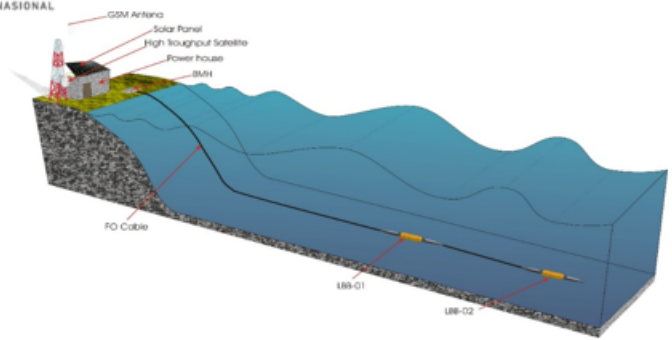
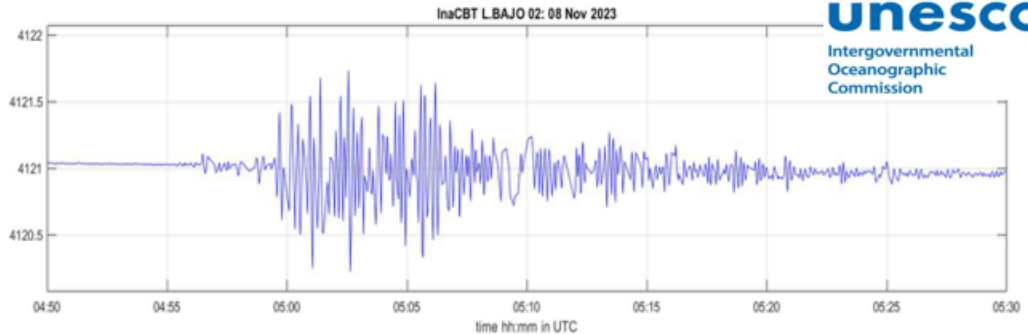




EQ and Tsunami Monitoring and Warnings using Cable-Based Tsunameter (CBT)

The PTWS-WG-SCS-XII, UNESCO-IOC

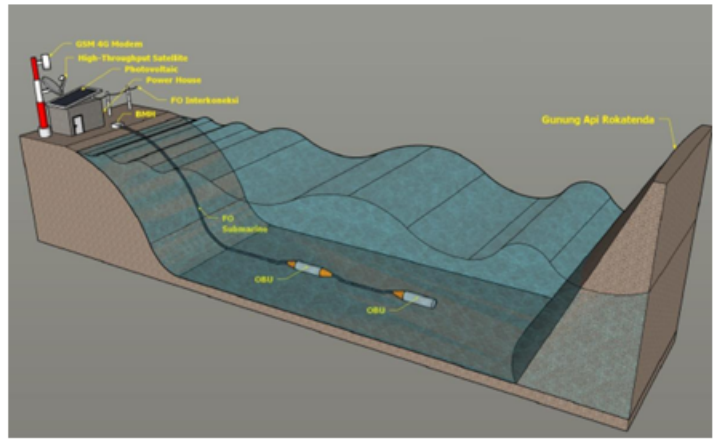
Jakarta, 8 November 2024

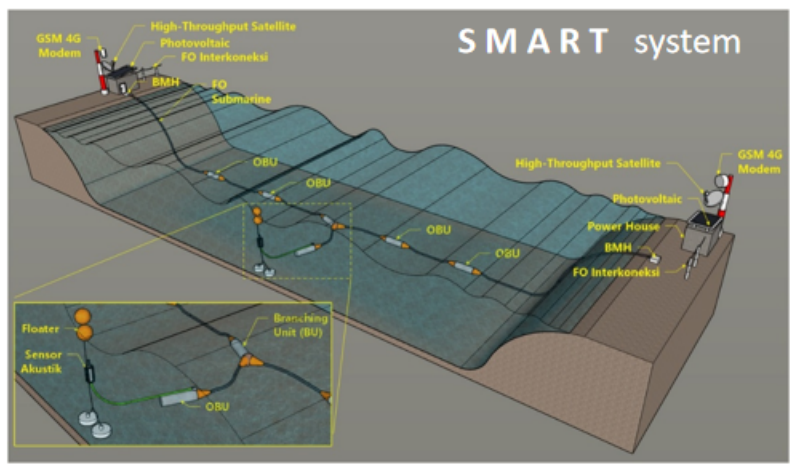
(was also presented in the 40th Data Buoy Cooperation Panel, Oct 2024)

Dr. Wahyu W. Pandoe
Indonesia National Committee of IOC-UNESCO Programme
National Research and Innovation Agency - BRIN

Introduction: Cable-Based Tsunami sensors (CBT)

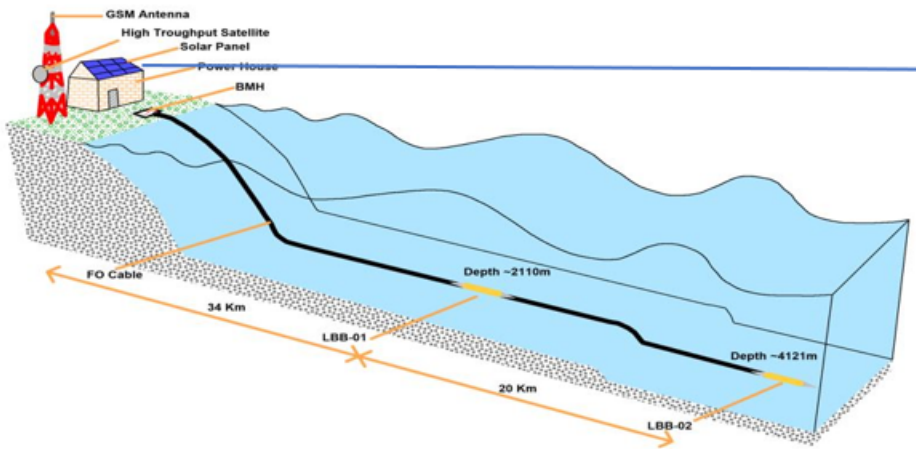
- Effective for Near Field and Atypical Tsunami
- Can be integrated with ocean bottom seismic sensors (OBS)
- High data sampling rate
- Fast data transmission
- Life time expectation > 20yrs,
- no need yearly regular maintenance except the Landing Station
- NO vandalisms
- International efforts:
  - SMART Cable System (JTF WMO-IOC-ITU)
  - Japan: S-NET, DONET
  - USA: MARS Landing System
  - Indonesia: **InaCBT**
  - India: .....



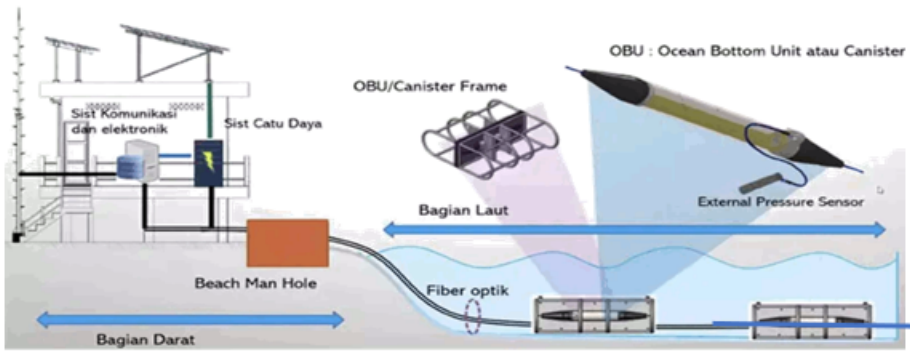


Scientific Monitoring and Reliable Telecommunication

Configuration InaCBT



Landing Station (LS)



Location: Labuan Bajo – FLores Sea.

- Deployment: February 2022
- Operating since: February 2022
- Sensors (now):
  - ❑ Precise Pressure Gauge (1Hz)
  - ❑ 3D Accelerometer (125Hz)
  - ❑ Temperature

extend to 2nd LS (optional)

Cable-based Tsunami & EQ Detection:

Ina-CBT *(Indonesian Cable - based Tsunameter)*

Location: Labuan Bajo – L. FLores.

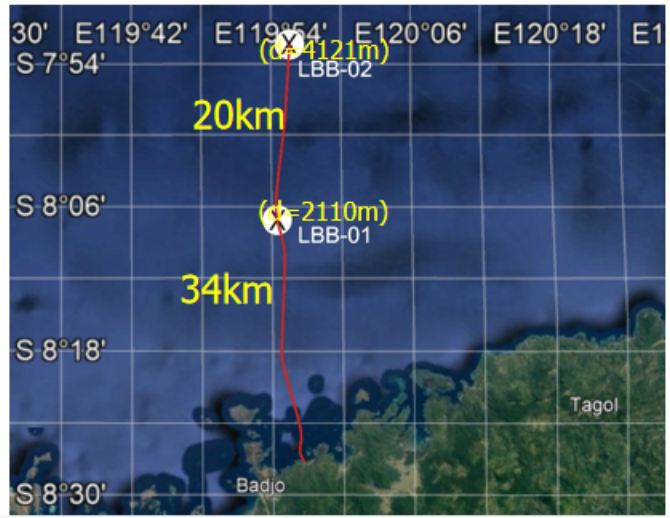
Length: 54 km (LBB-01 34km + LBB-02 20km)

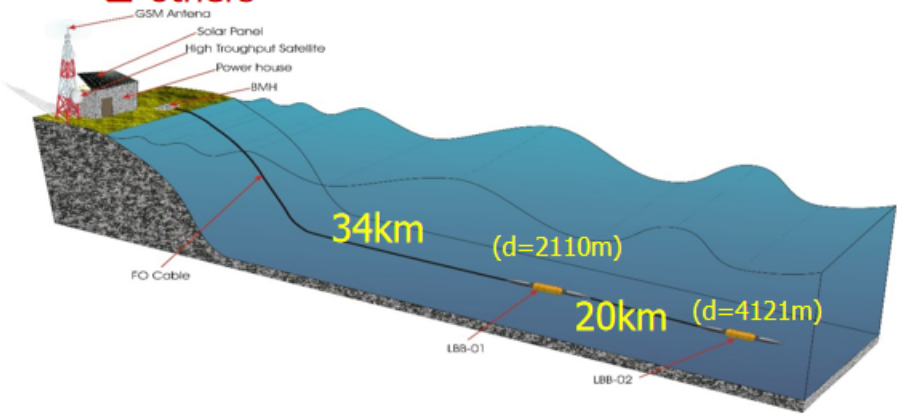
- Operating since: February 2022
- Sensors (InaCBT):
  - ❑ Precise Pressure Gauge (1Hz)
  - ❑ 3D Accelerometer (125Hz)
  - ❑ Temperature

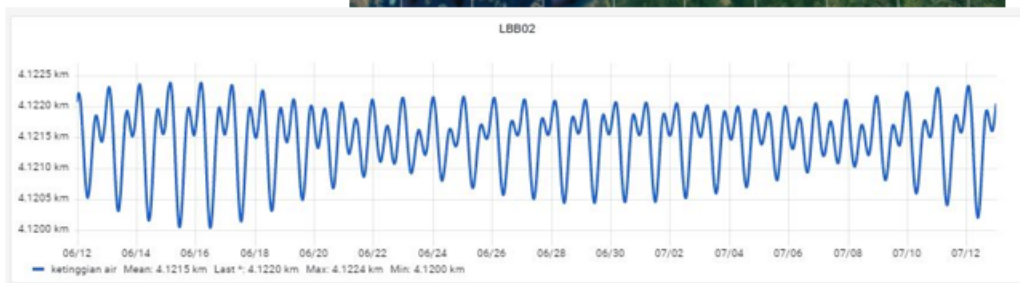
InaCBT

MHEWS

- Add 'optional' Sensors (MHEWS):
  - ❑ Ocean Bottom Seismometer (OBS)
  - ❑ Hydrophone
  - ❑ others



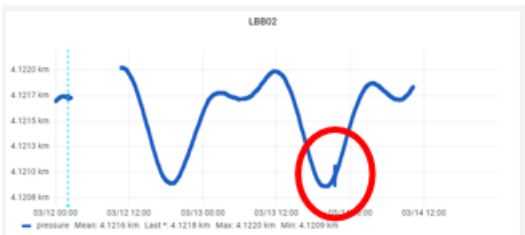




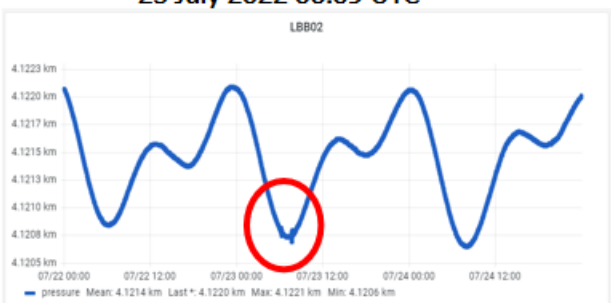
Epicenters of EQs which were detected by InaCBT

Jarak Episenter Gempa Terhadap CBT LBB 02	
EQ Nias (M6.7)	2559,95 km
EQ Flores (M5.7)	281,43 km
EQ Flores (M5.4)	277,23 km
EQ PNG (M7.6)	2942,37 km
EQ BKG (M6.8)	2164,71 km

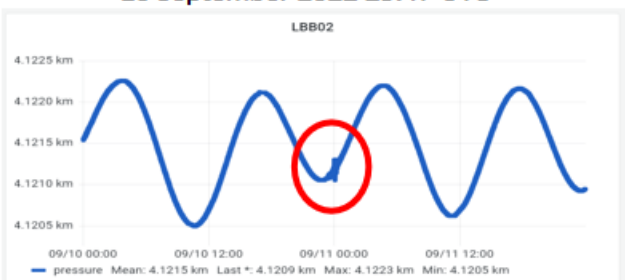
13 March 2022 21.09 UTC



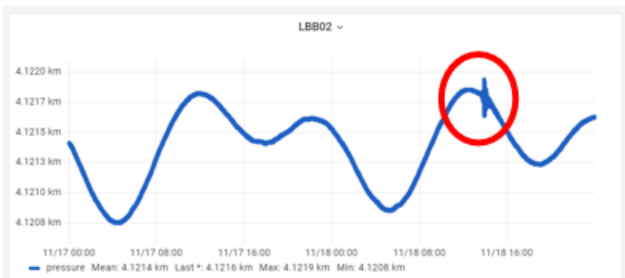
23 July 2022 06.09 UTC



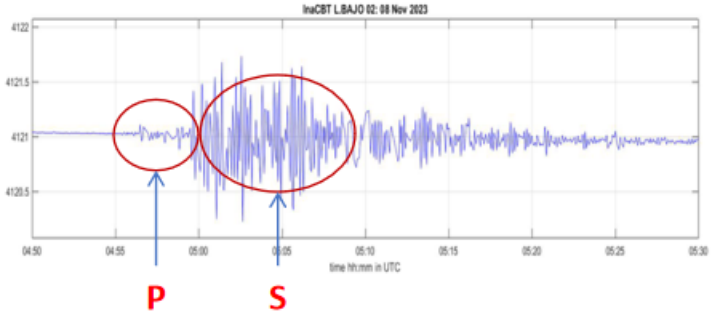
10 September 2022 23.47 UTC



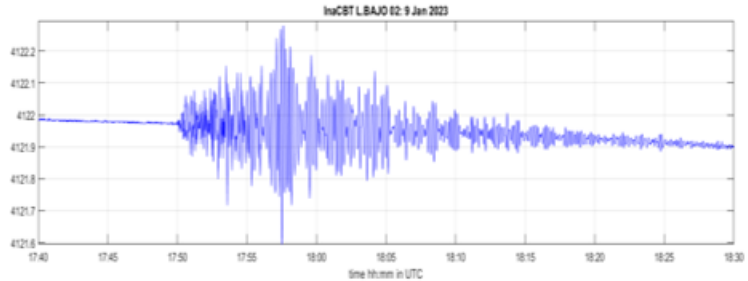
18 November 2022 20:37 UTC

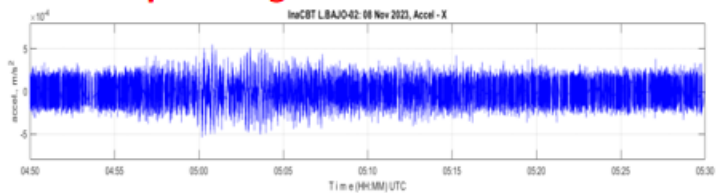


EQ Aru 08 Nov 2023 Vs EQ Maluku 9 Jan 2023

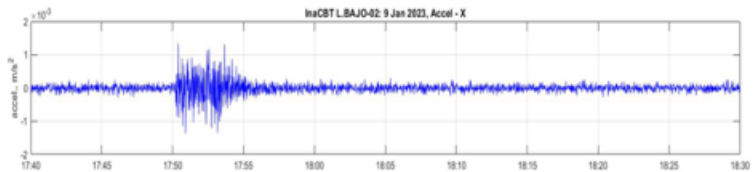


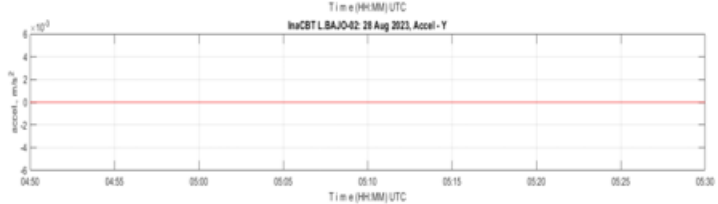
Pressure



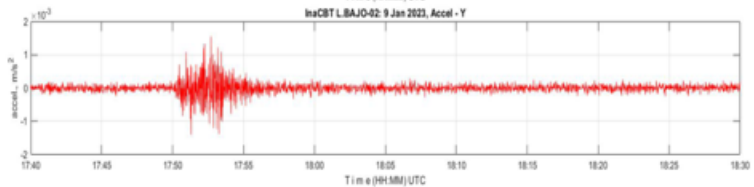


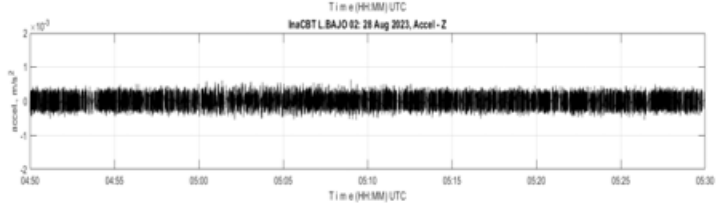
Accel-x



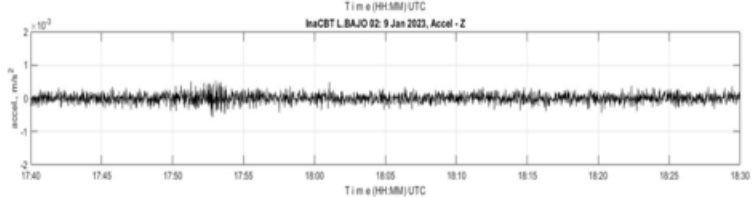


Accel-y





Accel-z

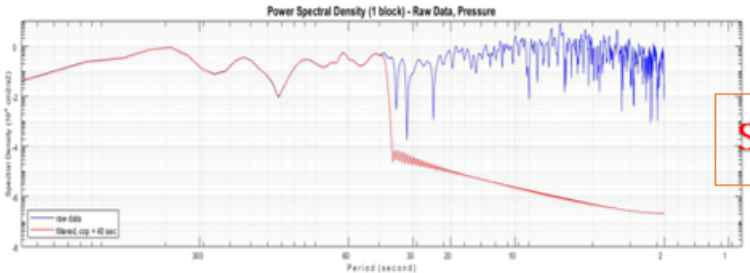


Q: How to identify P, S, Surface and other Waves ?

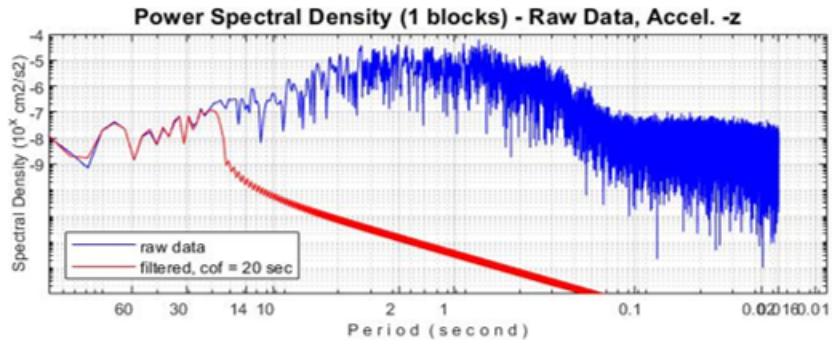
EQ Aru 08 Nov 2023 Vs EQ Maluku 9 Jan 2023

BRIN
BADAN RISET DAN INOVASI NASIONAL

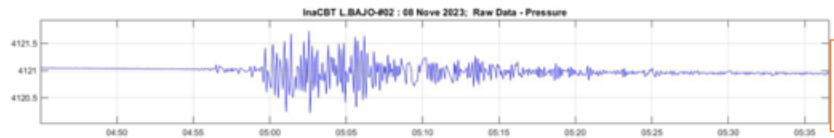
Pressure



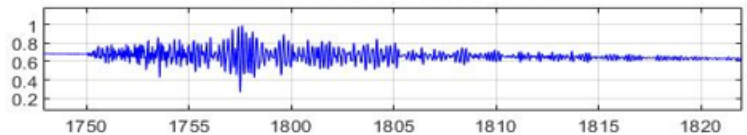
Spectral

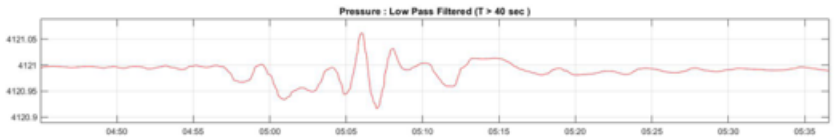


Pressure

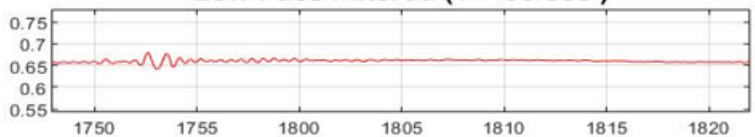


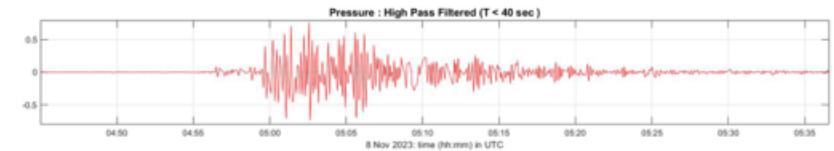
Raw



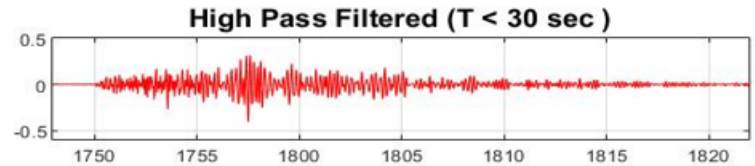


LowF

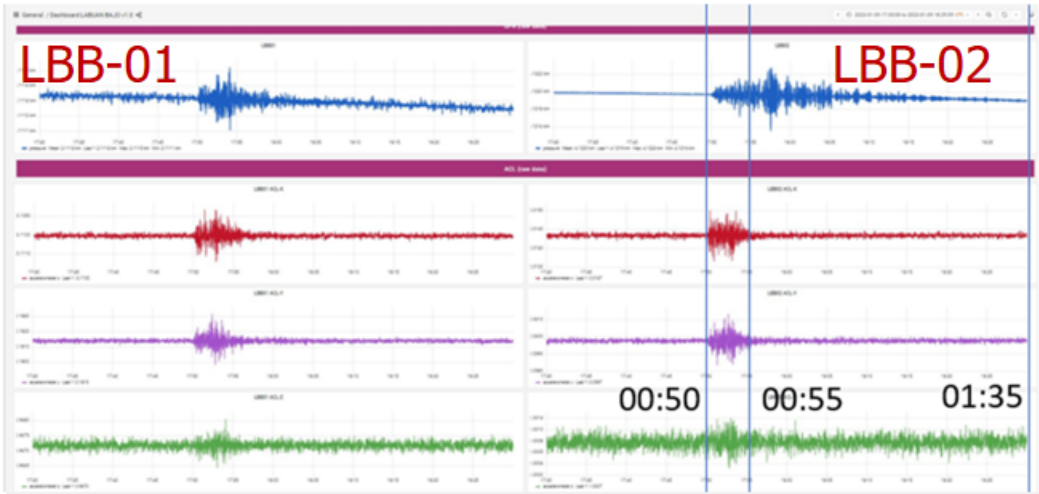


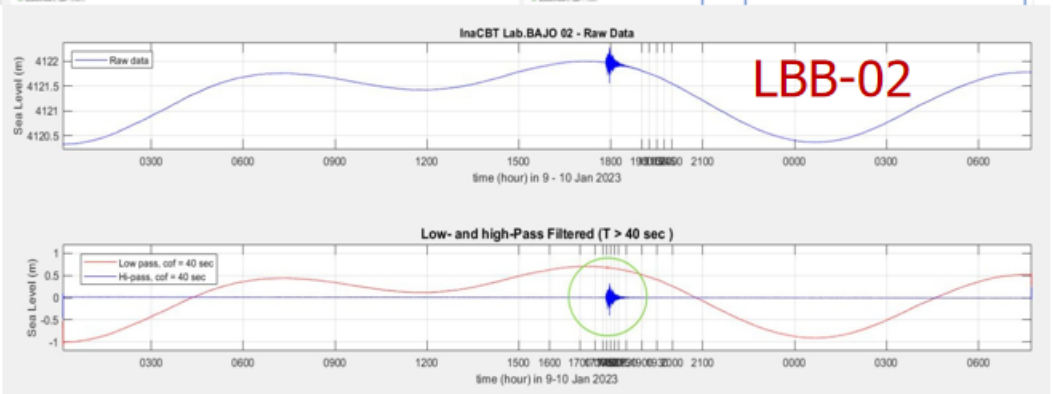


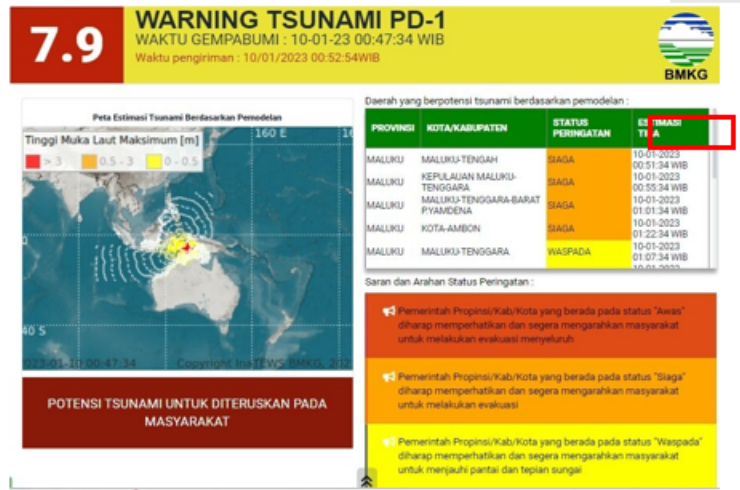
HighF

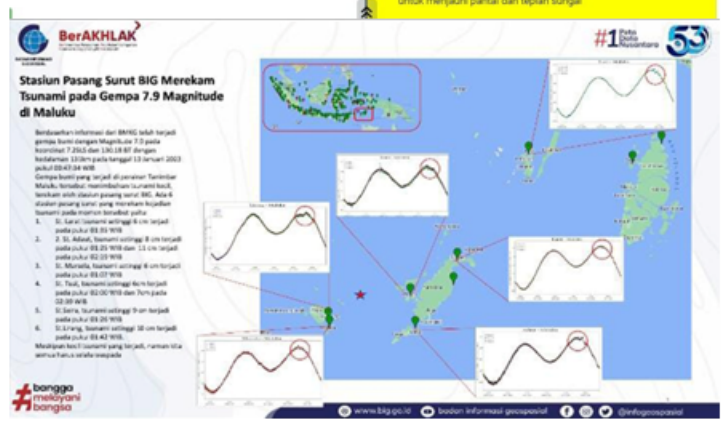


Observation on event: Maluku EQ, 9 Jan 2023



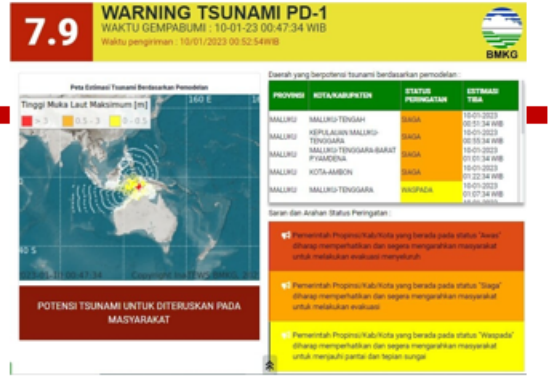




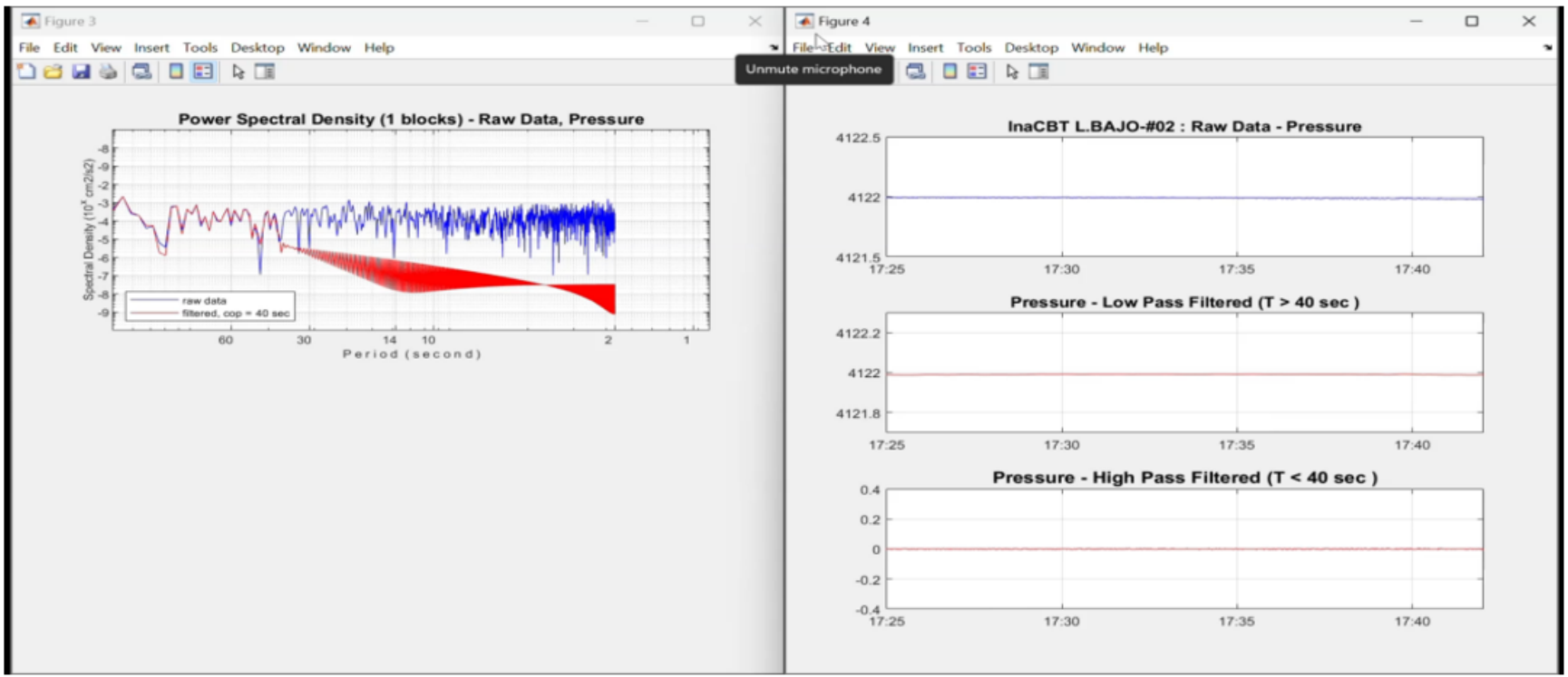


Increase amplitude at tidal stations : 5-10 cm

Moving Spectral Analysis



- EQ event 9 Jan 2023 gives a good example how the InaCBT works well
- moving spectral (video) 9 Jan2023 EQ event



Closing (& Questions)

- InaCBT is still in the research / experimental stage
- How to distinguish EQ source: seismic vs non seismic Tsunami ?
- How to distinguish Primary, Secondary, Surface and other waves ?
- Consider:
  - Each type of wave can be classified by range of frequency, period and duration of the wave generation
  - Input/feeding for the numerical model
  - Requires high sampling rates sea level monitoring

Related Publications

Privadi, A., Damara, D. R., Widati, P. L. & Triputra, F. R. 2021. Indonesia's Cable Based Tsunameter (CBT) System as an Earthquake Disaster Mitigation System in East Nusa Tenggara. Proceeding - 2021 IEEE Ocean Engineering Technology and Innovation Conference: Ocean Observation, Technology and Innovation in Support of Ocean Decade of Science, OETIC 2021 (pp. 63-67), Jakarta. DOI: https://doi.org/10.1109/OETIC53770.2021.9733734

Purwoadi, M. A., Anantasena, Y., Pandoe, W. W., Widodo, J. & Sakya, A. E. 2023. Introduction to Indonesian Cable-based Subsea Tsunameter. 2023 IEEE International Symposium on Underwater Technology, UT 2023, March (pp. 1-6), Tokyo. DOI: https://doi.org/10.1109/UT49729.2023.10103368

Shinohara, M., Yamada, T., Sakai, S., Shiobara, H. & Kanazawa, T. 2015. New ocean bottom cabled seismic and tsunami observation system enhanced by ICT. 2014 Oceans - St. John's, OCEANS 2014, St. John's. DOI: https://doi.org/10.1109/OCEANS.2014.7003045

Wahyu W. Pandoe, Michael A. Purwoadi, Zulfa Qonita, Alfi Rusdiansyah, Aris Suwarjono. 2024. Indonesia Cable-Based Tsunameter (InaCBT): Tsunami Detection and Identification on Other Seismic Wave Signals. Ocean and Coastal Research, *accepted*.

TERIMA KASIH

KR.Baruna Jaya IV-BPPT
Perairan Gunung Anak Krakatau
12 April 2019