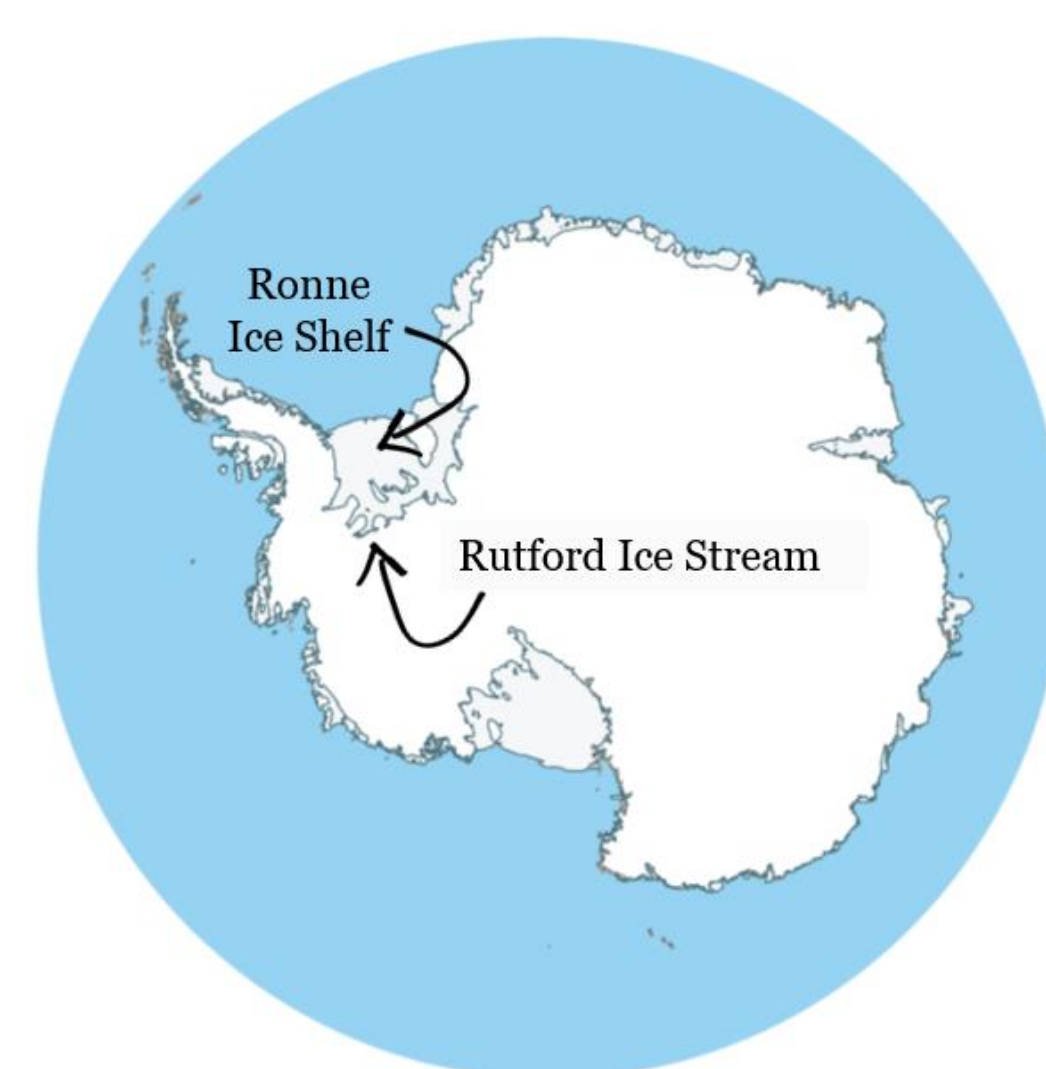


## Research Site - Rutford Ice Stream

- Numerical models are used to quantify Antarctica's future contribution to sea-level rise, but remain poorly modeled due to inadequate bed information
- Icequakes are a rapid, high-volume method to gain information about glacier beds

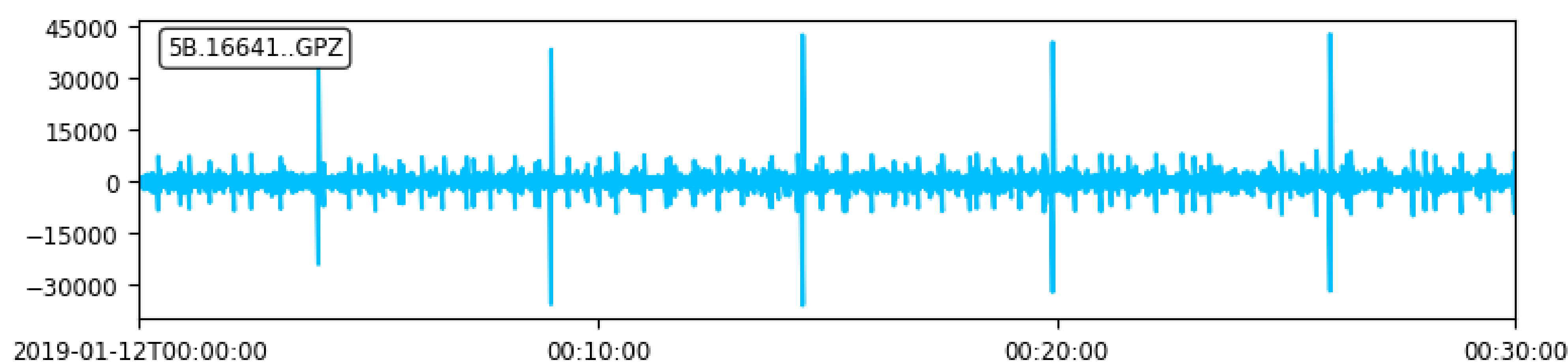


**Fig. 1.** Location of the Rutford Ice Stream (RIS) on a map of Antarctica. The RIS is situated on the West Antarctic Ice Sheet (WAIS) and drains into the Ronne Ice Shelf. As part of the BEAMISH project to perform a detailed survey of the Rutford bed, we collaborated with the British Antarctic Survey (BAS) to install several seismic arrays at inland RIS and one close to the RIS grounding line. We are currently focusing on the grounding line array, which consists of 29 stations that are each equipped with a 3-component geophone sampling at 1000 Hz.

## Repeating Signals & Clustering

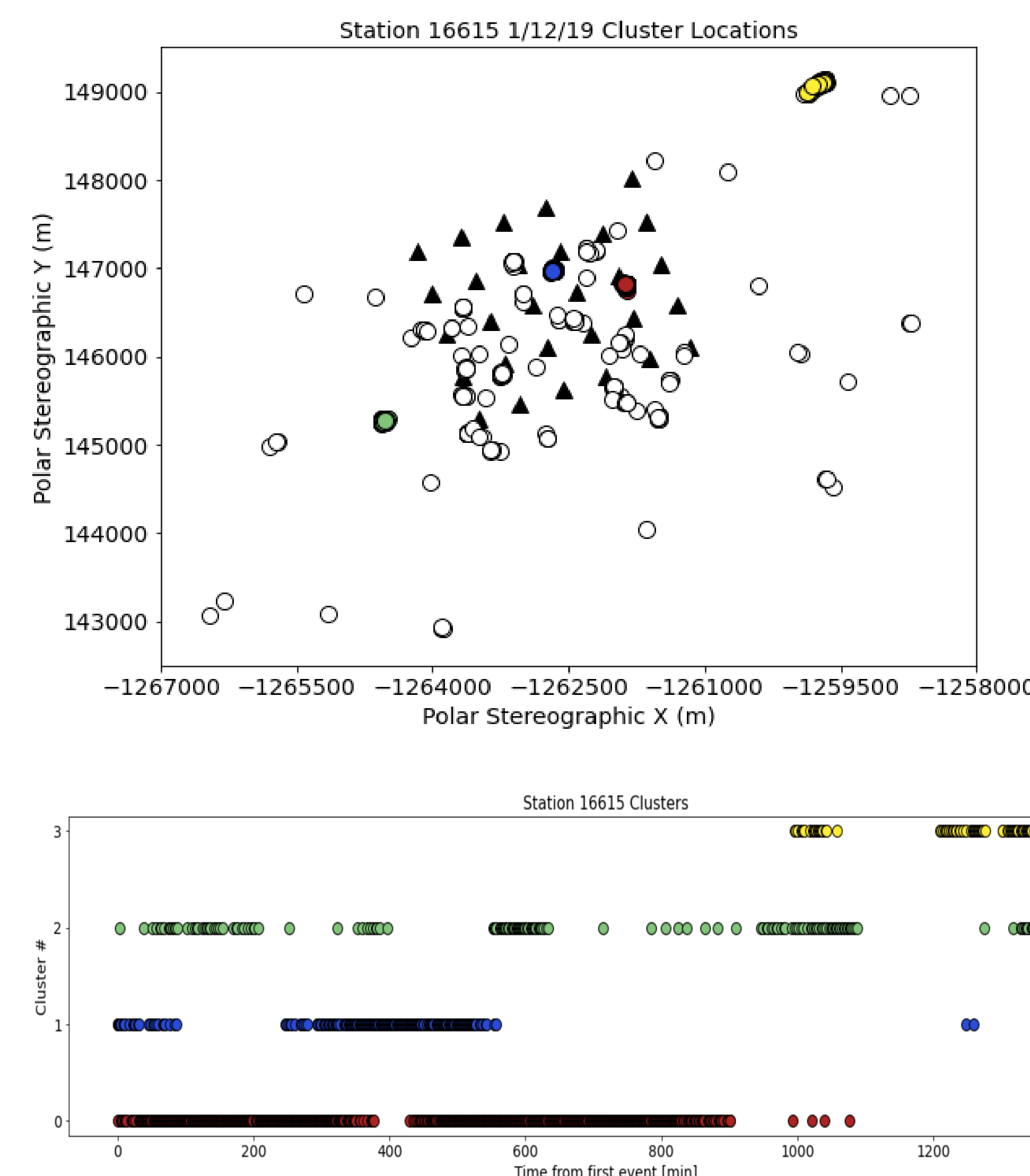
- Repeating signals can give information about sticky spots - localized regions of high basal drag surrounded by a weaker bed
- Basal shear stress (resistance) of ice streams are disproportionately supported on sticky spots
- Repeating events picked using a self-developed amplitude-based picker, located using the QuakeMigrate software and clustered with DBSCAN
- Resolve sticky spot characteristics (dimensions, #) and cluster interactions within the unexplored Rutford grounding line array

2019-01-12T00:00:00 - 2019-01-12T00:30:00



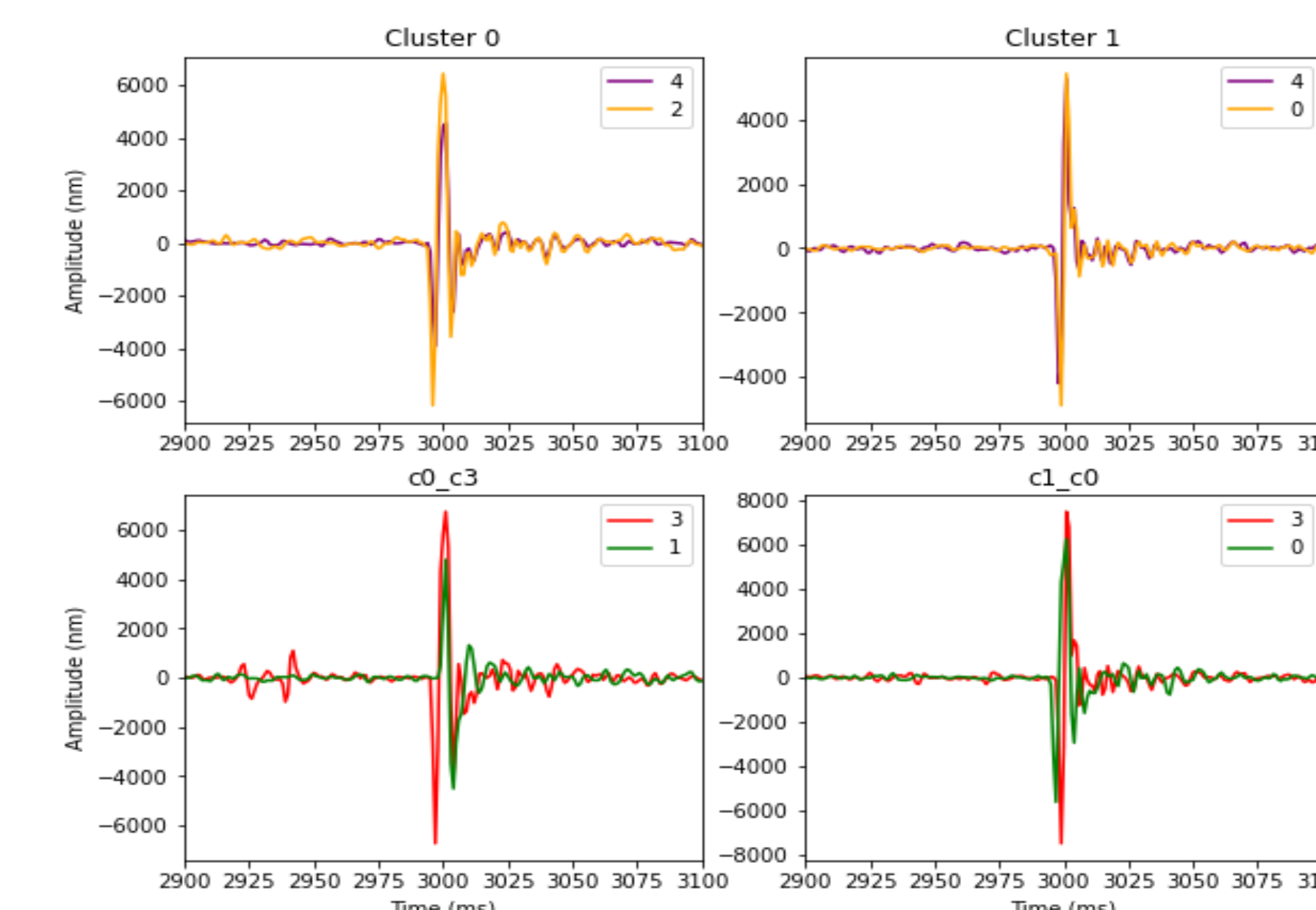
**Fig. 2.** Vertical component trace of Station 16641, part of the grounding line array

## Cluster Analysis (Ongoing)

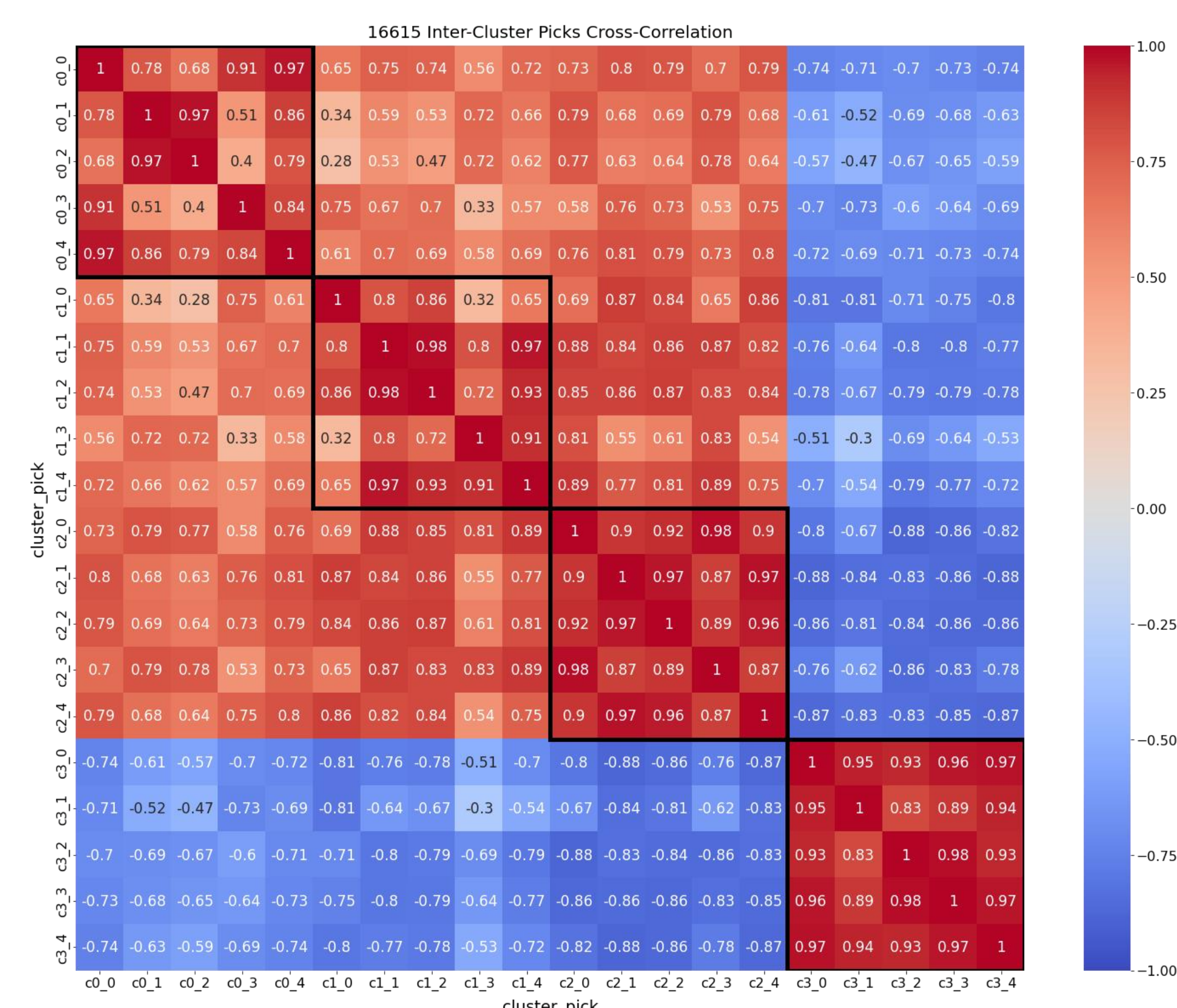


**Fig. 4.** One-day timeline of Station 16615 clusters

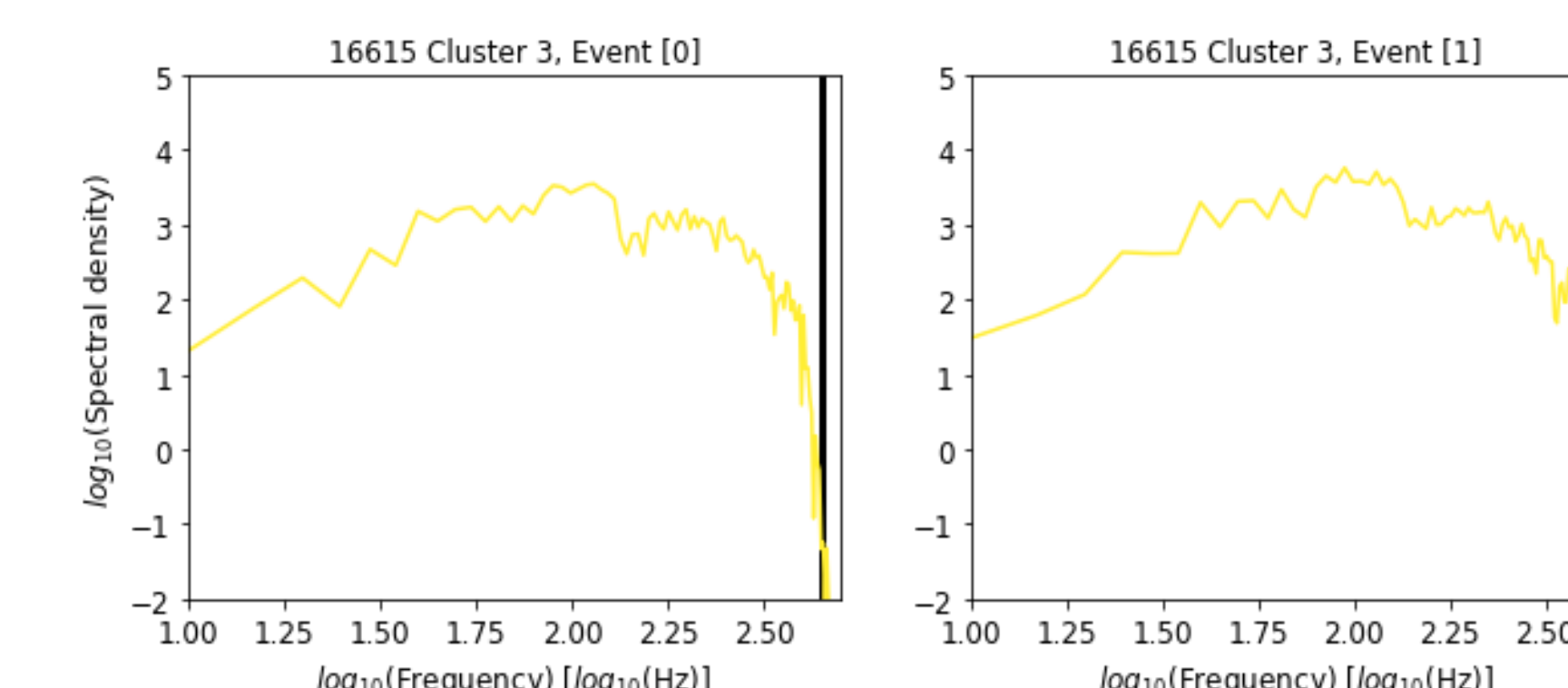
**Fig. 3.** Horizontal locations of Station 16615 clusters located using DBSCAN, a machine learning method for grouping events based on proximity (~100 m) and density (minimum number of events that are all chained together by the proximity distance). Successfully grouped clusters are shown in color while events that remain white were either too far away from other events or were not able to form a dense enough cluster.



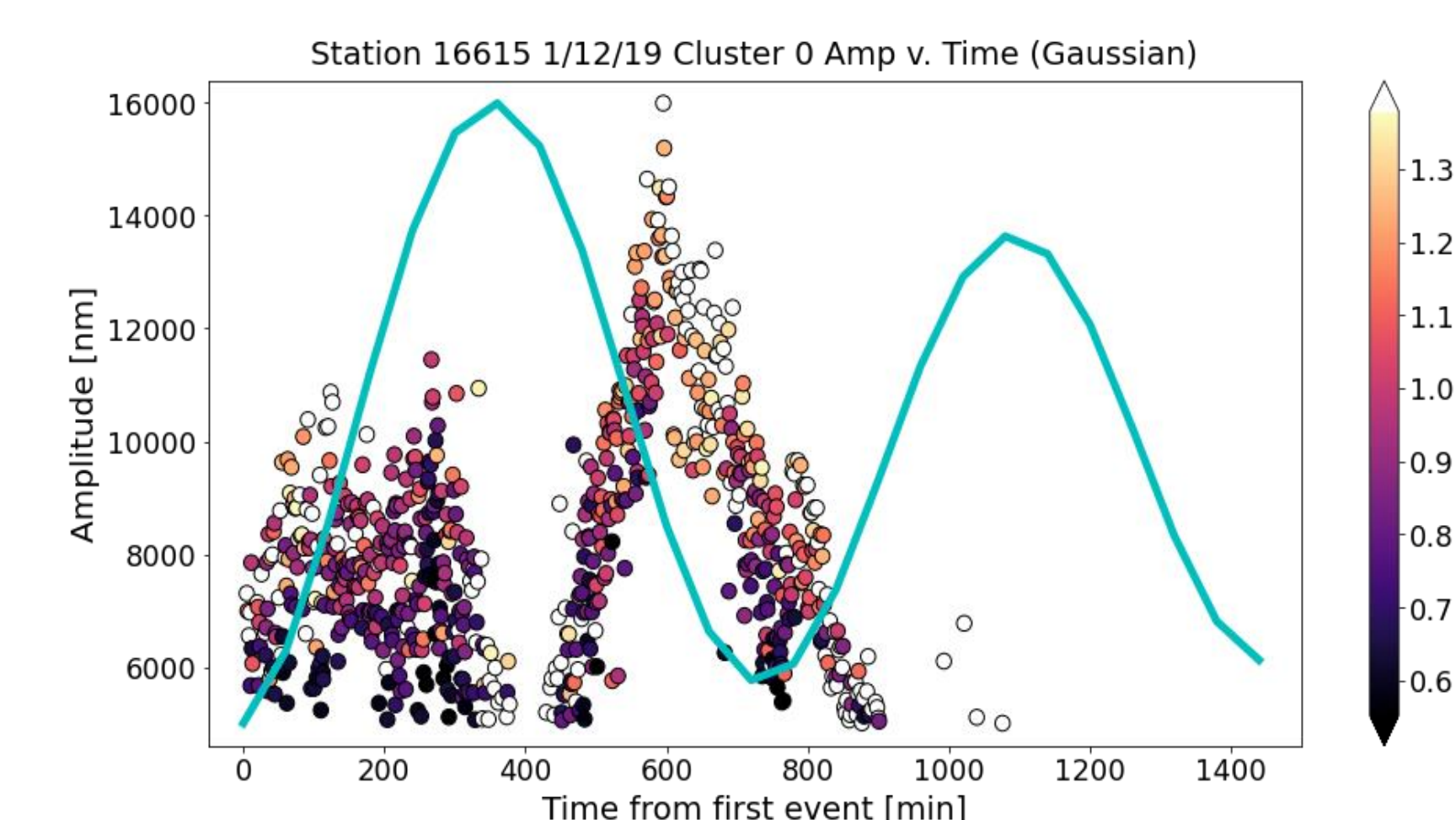
**Fig. 5.** Overlain Station 16615 traces for intra-cluster (top row) and inter-cluster (bottom row)



**Fig. 6.** Cross-correlation heatmap of Station 16615 intra- & inter-cluster picks computed around a small wave-arrival window



**Fig. 7.** Log-log plots of Station 16615 events



**Fig. 8.** Amplitude vs. time plot for cluster 0 in Station 16615 compared with tidal data

## Acknowledgements

Thank you to the BAS and NSF OPP (Award #1643961) for supporting our work.  
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## References

Alley, R. (1993). In search of ice-stream sticky spots. *Journal of Glaciology*, 39(133), 447-454.  
Kufner, S. K., et al. (2021). Not all icequakes are created equal: basal icequakes suggest diverse bed deformation mechanisms at Rutford Ice Stream, West Antarctica. *Journal of Geophysical Research: Earth Surface*, 126(3).