

Best Practices for Machine Learning based Icequake Picking with Distributed Acoustic Sensing

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Data Set (July 2020)



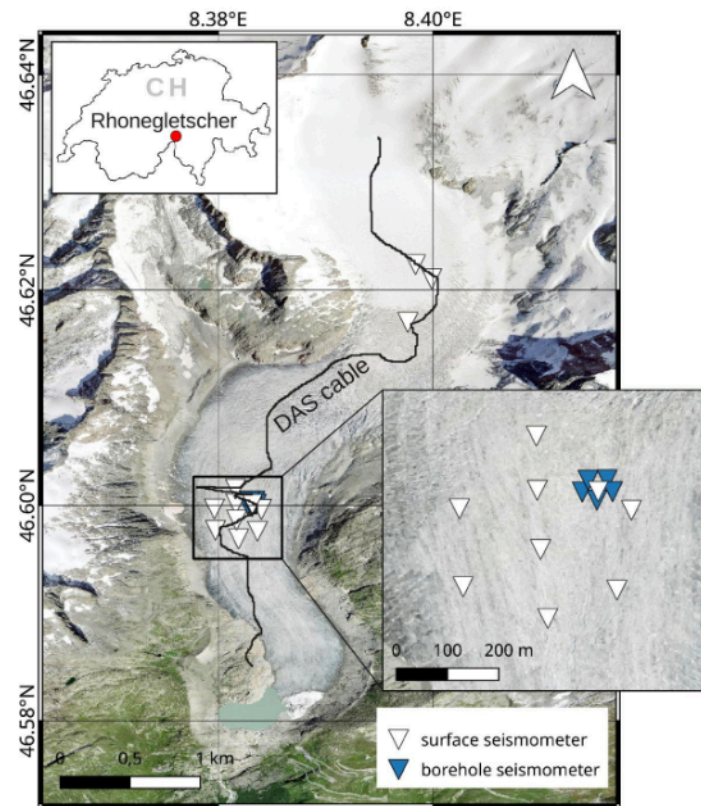
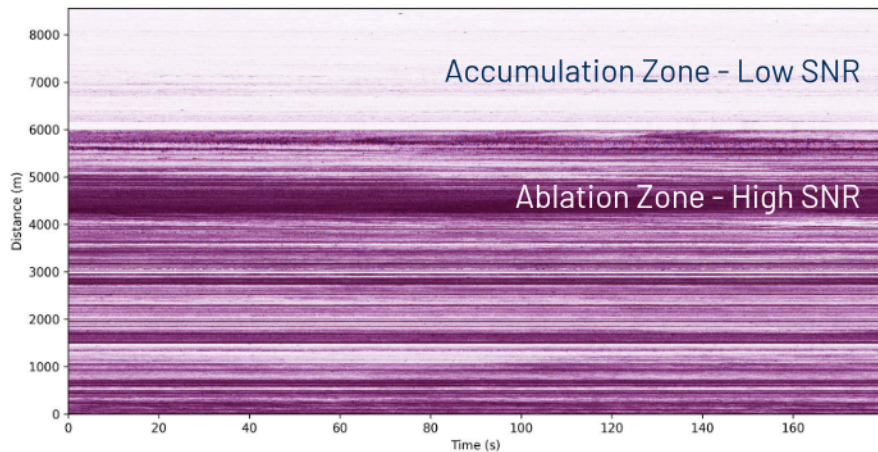
DAS recording:

- length = 9 km
- sampling frequency = 1000 Hz
- volume = 13 TB of strain rate data

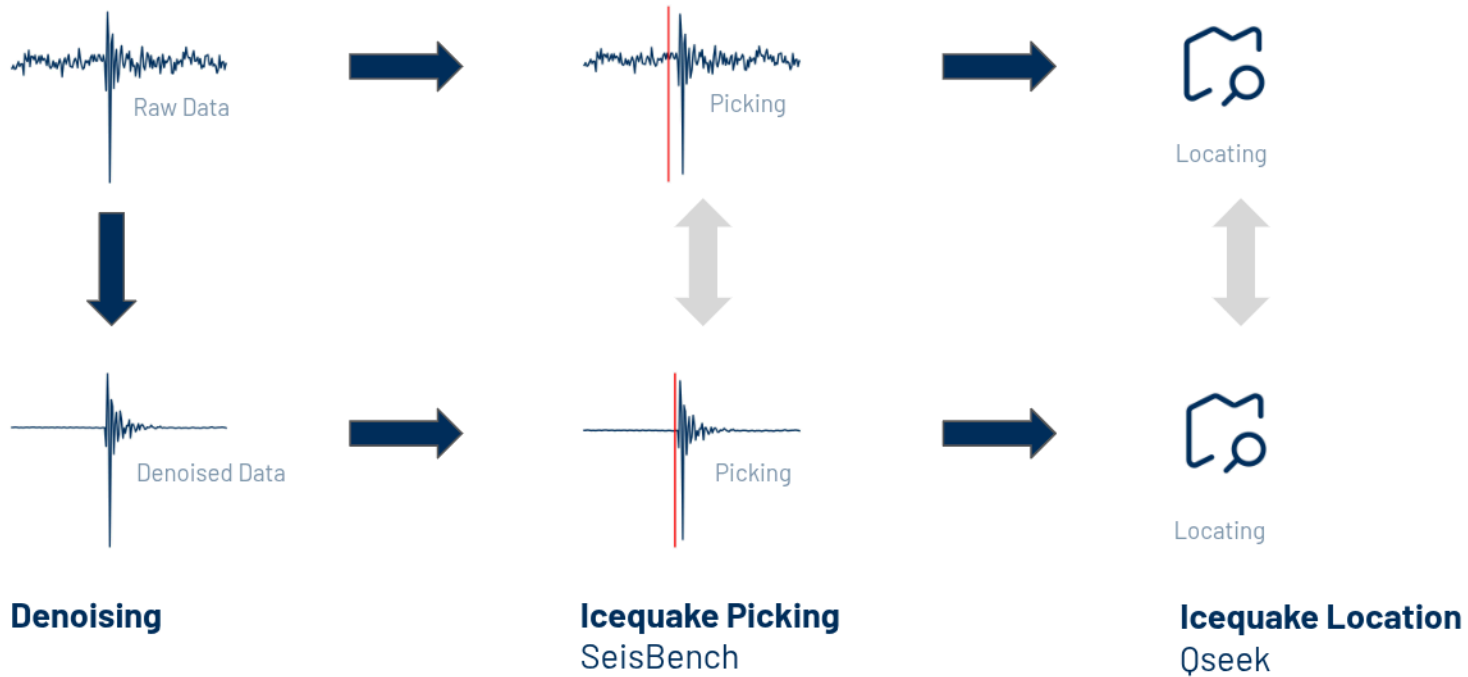
Seismometer:

- 12 surface seismometer
- 5 borehole seismometer

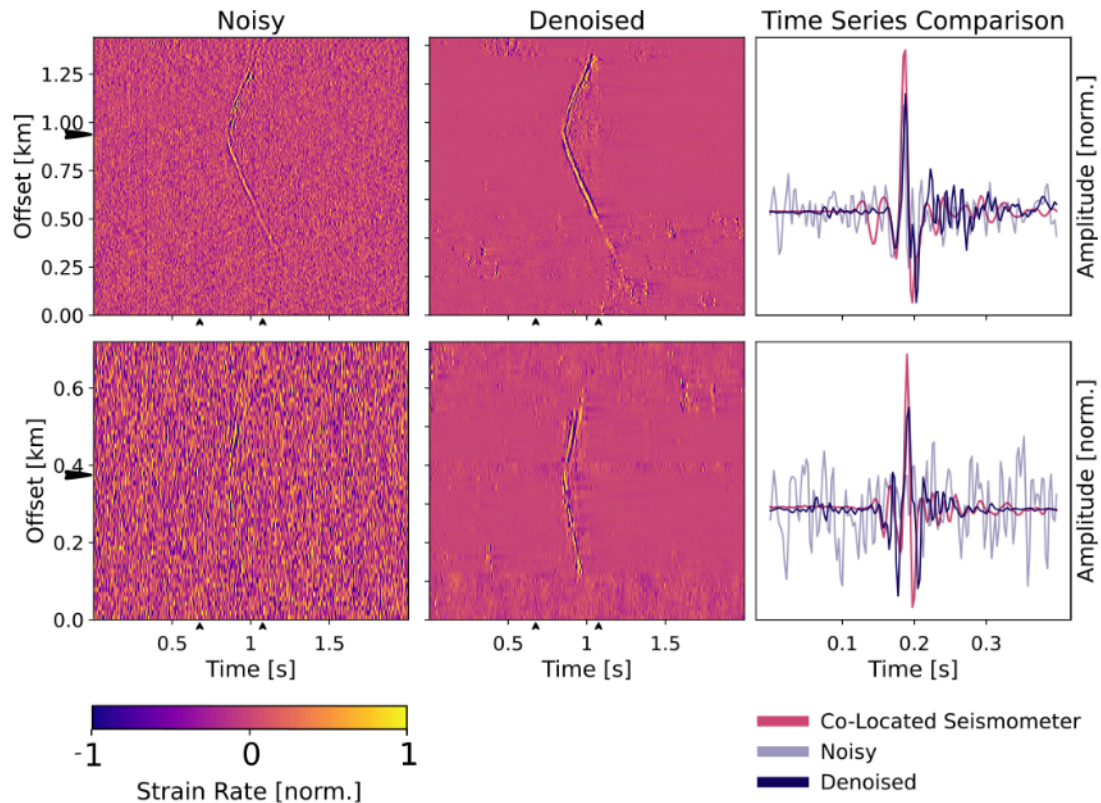
DAS Data



Workflow



Denoising



Self-Supervised autoencoder trained on icequakes recorded on DAS

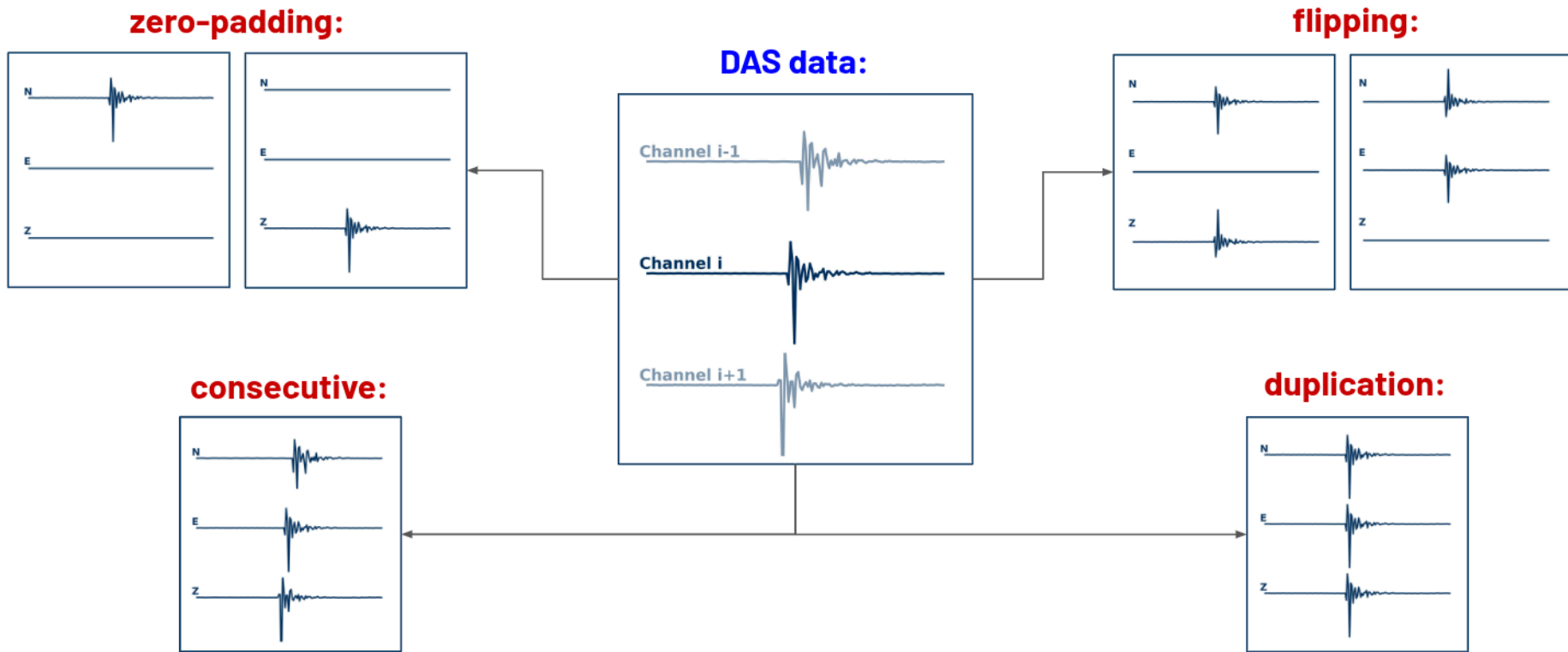
Key Results:

- Enhanced inter-channel coherence
- Increased SNR value
- Outperforms conventional denoising methods and other ML-based models
- Downside: Denoising artifacts in rare cases



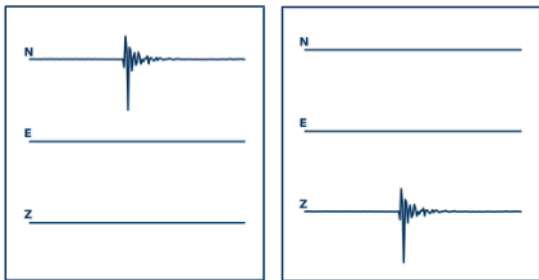
More info here:

Icequake Picking (Mapping Strategies)

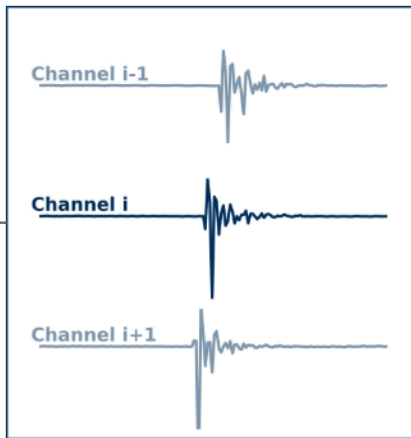


- Icequake Picking (Mapping Strategies)

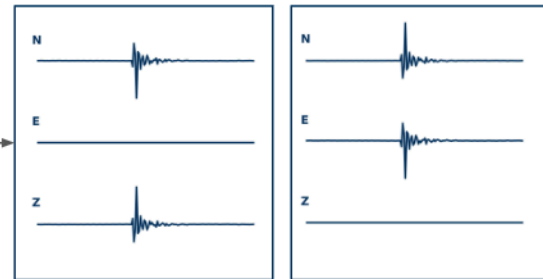
zero-padding:



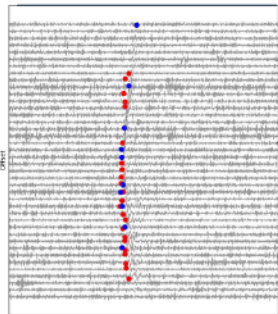
DAS data:



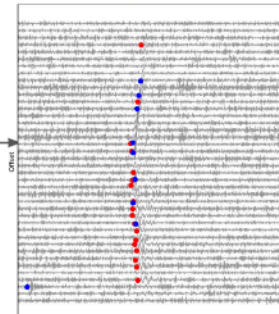
flipping:



consecutive:



duplication:



Locations

DAS & Seismometer

DAS

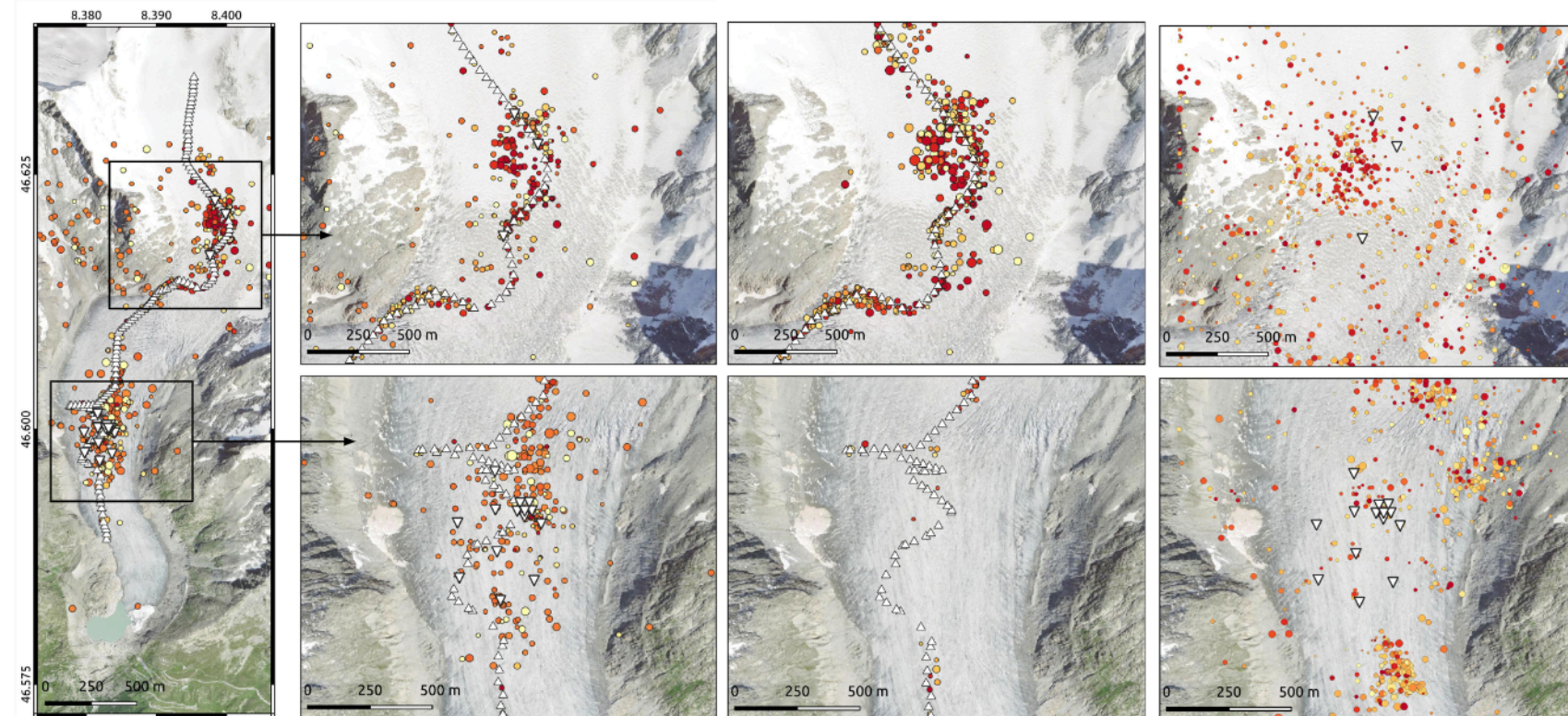
Seismometer

Day Time:

- 00:00
- 04:00
- 08:00
- 12:00
- 16:00
- 20:00

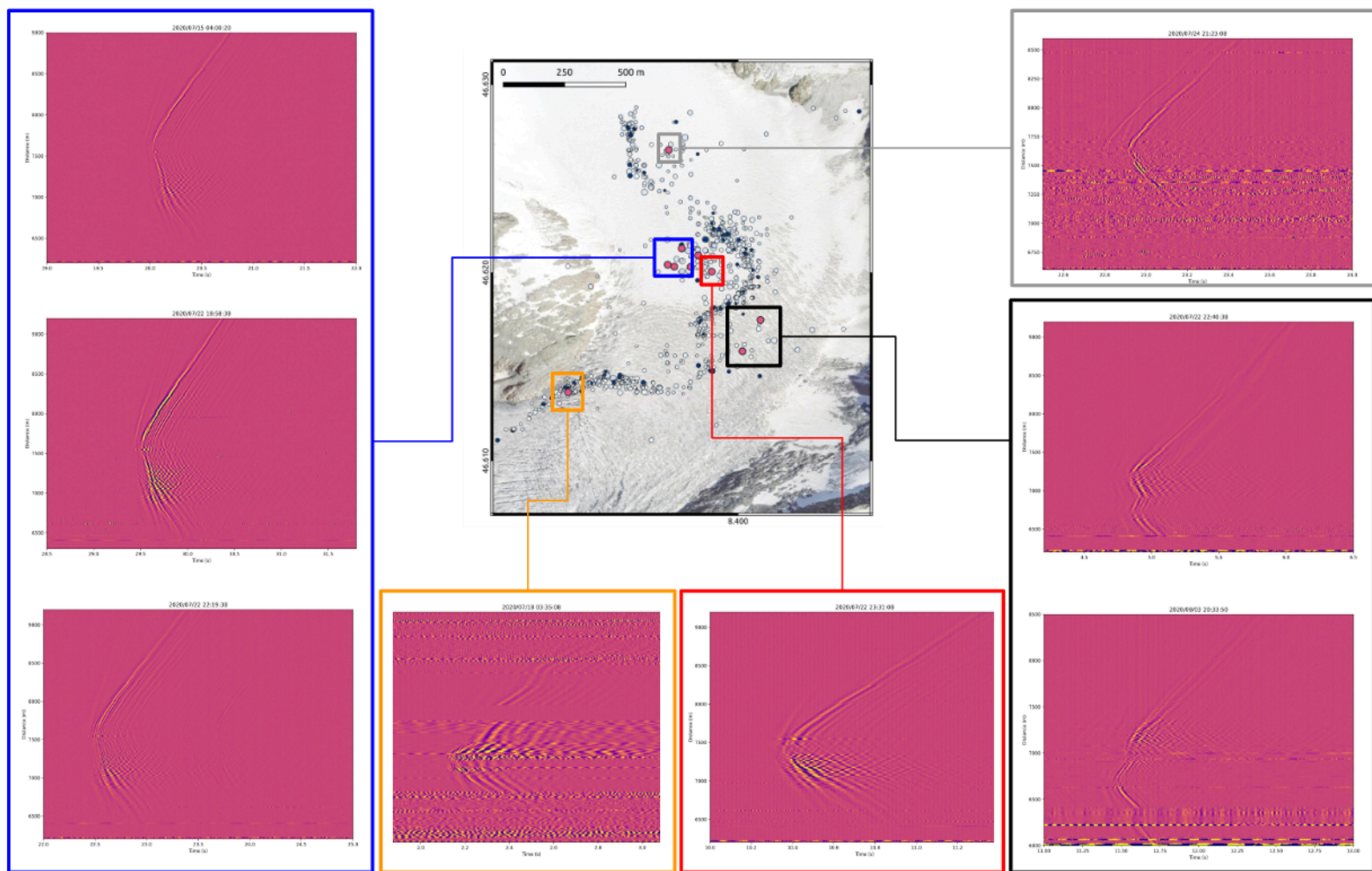
Location Confidence:

- low
- high



Results are obtained with Qseek [Isken et. al., 2025]

Locations



Outlook

- Improve icequake picking by retraining on cryoseismological DAS data
- Parameter tuning to improve location quality and reduce artifacts
- Including elevation model into picking algorithm
- Clustering of Events



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