Insights into Caldera-Ridge Interactions and Eruption Preparation at Axial Seamount from Machine-Learning Analysis of Cabled and Temporary OBS data

Meritxell Colet, Kaiwen Wang, Felix Waldhauser, William S. D. Wilcock, Maya Tolstoy, Yen Joe Tan, and David Paul Schaff

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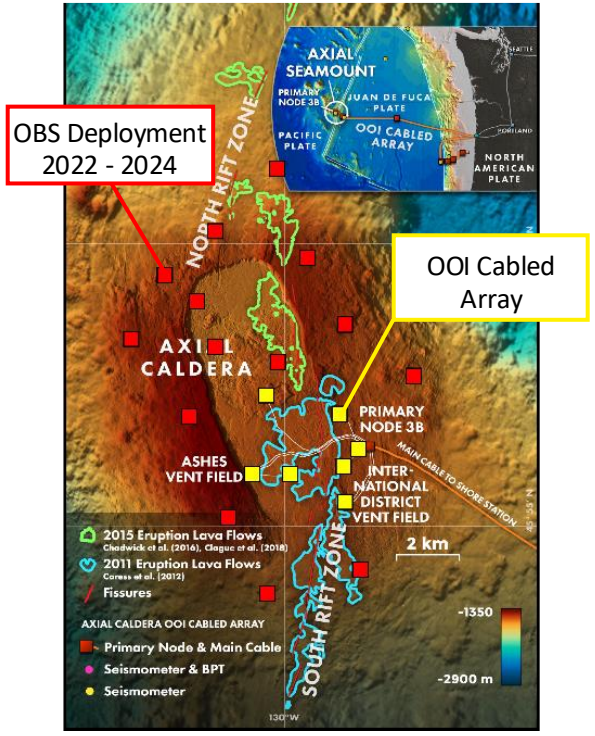
8:30am-12pm

Goal of this study:

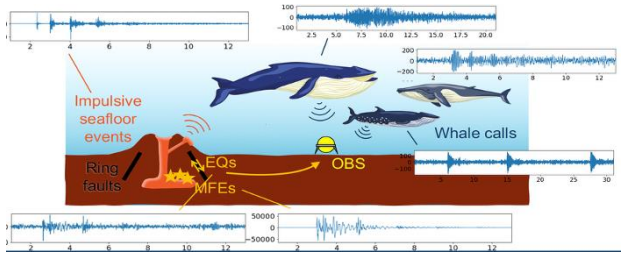
Extent OOI cabled array with 15 temporary OBSs to study:

- The dynamics of the northern caldera
- The interactions of the caldera ring faults and eruptive rifts
- The impacts of magmatic processes during eruption cycle on the time-dependent seismic structure of the upper crust.



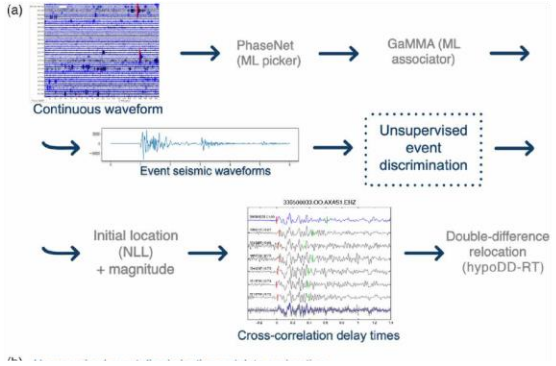
Data:

- 7 OOI cabled (real-time) OBSs
- 15 temporary OBSs (2 BB): Sept 2022-Sept 2024
- Continuous data records earthquakes together with various other signals, needs efficient discrimination of seismic sources.



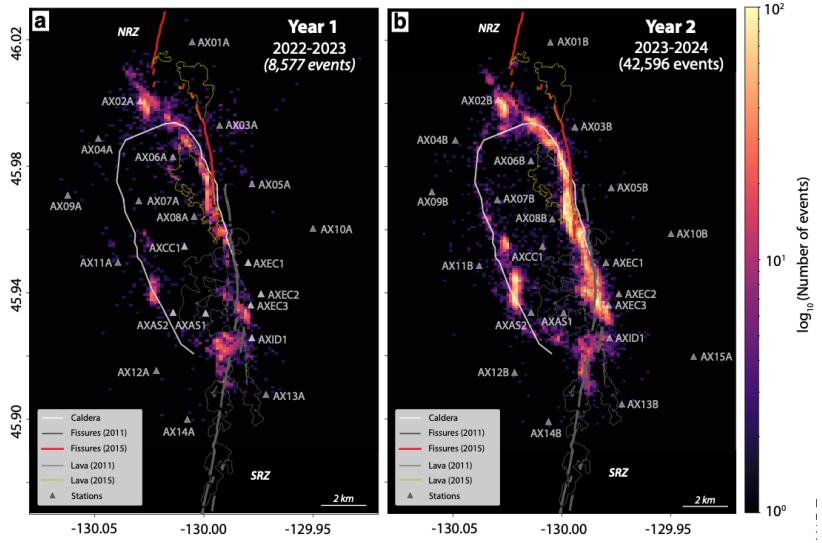
Methods:

- We combine supervised and unsupervised ML with cross-correlation based double-differencing to develop a dense, high-resolution earthquake catalog (Wang et al, 2024).
- This workflow already runs in real-time using the OOI cabled array data at ***https://axialdd.ldeo.columbia.edu***



ML-RT@Axial

Preliminary results:
A high-resolution earthquake catalog



Observations:

- Results consistent with real-time catalog in southern part of the caldera.
- Significant activity along the entire east wall of caldera, and in step-over area to the North Rift Zone.
- Sparse seismicity along northern part of west wall.
- New catalog provides insights into the structural complexity and dynamics of eruption preparation.

Ongoing work:

- Develop 3D velocity model from seismic tomography for accurate earthquake location.
- Integrate temp catalog in real-time monitoring system.
- Explore transfer learning to improve monitoring outside the OOI cabled array.