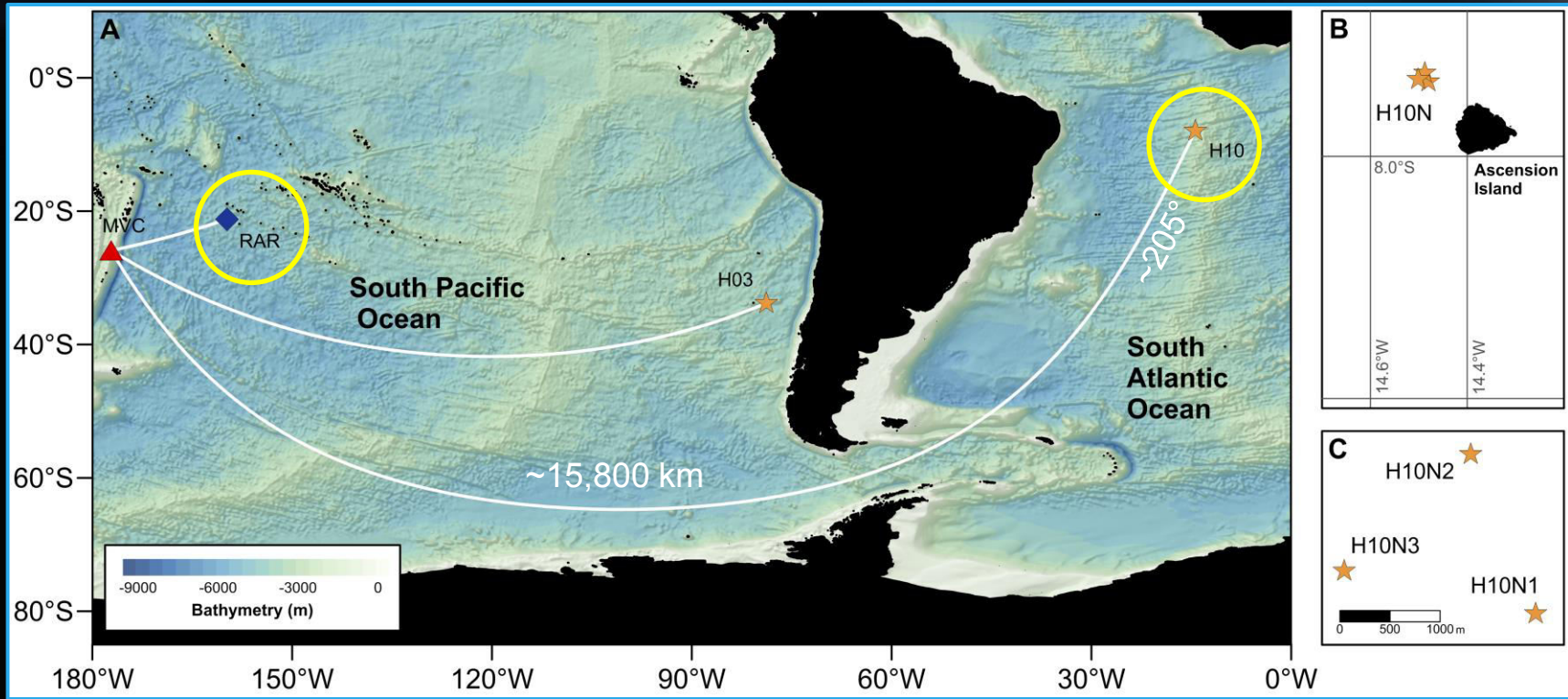


Studying Submarine Volcanic Activity Using IMS Hydrophone Data: Detection and Implications for Ocean Noise

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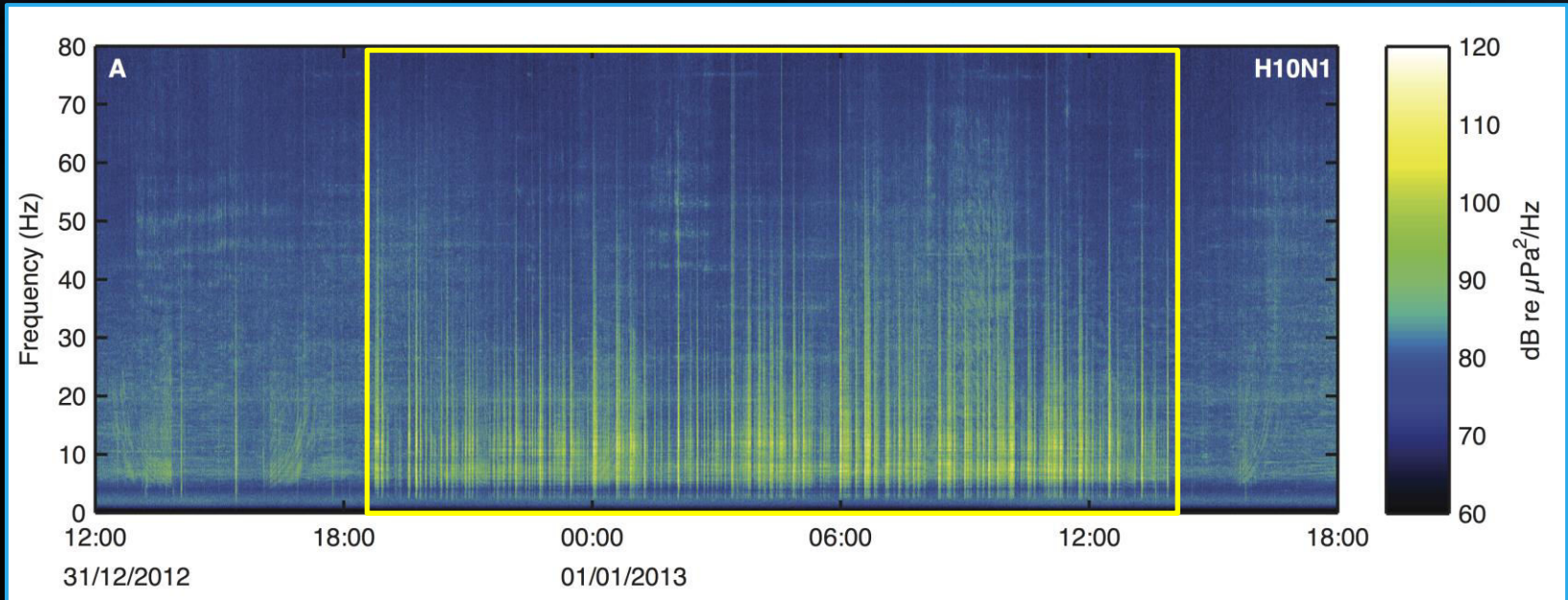
Science and Technology 2017 Conference – T1.4-O5
Vienna, Austria // 28th June 2017

Introduction



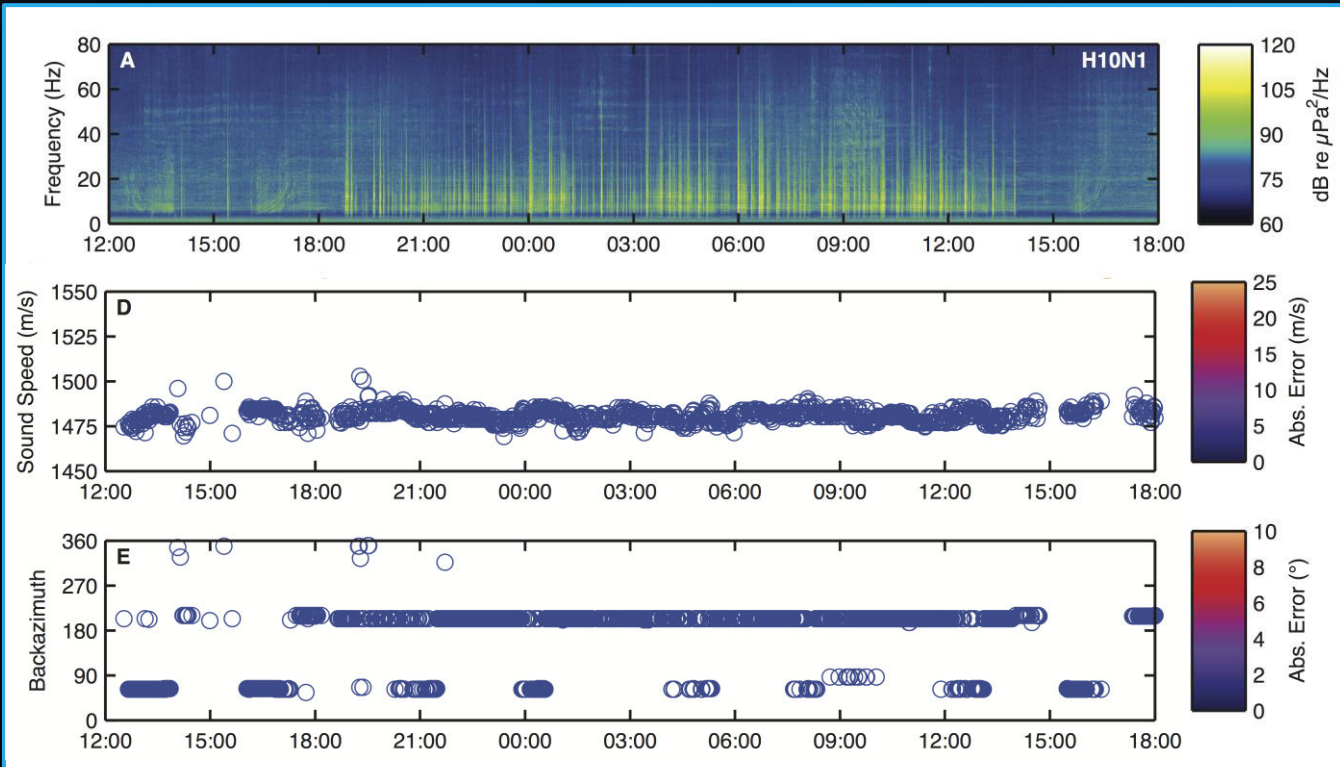
Volcanic activity at Monowai recorded at hydrophones and broadband seismometers
→ Only array H10N has the 'complete' record: 2005 – 2016

Motivation



- Volcanic activity not normally detected by automated IMS algorithms
 - IMS objectives do not include 'volcano monitoring'
 - Signals vary greatly in duration, frequency, magnitude
 - Association not made unless P wave detected

Hydroacoustic Observations and Processing



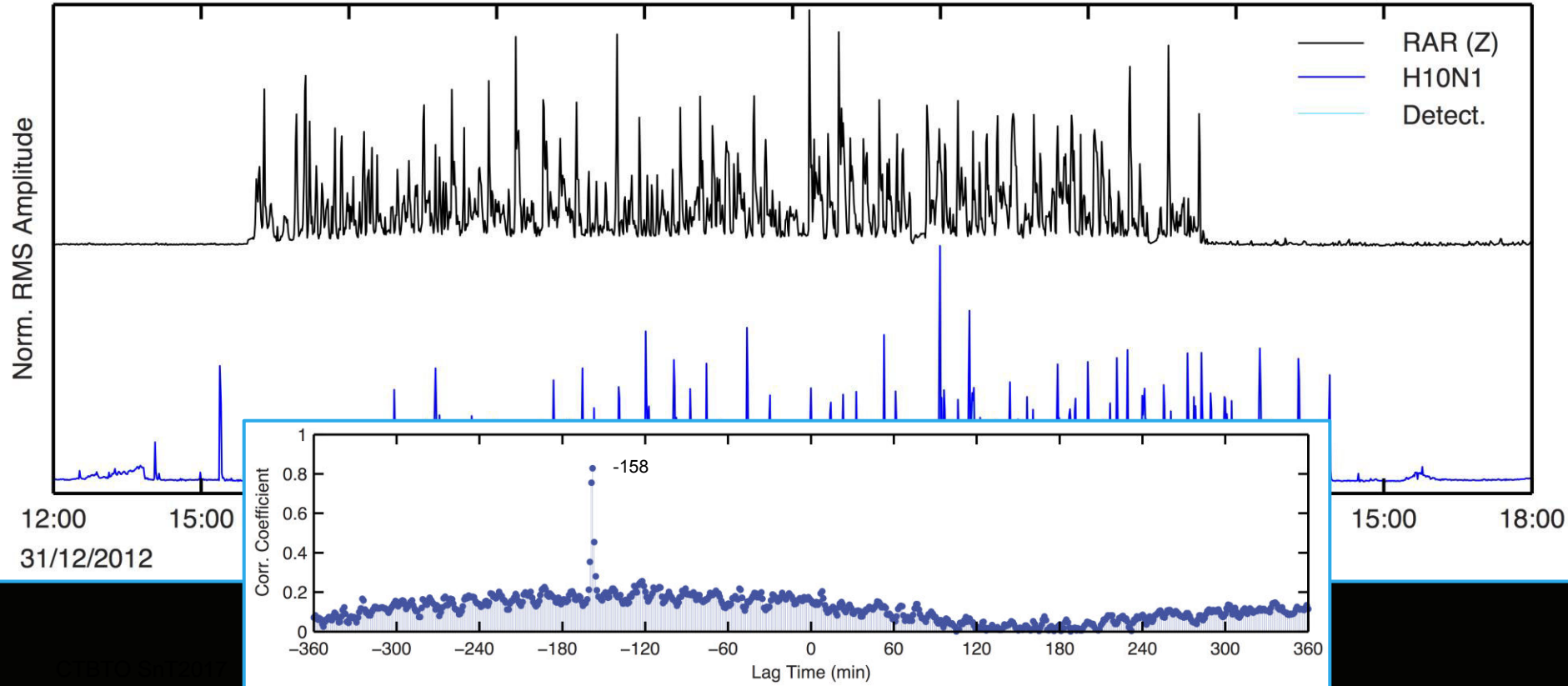
Processing:
4 – 12 Hz BP
1-min windows

Cut-off criteria:

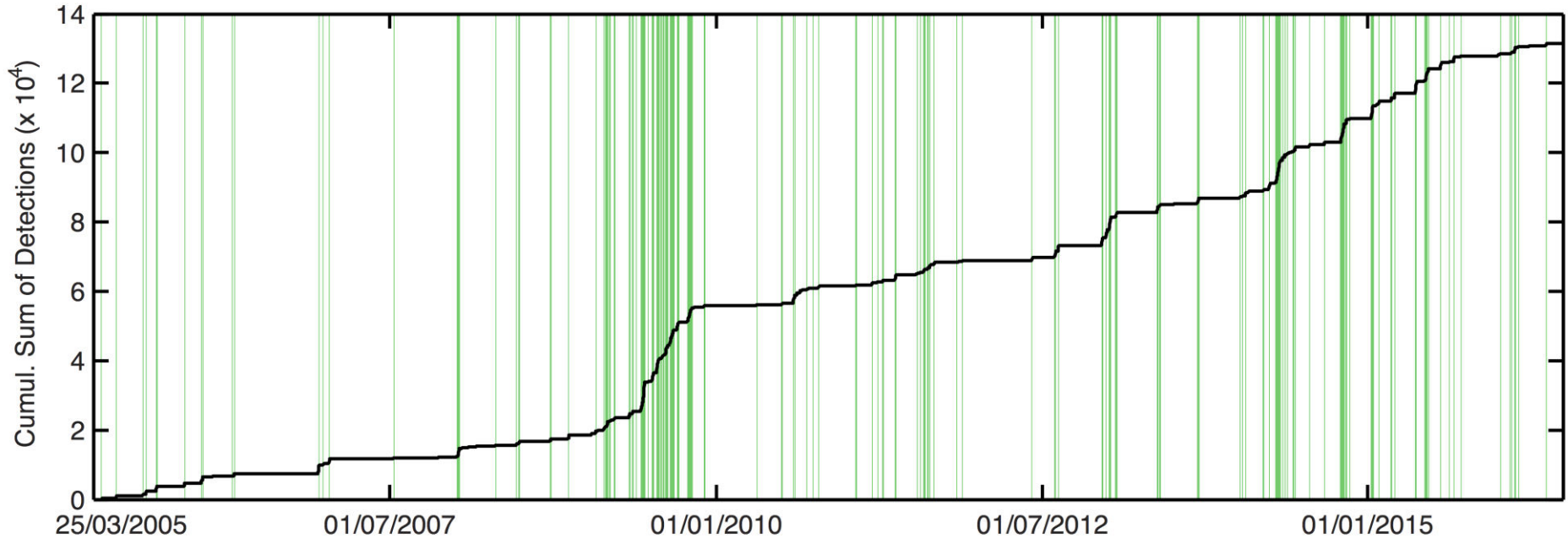
- $cc > 0.33$
- ± 15 m/s
- $\pm 0.5^\circ$

Breaking with the 'event-based' approach: Binning data to for sound speed & backazimuth inversion

Density-based clustering and validation

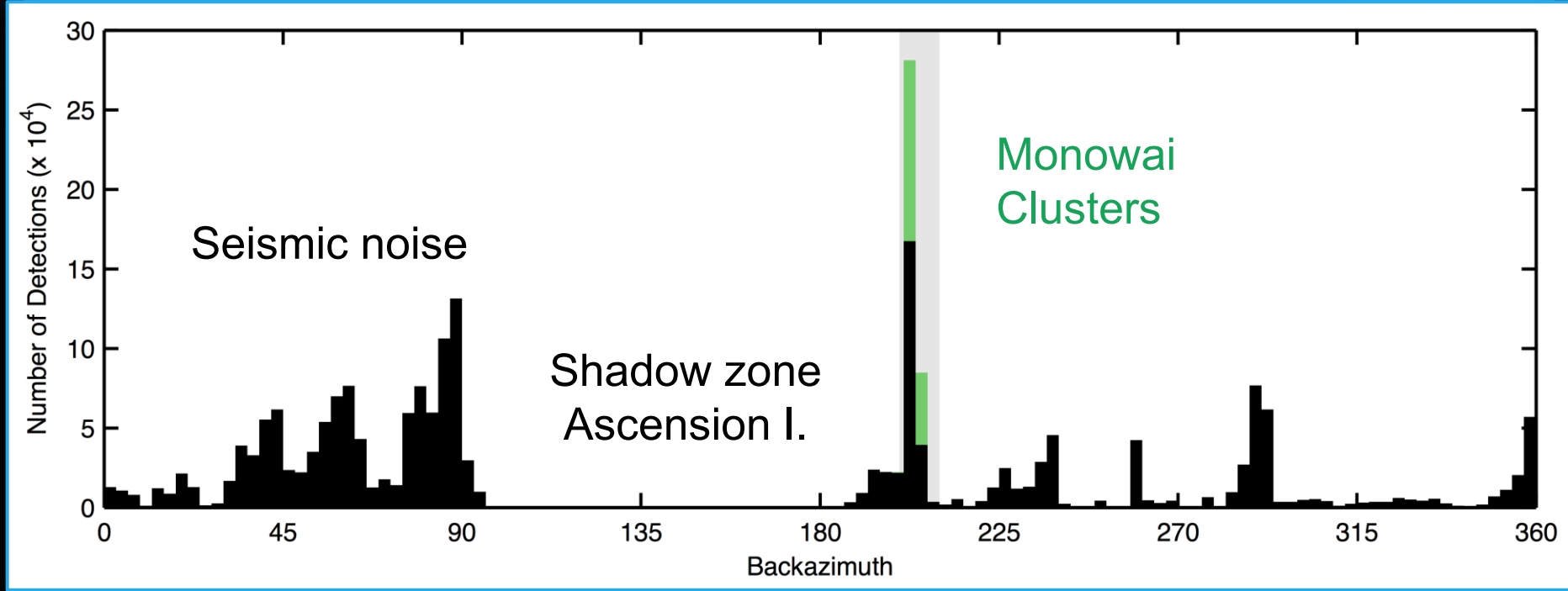


The record of volcanic activity at Monowai, 2005-2016



Clustering results of ~11 years of hydroacoustic data recorded at H10N

Directionality of low-frequency noise at H10N (2005-2016)



Least-square inversion using 1-min data windows (4-12 Hz BP)
→ Only signals in the SOFAR: $1432 \leq \text{app. velocity} \leq 1532$ m/s
→ Cut-off criteria: ± 15 m/s, $\pm 0.5^\circ$, $cc \geq 0.33$

Summary

158 episodes of volcanic activity detected between 2005 and 2016

→ Total added time: **138.8 days**

→ Monowai is a **major source of low-frequency noise** in the Atlantic

Approach can be used to detect arc volcanism elsewhere

→ H03 (Tonga-Kermadec) / H11 (IBM)

Improve clustering algorithm to identify other persistent sources for environmental surveying (airguns, icebergs?)

Implications for test-ban monitoring

Are **detection capabilities** influenced by varying ambient sound levels?

→ Mean RMS level activity: 94 dB re 1 μ Pa

→ Mean RMS level background: 90 dB re 1 μ Pa



Thank you for your
attention!