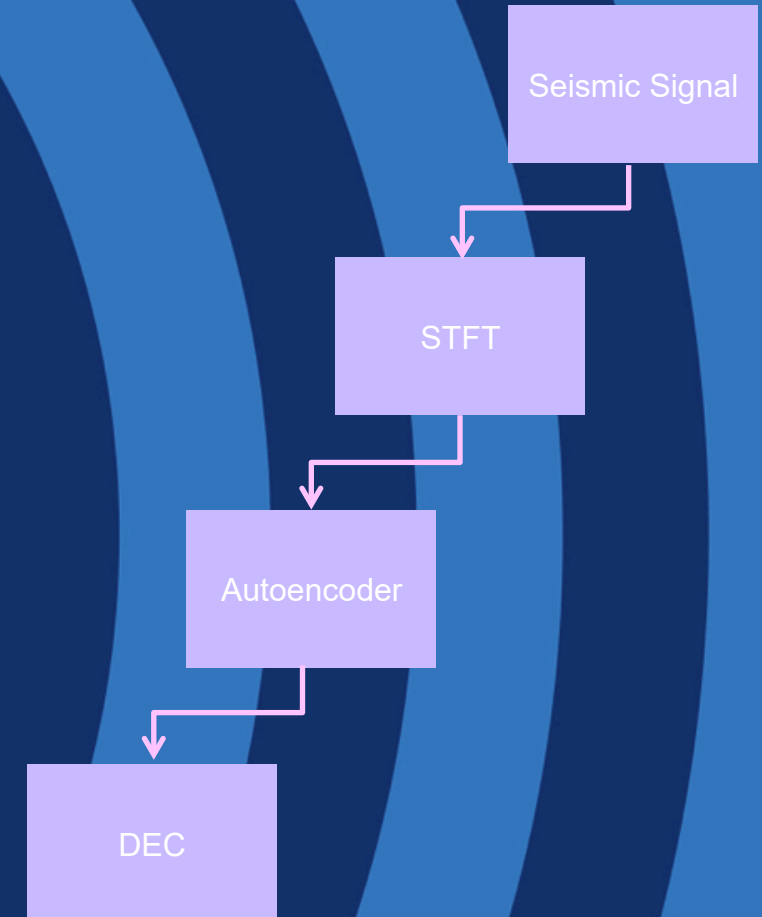
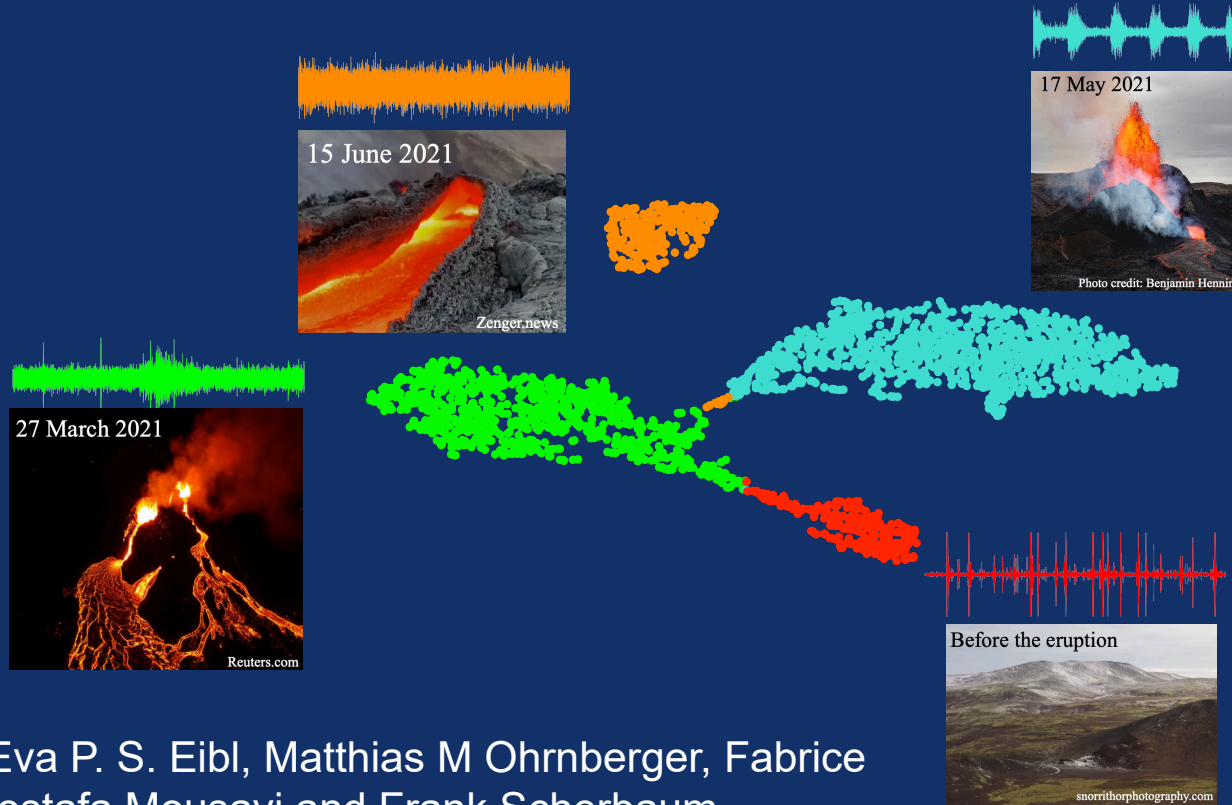


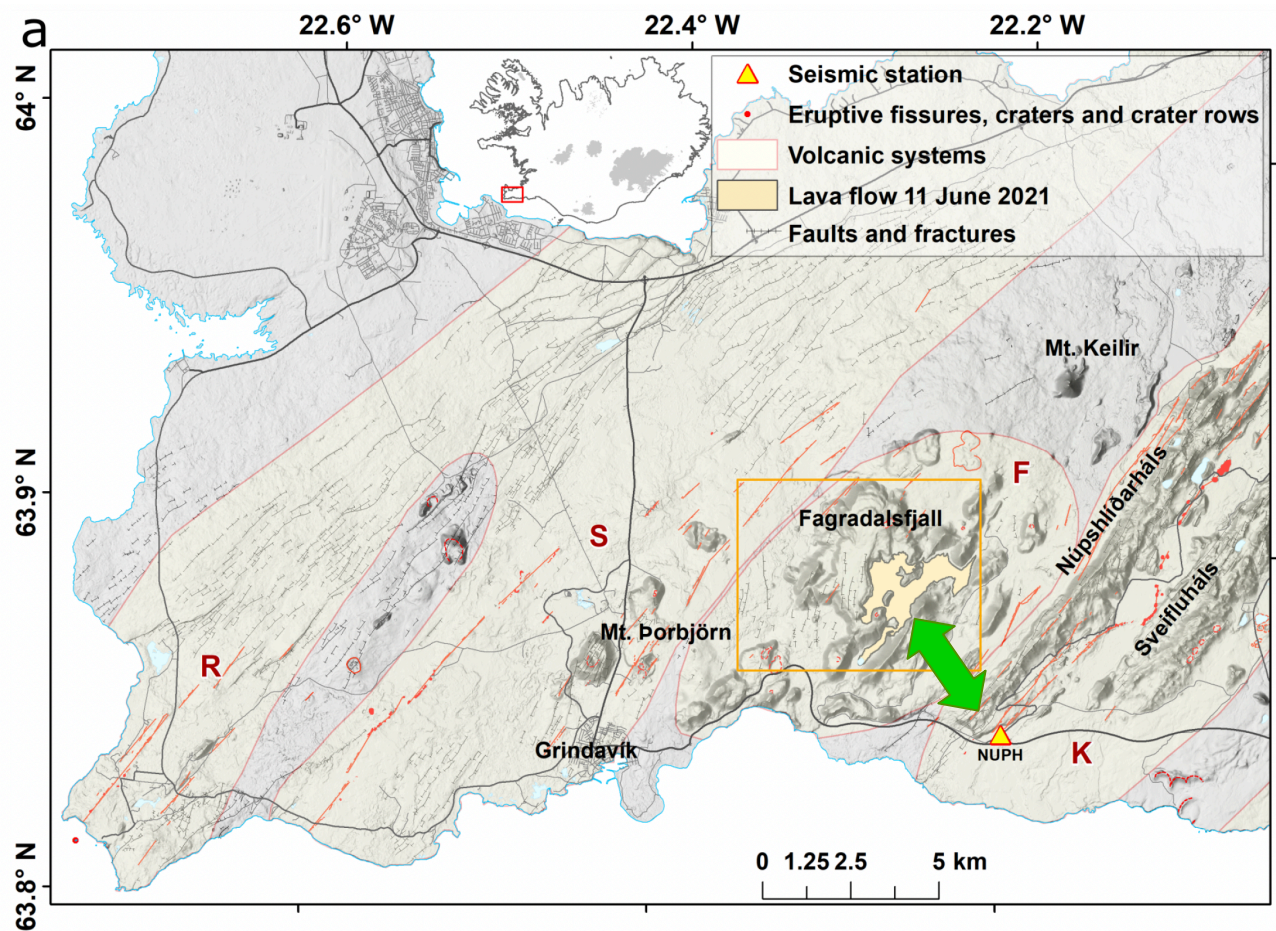
Deep Clustering of Tremor Episodes Can Reveal Different Eruptive Periods during the 2021 Fagradalsfjall Eruption, Iceland



Zahra Zali, Eva P. S. Eibl, Matthias M Ohrnberger, Fabrice Cotton, S. Mostafa Mousavi and Frank Scherbaum

December 2022

2021 Fagradalsfjall Eruption, Iceland

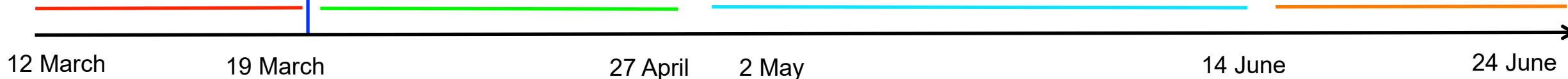


Eruptive site and instrument location

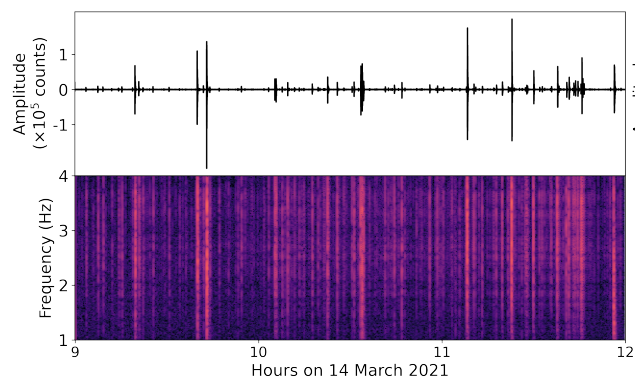
Eibl et al. (2022)

Different phases during the eruptive activity

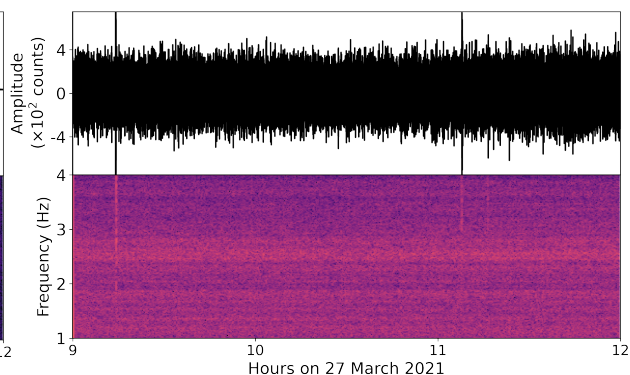
Start of the eruption



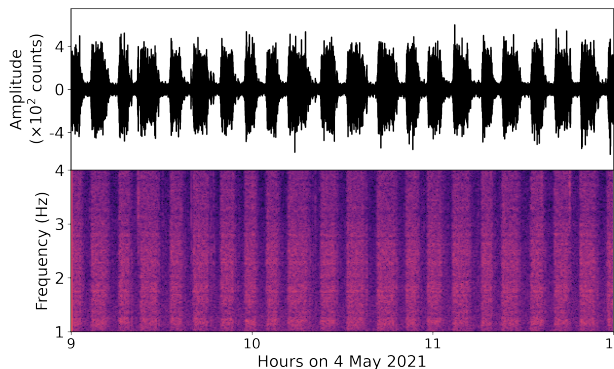
Earthquakes



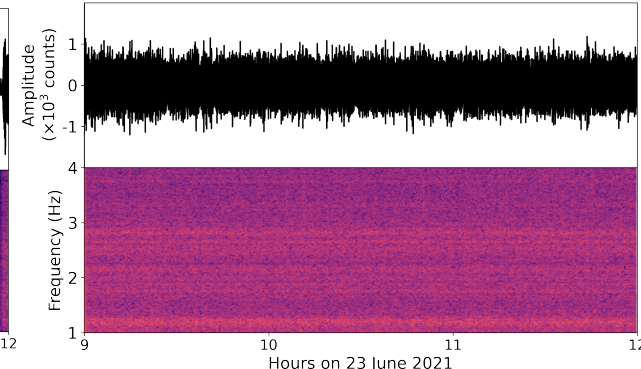
Continuous tremor



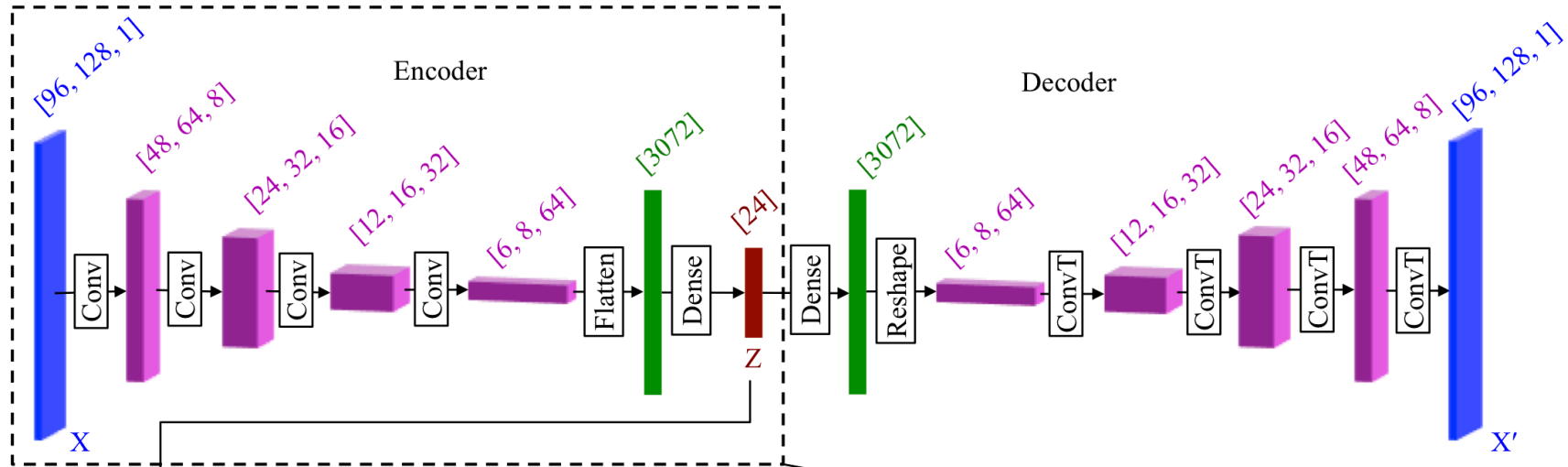
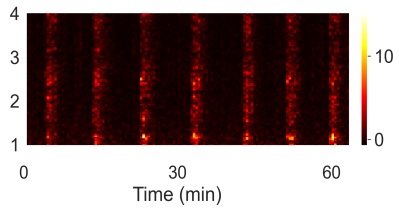
Pulsating patterns



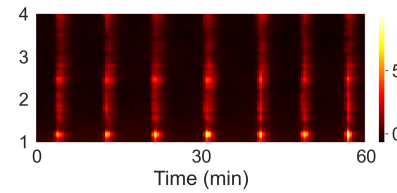
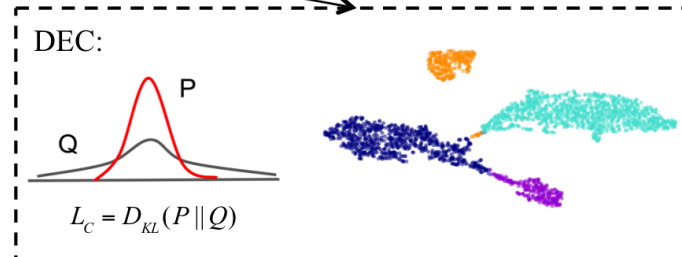
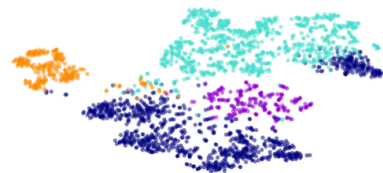
Continuous tremor (different frequency & amplitude)



Deep embedded clustering



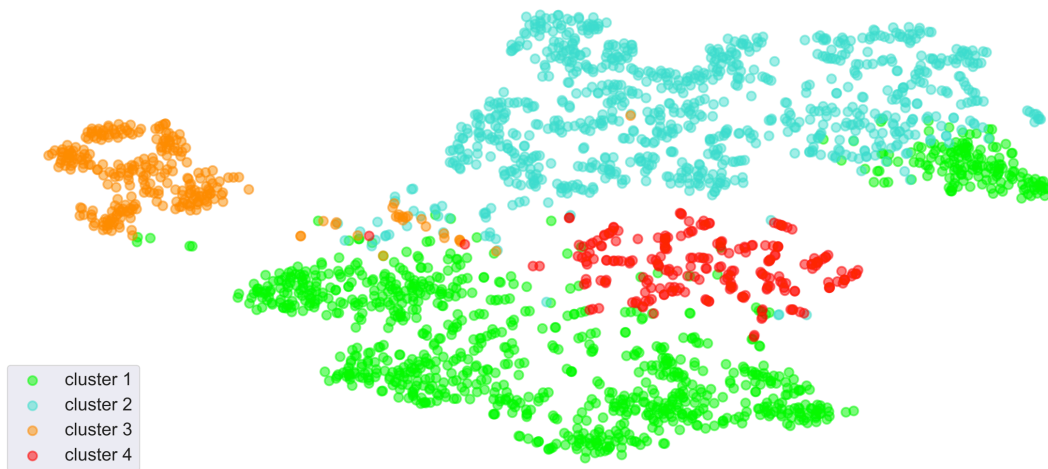
Clustering Layer
K-means



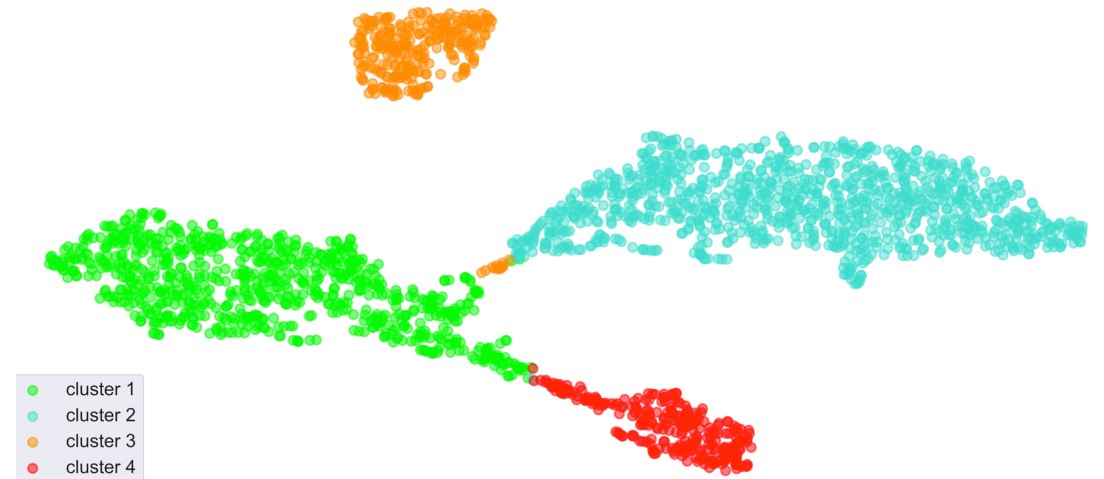
T-sne visualizations in feature domain

Number of clusters: 4

Selected based on the Sum of Square Error (SSE) value which has a significant and elbow-shaped decrease.

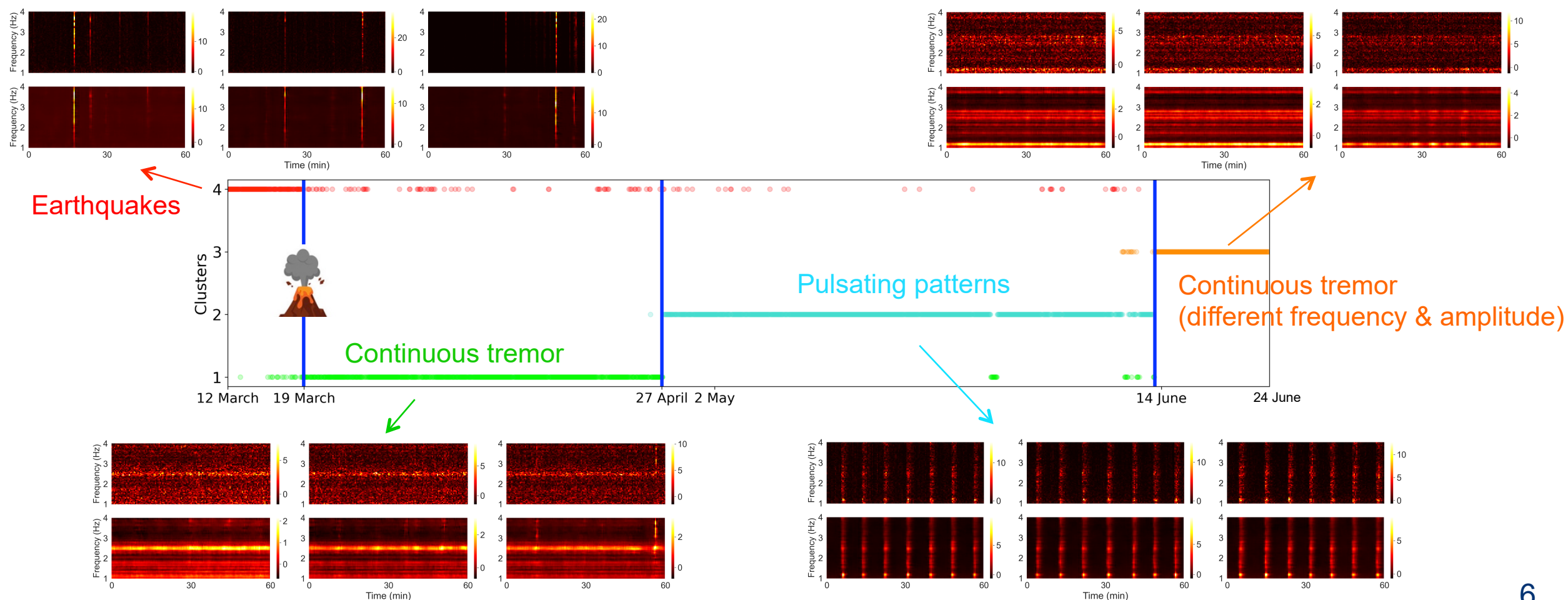


After pretraining

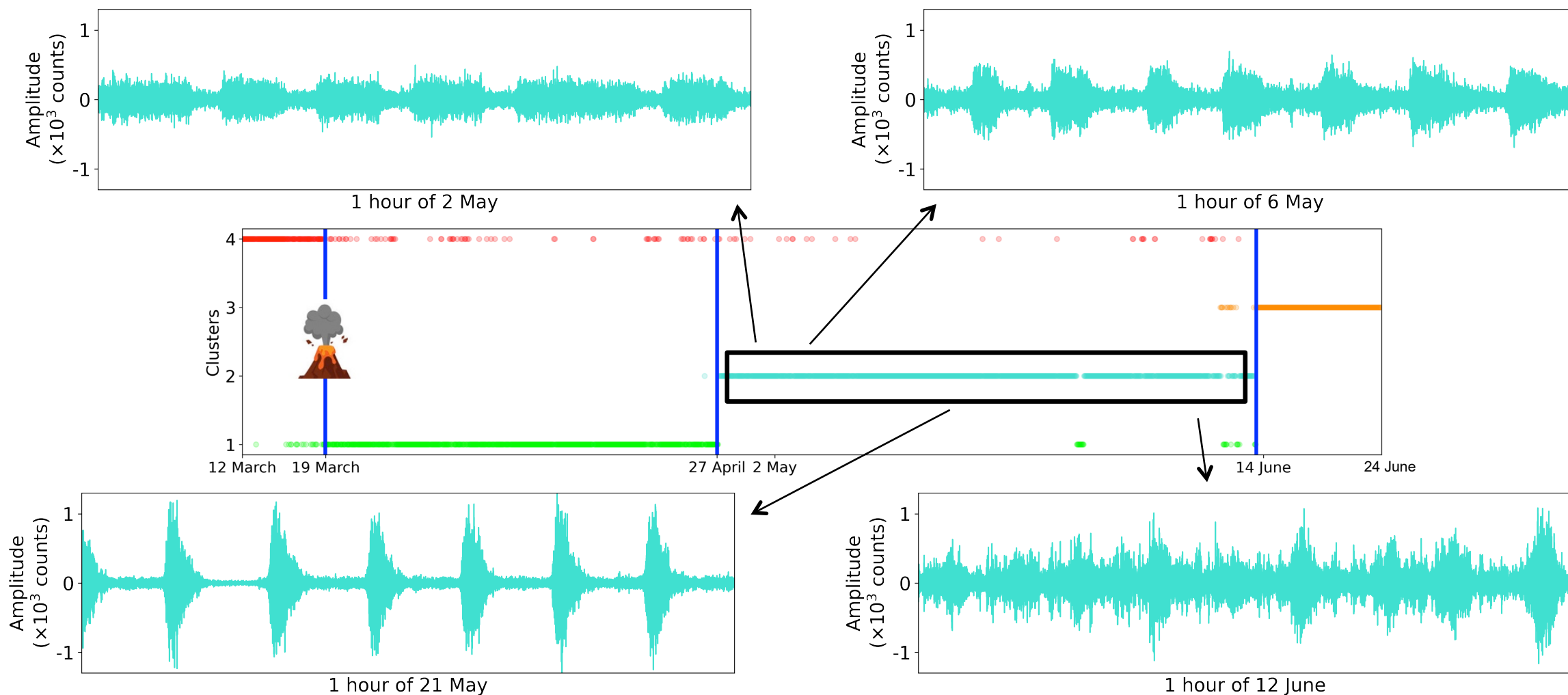


After 25000 iteration during the fine-tuning

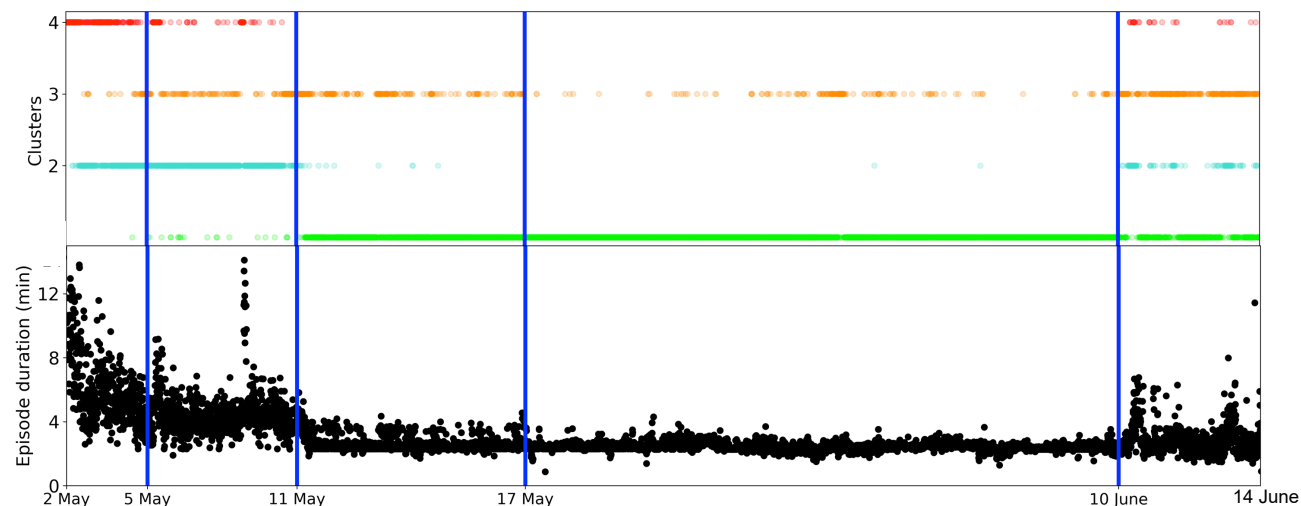
Deep clustering reveals different eruptive phases



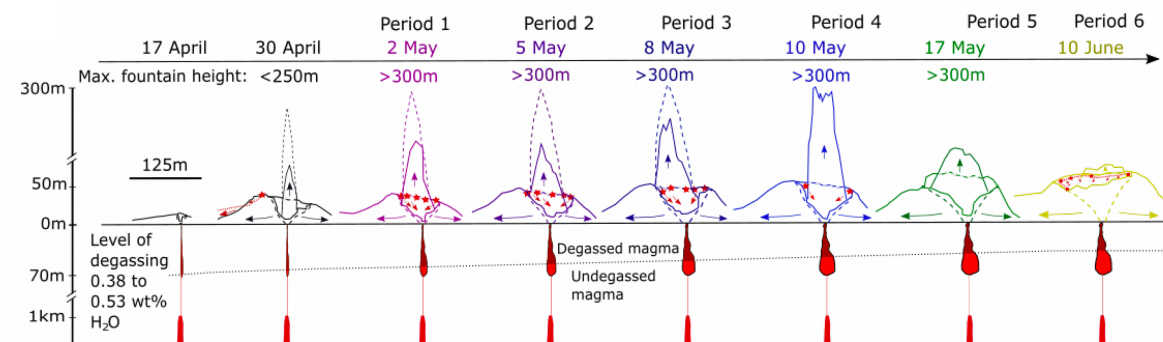
Clustering of the fountaining patterns



Different periods during episodic lava fountaining



Our clustering result is in line with other studies on the volcanic activity.



Key takeaways

- ✓ Deep embedded clustering reveals different phases during the eruptive activity without using any prior information.
- ✓ This technique can disclose subtle precursors before the eruption.
- ? Open question: What properties of the volcanic system can be related to the extracted salient features?

Thank you!