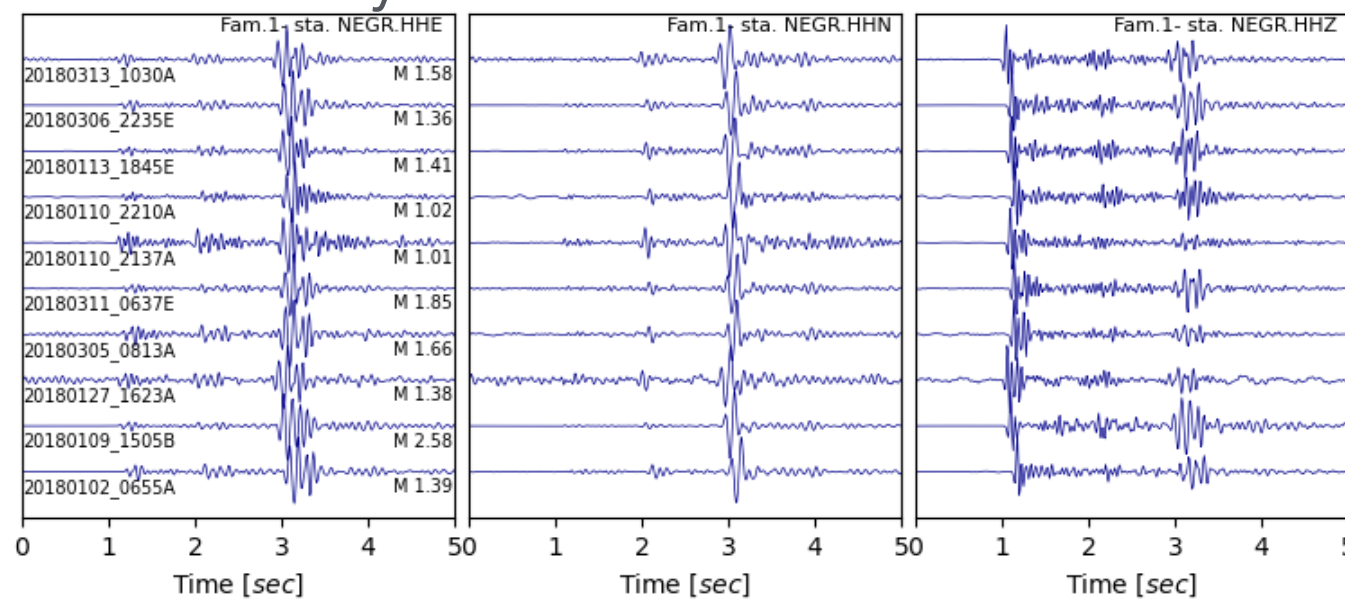
• Current stage and results; comparison with ROMPLUS catalog

Event characterisation - identifying similar events with cross-correlation analysis

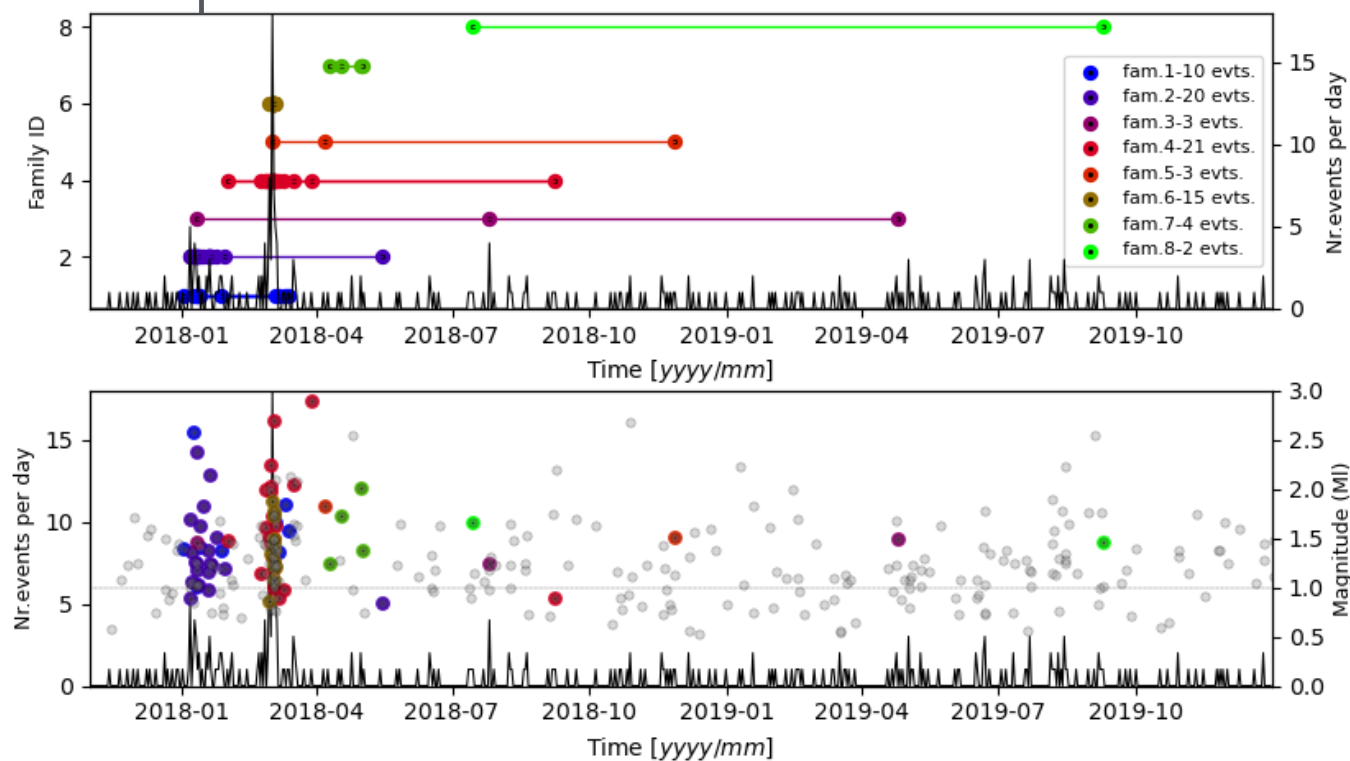
Location of identified families



Selected family waveforms: 2.0 -15.0 Hz filtered



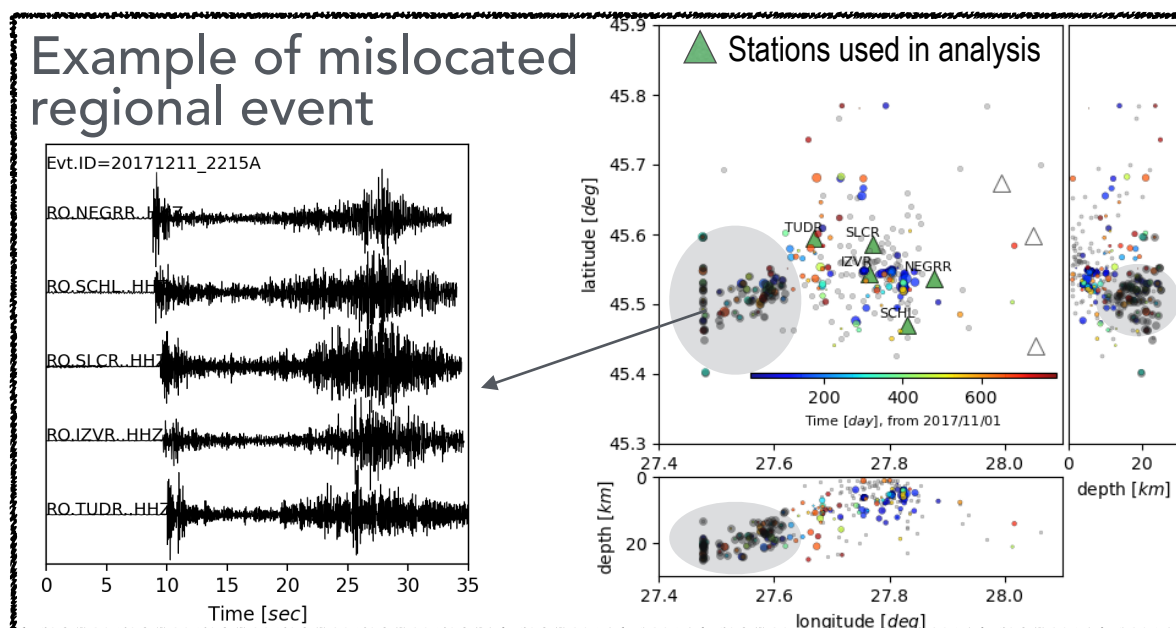
Temporal evolution of families



- 5-station, 3-component CC analysis for identifying families of similar events ($CC > 0.8$)
- ~ 8 families: 2-20 events per family
- Sequential activation of families during period of more intense activity
- Small swarm-like activity in Jan 2018 - March 2018
- Pattern similar to 2013 swarm
- Automatic catalog - more details about intense activity period

- Summary remarks

Challenges



- Mislocated and misidentified regional events - due to small-scale of network -> careful event-selection scheme (spectral analysis?)
- Increased number of false detections if number of functioning stations is decreased (only 5-stations) -> additional false-event removal procedure (SNR-based)

Ongoing and future developments

- Current-stage - off line data processing :P-wave detection/location and event similarity
- Ongoing development - P&S-wave based event relocation, removal of regional events
- Future development - pseudo real-time setup of analysis workflow: analysing with one-day delay continuous daily data (achievable on a local multi-core PC)
- Investigating source properties of local events - improvement of parameter setup and evaluation of seismic (re-)activation identification