Machine learning appliqué à l'analyse de la sismicité de l'éruption à Mayotte

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and the REVOSIMA
Mayotte Island and the Comoros archipelago

- Moderately active seismically
- Volcanic activity in Karthala
The Mayotte seismicity crisis

• The Seismic crisis started in **May 2018.** (Cesca et al, 2020, Lemoine et al, 2020) culminating with a **5.9** earthquake

• New offshore volcanic edifice discovered in May 2019 (Feuillet et al, 2021)
Analysis of the crisis with its seismicity

Monthly seismicity
The Mayotte seismicity crisis

- Real-time monitoring challenges:
  - Small land-based network (8 stations);
  - Earthquakes are outside of the network and only on one side.

- Need to automatically pick P and S phases
Use of PhaseNet for automatic picks

Automatic detection with Machine Learning

PhaseNet
Neural network based method
Trained on data in California

Zhu and Beroza 2018
Use of PhaseNet for automatic picks

Automatic detection with Machine Learning

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Automatic detection with Machine Learning

Continuous analysis of the seismicity

PhaseNet

Zhu and Beroza 2018

Automatic detection on YTMZ

Mittal et al., in review
Automatic detection from March 2019 to February 2021

Detection of 50000 events

Separation between VT/LP events

Retailleau et al., in prep
Detection of 50000 events

Separation between VT/LP events

NonLinLoc (Lomax et al., 2009) + Lavayssière et al., in review
Automatic detection from March 2019 to February 2021

VT earthquakes

Poster of Aude Lavayssière
Real-time monitoring

Data request
Seedlink

Phasenet
Phase identification and picking

Earthworm
Event identification
Location

Seiscomp
Magnitude calculation
Multi-origin catalog

Retailleau et al., in review
Monitoring with the seismicity Phasenet
Phase identification and picking
Seiscomp
Magnitude calculation
Multi-origin catalog
Earthworm
Event identification
Location
Event - Manual origin - SeisComP3 - PhaseWorm

New method
Manual detection
Previous method

Number of VT
December 2020
January 2021

Number of LP

45.1° E
45.3° E
45.5° E
45.7° E

12.7° S
12.8° S
12.9° S
13° S

New method
Previous method

Event
- Manual origin
- SeisComP3
- PhaseWorm

Retailleau et al., in review
Real-time monitoring
- Running since March 2021
- Now also in Martinique

Data request
Seedlink

Phasenet
Phase identification and picking

Earthworm
Event identification
Location

Seiscomp
Magnitude calculation
Multi-origin catalog

- Manual origin
- SeisComP3
- PhaseWorm
Summary

- Seismic crisis in May 2018
- Followed with subsidence and east displacement
- Start of eruption estimated late June early July

Analysis of the seismicity through automatic detection

• Detection of numerous events and addition of LP earthquakes analysis
• Real-time detection of the seismicity since March 2021