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InaTNT – Indonesian Tsunami Non Tectonic

Iman Fatchurochman

ICG Indian Ocean Tsunami Warning & Mitigation System SOP Workshops July 2023:

Standard Operating Procedures (SOPs) for
National Tsunami Warning Centres (NTWCs) and
Disaster Management Organisations (DMOs)

Outline

- Background
- InaTNT Development
- Sea Level Observation Network
- InaTNT GUI
- Observed Case

Background

Chronology of TSUNAMI PALU SEPTEMBER 28, 2018

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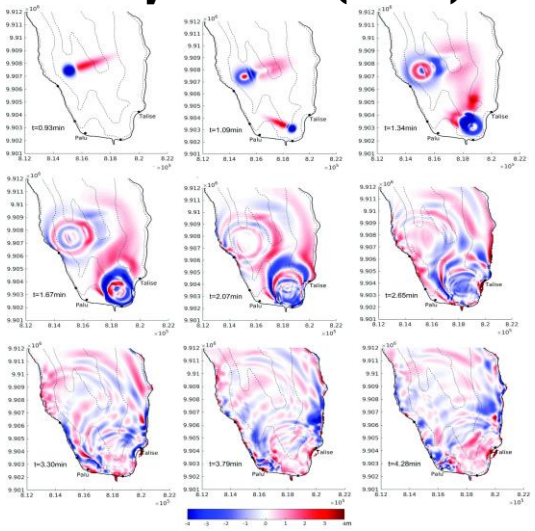
05:02:UTC

Origin Time

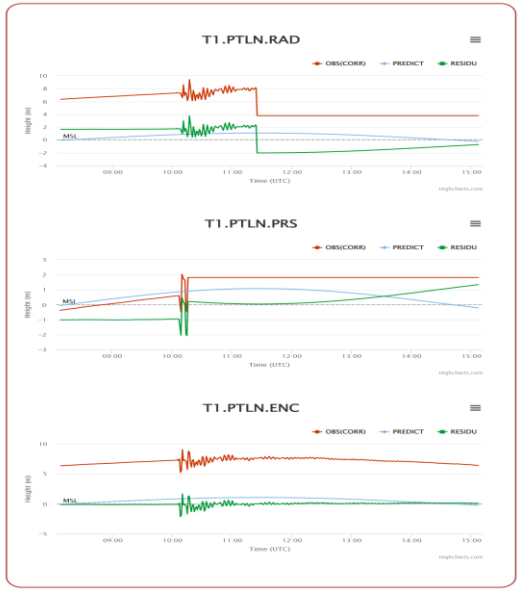
05:06UTC

The tsunami hit the city of Palu (~3.5')



Model tsunami (Aranguiz et al. 2020)

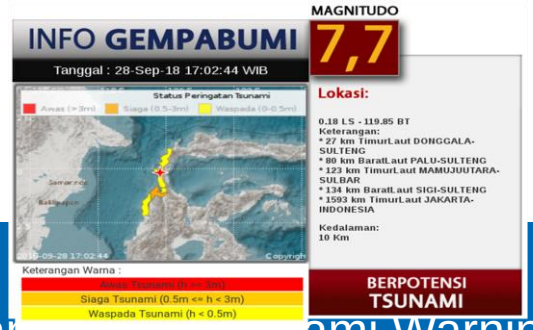
Tsunami recorded on the Pantoloan TG(05:06 UTC)



Tsunami recorded on the CCTV of a private house in Palu

https://www.youtube.com/watch?v=Cxg9gP17KOw&t=506s

05:07UTC



BMKG issued Tsunami Early Warning System (+5')

Background

Chronology of TSUNAMI KRAKATAU DECEMBER 22, 2018

22 Dec (Local Time)

07:00 AM — BMKG issues early warning of high sea waves

08:56 PM — PVMBG announced Mount Anak Krakatau Eruption

09:30 PM — BMKG received reports of abnormal high tides

09:30 – 10:00 PM — BMKG checked Tide Gauge data

10:30 PM — BMKG issued a press release for an atypical Sunda Strait tsunami

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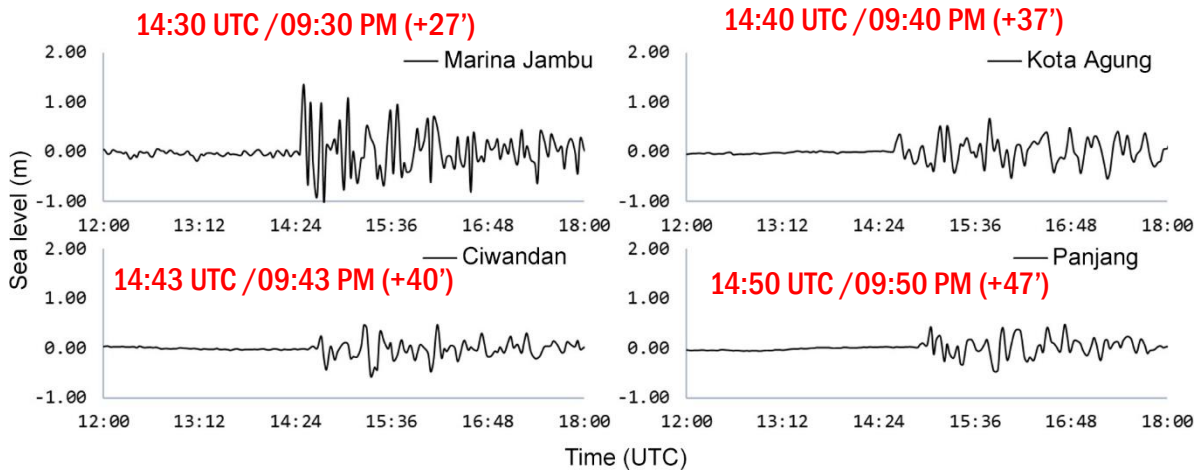
Tsunami Record



InaTNT Development

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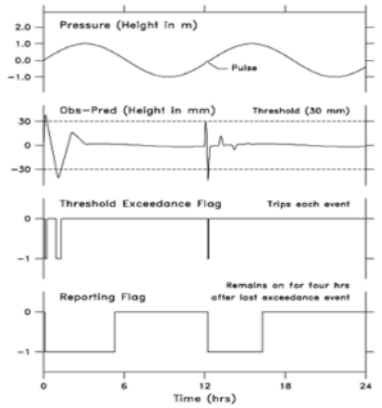
InaTNT is an integrated system that **detects sea level change anomalies that indicate a tsunami wave which recorded by sea level observation data.** Several sea level observation networks from internal (BMKG, BIG, BRIN (formerly BPPT), KKP) and external resources have been integrated into InaTNT system. The presence of InaTNT will improve the performance of the InaTEWS System in detecting tsunamis caused by tectonic and non-tectonic sources.

OBJECTIVES OF INATNT DEVELOPMENT

1. **Integrate sea level observation data** from internal and external resources/stakeholders internal into a single integrated system and display
2. **To provide sea level anomaly automatic detection facility** through mareogram data as heads up for the operator
3. **To provide supporting system and SOP** for Non Tectonic Tsunami Warning System.

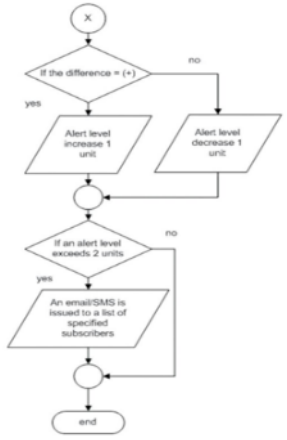
SEA LEVEL ANOMALY DETECTION ALGORITHM APPLIED IN INATNT

TDA – BUOY



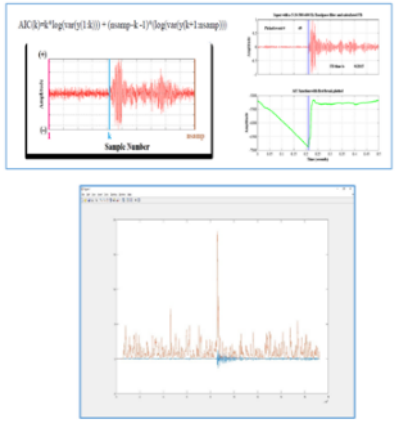
https://nctr.pmel.noaa.gov/tda_documentation.html

TDA – IDSL



IDSL Alert Mechanism (Annunziato, 2015)

TDA – INATNT



Sea Level Observation Network

PGT - BMKG

TSUNAMI GAUGE

PUSMAR - BMKG

AWS – WATER LEVEL

BPPT/BRIN

IDSL – WATER LEVEL

BPPT/BRIN

TSUNAMI BUOY

BPPT/BRIN

Cable Based Tsunameter (CBT)

BIG

TIDE GAUGE

NO	NETWORK	TOTAL	OWNER	SAMPLING RATE	TRANSMIT RATE
1	**AWS Water Level**	35	BMKG	1 minute	1 minute
2	**Tsunami Gauge**	5	BMKG	1 minute	5 minutes
3	**Tide Gauge 1**	237	BIG	1 minute	5 minutes
4	**Tide Gauge 2 (RT)**	26	BIG	5 seconds	5 seconds
5	**IDSL**	11	KKP/BRIN	11 seconds	11 seconds
6	**Buoy**	7	BPPT/BRIN	15 minutes (normal mode) / 15 seconds (tsunami mode)	1 hour (normal model) / 1 minutes (tsunami mode)
7	**CBT**	2	BPPT/BRIN	15 seconds	15 seconds

Total: 298 Sensors

Sea Level Observation Network

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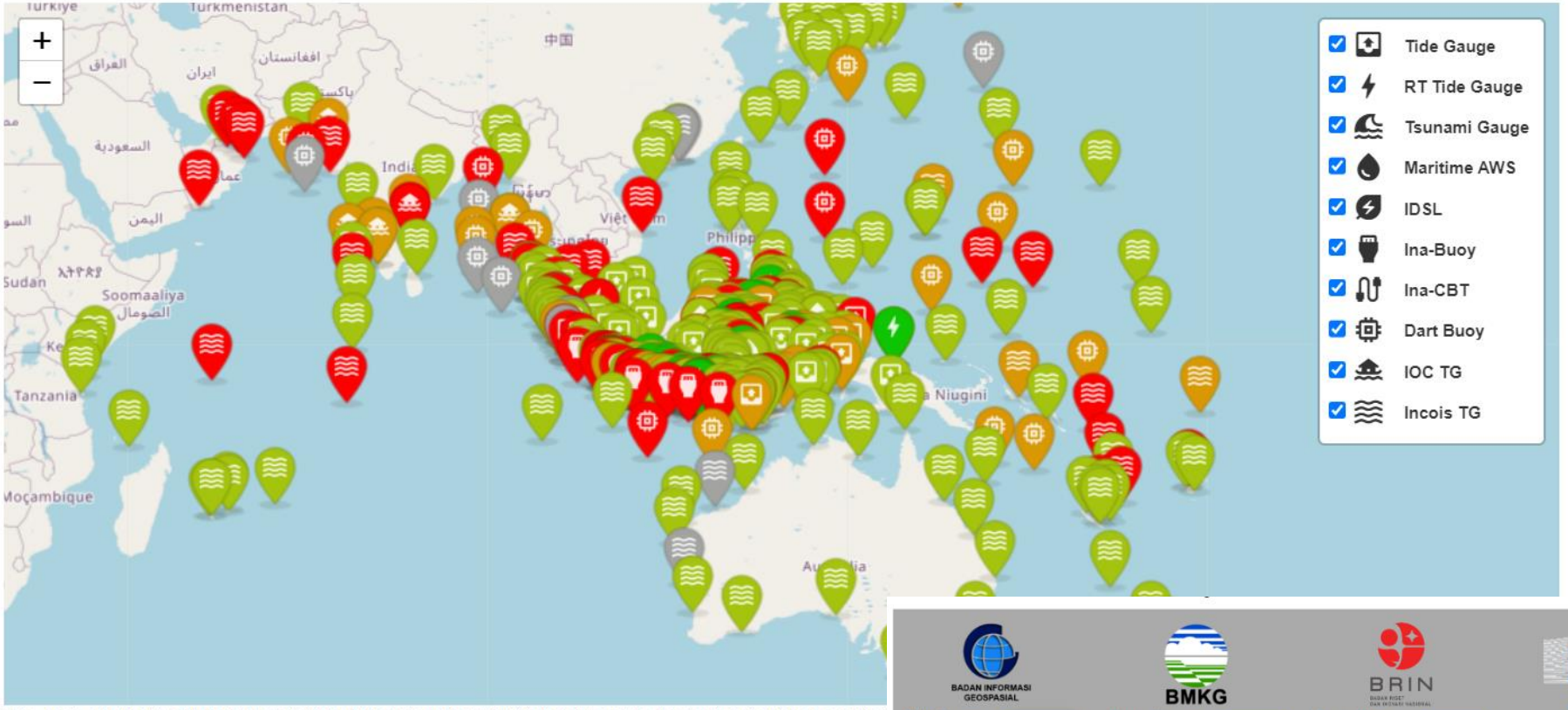
STATUS MAP

Data Latency Water Level Station Distribution Map



The map shows the water level station data latency level which represents the last data time recorded
shape of the icon for each type of water level station. Animated blue circle marker represents a new e

Tide Gauge (T1)	Online	Tsun. Gauge (TS)	Online	Tsun. Buoy (BY)	Online	IDSL (ID)	Online	IOC TG (TO)	Online	Dart Buoy (DB)	Online
RT TG (T2)	Online	AWS-WL (WL)	Online	CBT (CT)	Online	INCOIS TG (IC)	Online				

Provider server status checking is carried out by using the ping method directly from the client to the remote server

CCTV & Barometer Sensors

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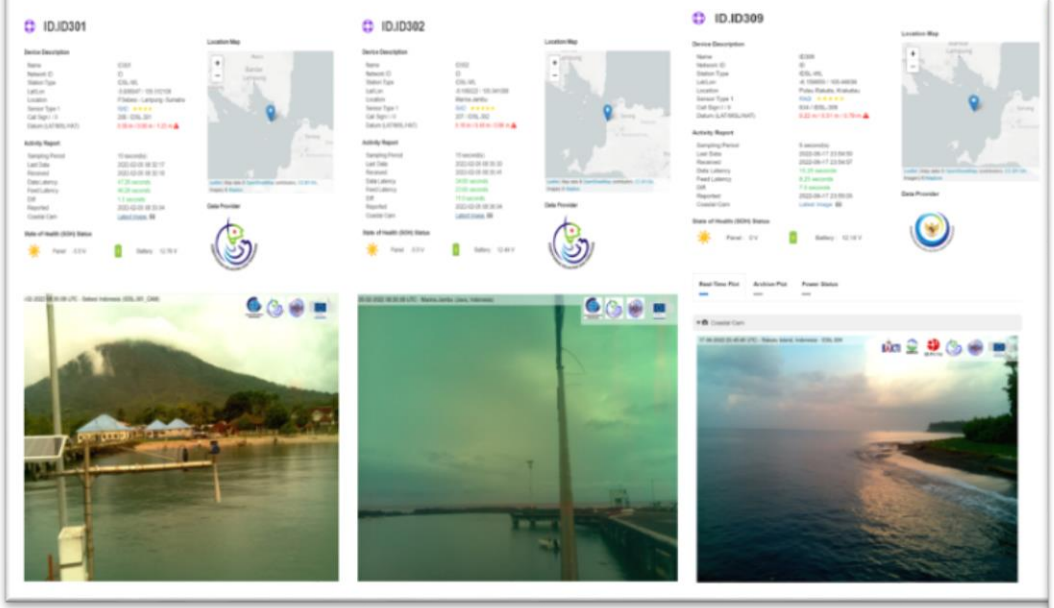
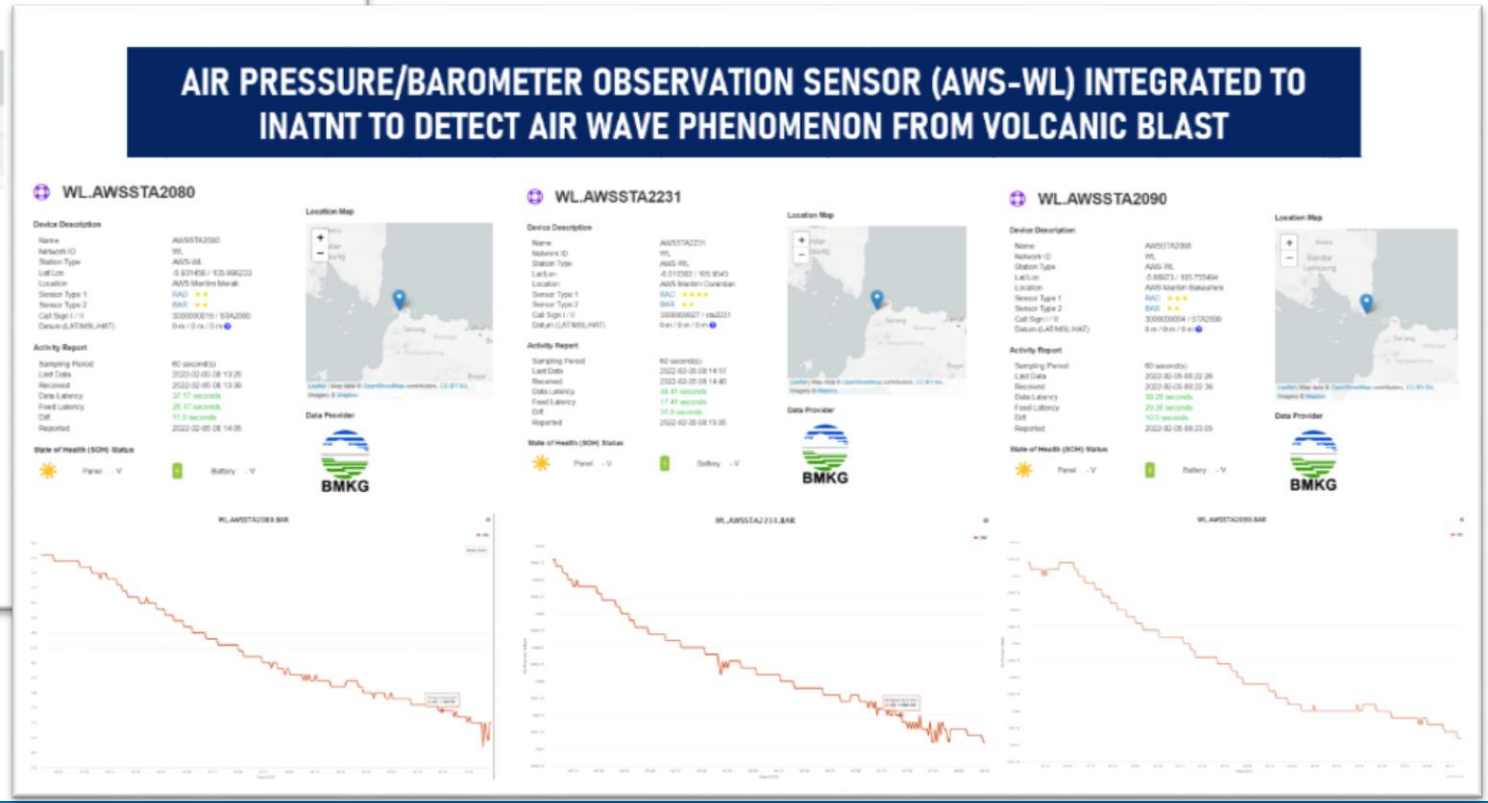
INEXPENSIVE DEVICE SEA LEVEL MEASUREMENT (IDSL) & TSUNAMI GAUGE SENSORS ARE EQUIPPED BY COASTAL CAM/CCTV TO VISUALLY CONFIRM TSUNAMI WAVE

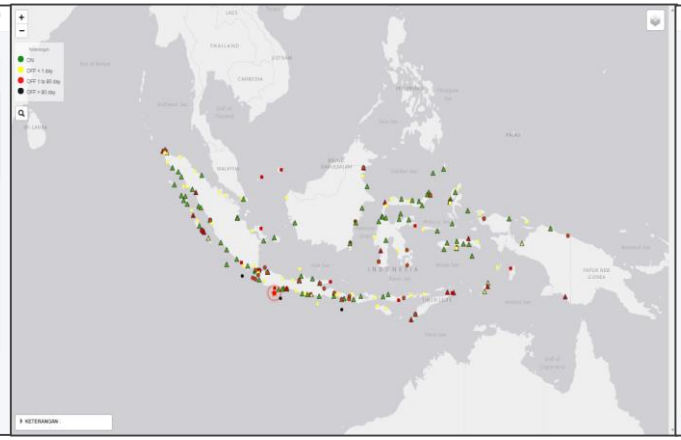


AIR PRESSURE/BAROMETER OBSERVATION SENSOR (AWS-WL) INTEGRATED TO INATNT TO DETECT AIR WAVE PHENOMENON FROM VOLCANIC BLAST

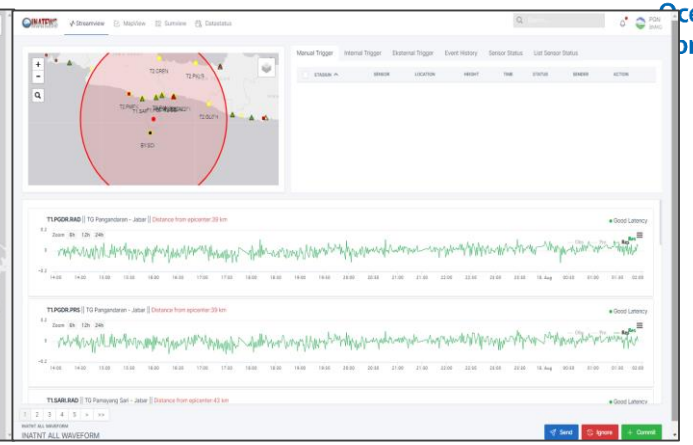


Graphical User Interface-GUI

STREAMVIEW

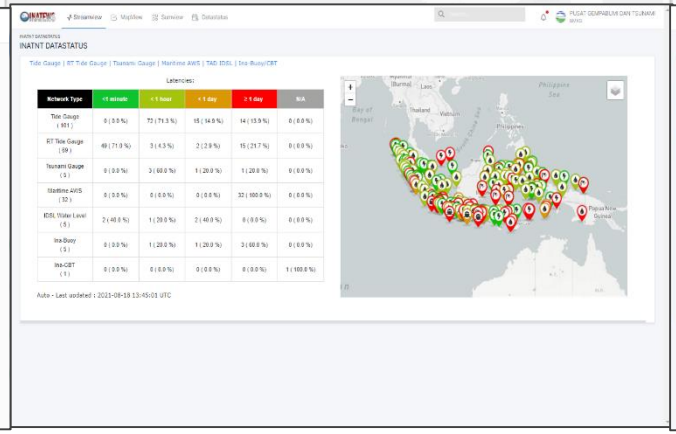


MAPVIEW

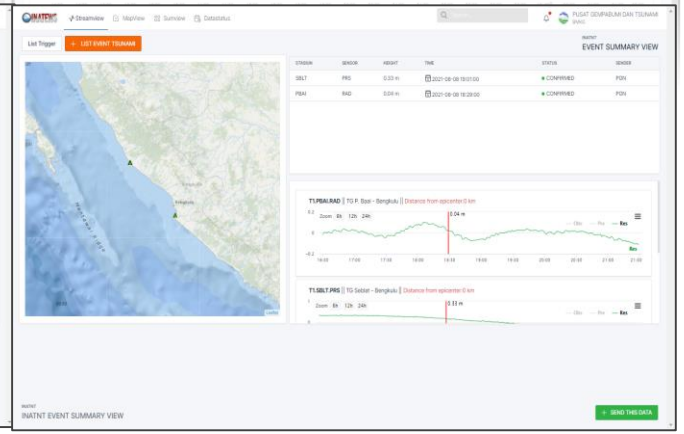


MONVIEW

CREATE EVENT



DATA STATUS



SUMVIEW

Indonesia Tsunami Non-Tectonic (InaTNT) for Indian Ocean

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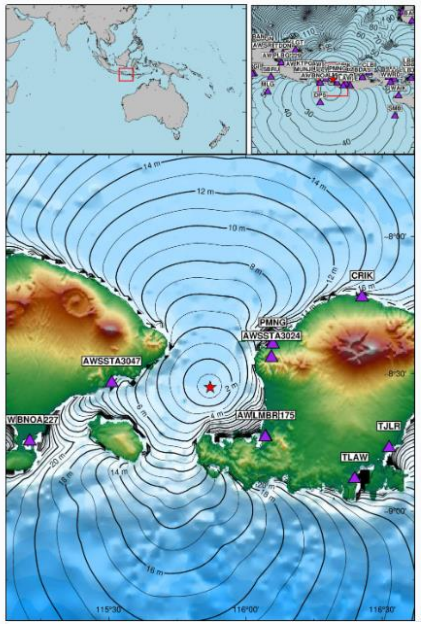
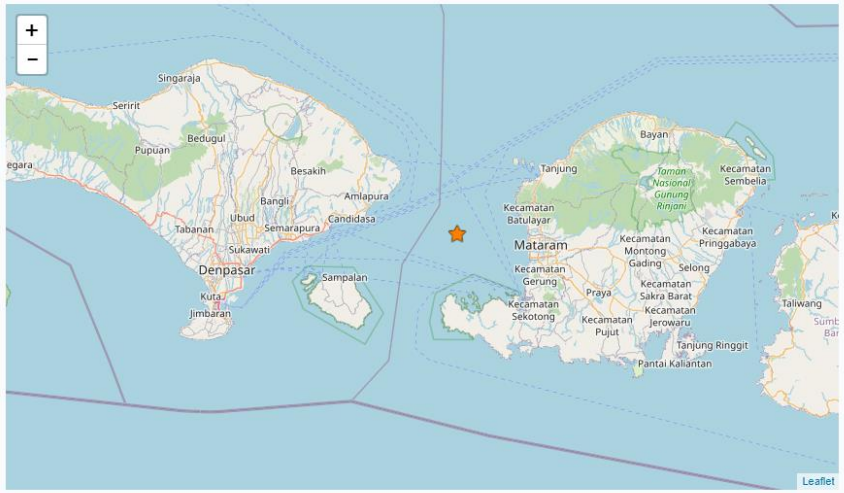
TSUNAMI TRAVEL TIME AND ARRIVAL TIME PREDICTION FROM ALL EARTHQUAKE POSSIBILITIES

Detail Information





Earthquake Information

EVENTID	REPORTED	ORIGIN TIME	LAT	LON	DEPTH	MAG	LOCATION	INFO TYPE	MESSAGE
SO230702012307	2023-07-02 01:23:07	2023-07-02 00:57:11	-8.550	115.870	23.00	3.30	Kota Gerung, Nusa Tenggara Barat	FELT	Telah terjadi gempabumi mag:3.3, lokasi: di laut 33 km BaratLaut Lombok Barat, waktu:02-Jul-23 07:57:11 WIB, kedlmn:23 Km, gempa ini dirasakan(MMI):III Mataram, III Lombok Barat, II - III Lombok Utara

Estimated Time Arrival

---LAT---	---LON---	-------STATION-------	----------ARRIVAL TIME UTC (RANGE)----------
-8.4000	116.0867	AWSSTA3024 WL	2023-07-02 01:04:22 ~ 2023-07-02 01:04:28
-8.5333	115.5200	AWSSTA3047 WL	2023-07-02 01:07:39 ~ 2023-07-02 01:07:45
-8.7333	116.0533	LMBR T1	2023-07-02 01:07:46 ~ 2023-07-02 01:07:52
-8.3833	116.1033	PMNG T1	2023-07-02 01:12:49 ~ 2023-07-02 01:12:55
-8.3833	116.1033	PMNG T2	2023-07-02 01:12:49 ~ 2023-07-02 01:12:55
-8.2216	116.4260	CRIK T1	2023-07-02 01:18:12 ~ 2023-07-02 01:18:18
-9.7411	115.2090	DPS BY	2023-07-02 01:19:59 ~ 2023-07-02 01:20:05
-8.1892	114.8330	CLBW T1	2023-07-02 01:27:08 ~ 2023-07-02 01:27:14
-8.7833	116.5367	TJLR T1	2023-07-02 01:38:43 ~ 2023-07-02 01:38:49
-8.7833	116.5367	TJLR T2	2023-07-02 01:38:43 ~ 2023-07-02 01:38:49
-8.7465	115.2099	BNOA T1	2023-07-02 01:43:04 ~ 2023-07-02 01:43:10
-8.7471	115.2087	AWSSTA2227 WL	2023-07-02 01:43:43 ~ 2023-07-02 01:43:49
-8.4500	117.3700	BDAS T1	2023-07-02 01:44:16 ~ 2023-07-02 01:44:22
-8.1333	114.4200	KTPG T1	2023-07-02 01:45:40 ~ 2023-07-02 01:45:46
-9.1928	112.5199	MLG BY	2023-07-02 01:45:49 ~ 2023-07-02 01:45:55
-8.8948	116.7490	BNTE T1	2023-07-02 01:45:50 ~ 2023-07-02 01:45:56
-8.8948	116.7490	BNTE T2	2023-07-02 01:45:50 ~ 2023-07-02 01:45:56
-10.4146	119.0387	SMB BY	2023-07-02 01:46:02 ~ 2023-07-02 01:46:08
-8.3851	114.5730	JBRN T1	2023-07-02 01:46:33 ~ 2023-07-02 01:46:39
-8.2142	117.7090	CLBI T1	2023-07-02 01:47:57 ~ 2023-07-02 01:48:03
-8.2142	117.7090	CLBI T2	2023-07-02 01:47:57 ~ 2023-07-02 01:48:03
-8.8836	116.3990	TLAW T1	2023-07-02 01:50:41 ~ 2023-07-02 01:50:47
-8.8836	116.3990	TLAW T2	2023-07-02 01:50:41 ~ 2023-07-02 01:50:47
-8.1500	114.4200	AWSSTA2092 WL	2023-07-02 01:51:31 ~ 2023-07-02 01:51:37
-8.3833	118.7033	BIMA T1	2023-07-02 01:52:40 ~ 2023-07-02 01:52:46
-8.3833	118.7033	BIMA T2	2023-07-02 01:52:40 ~ 2023-07-02 01:52:46
-7.9951	119.9360	LBB02 CT	2023-07-02 01:52:53 ~ 2023-07-02 01:52:59
-8.1500	114.4367	AWSSTA3046 WL	2023-07-02 01:53:21 ~ 2023-07-02 01:53:27
-8.1750	119.9210	LBB01 CT	2023-07-02 01:54:23 ~ 2023-07-02 01:54:29
-9.3896	119.2190	WAIK T1	2023-07-02 02:01:03 ~ 2023-07-02 02:01:09
-8.4342	112.6840	SBRU T1	2023-07-02 02:06:11 ~ 2023-07-02 02:06:17
-8.7167	118.8033	WWRD T1	2023-07-02 02:17:46 ~ 2023-07-02 02:17:52
-8.5833	119.0200	SAPE T1	2023-07-02 02:18:46 ~ 2023-07-02 02:18:52
-8.2667	111.7867	POPJI TS	2023-07-02 02:21:22 ~ 2023-07-02 02:21:28
-8.4379	114.3480	MUNJI TS	2023-07-02 02:22:50 ~ 2023-07-02 02:22:56
-8.3000	111.7200	PRGI T1	2023-07-02 02:38:54 ~ 2023-07-02 02:39:00
-8.3000	111.7367	ID308 ID	2023-07-02 02:39:25 ~ 2023-07-02 02:39:31
-5.5678	119.9221	BANT T1	2023-07-02 02:41:45 ~ 2023-07-02 02:41:51
-8.4926	119.8760	LBJO T1	2023-07-02 02:52:58 ~ 2023-07-02 02:53:04
-7.0667	113.9367	KLGT T1	2023-07-02 03:04:05 ~ 2023-07-02 03:04:11
-7.2333	113.3033	TDDN T1	2023-07-02 03:12:38 ~ 2023-07-02 03:12:44
-7.7149	113.2160	PBLG T1	2023-07-02 03:23:36 ~ 2023-07-02 03:23:42
-7.7149	113.2160	PLBG T2	2023-07-02 03:23:36 ~ 2023-07-02 03:23:42
-7.7167	113.2200	AWSSTA2229 WL	2023-07-02 03:25:24 ~ 2023-07-02 03:25:30
-5.1000	119.4200	UJPD T1	2023-07-02 03:40:06 ~ 2023-07-02 03:40:12
-5.1000	119.4200	AWSSTA2179 WL	2023-07-02 03:44:06 ~ 2023-07-02 03:44:12
-7.2000	112.7533	AWSSTA2091 WL	2023-07-02 05:02:41 ~ 2023-07-02 05:02:47
-6.8644	112.3680	LMGN T1	2023-07-02 05:33:35 ~ 2023-07-02 05:33:41
-6.8644	112.3680	LMGN T2	2023-07-02 05:33:35 ~ 2023-07-02 05:33:41
-7.2000	112.7200	SRBY T1	2023-07-02 05:36:58 ~ 2023-07-02 05:37:04
-6.7667	111.9367	TBAN T1	2023-07-02 06:21:49 ~ 2023-07-02 06:21:55

Observed Case

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GUI FOR MONITORING AUTOMATIC SEA LEVEL ANOMALY DETECTION

Water Level Anomaly Alert Monitoring

User: user [supervisor]

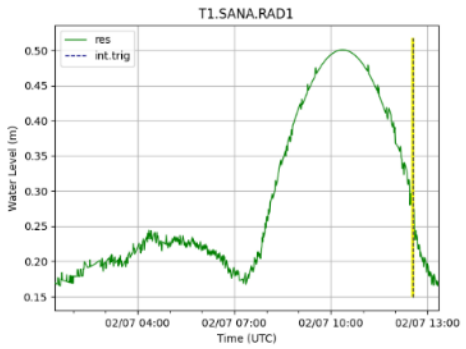
Home | Coast Cam | Logout

Detection Alert

Real-Time Alert | Archive | Events | Sensors

Sound Alert

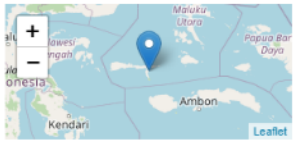
Latest Sea Level Anomaly



Height	-0.073 m (Low Tide)

T1.SANA.RAD1

(TG Sanana - Malut)



Associated Event: **None**

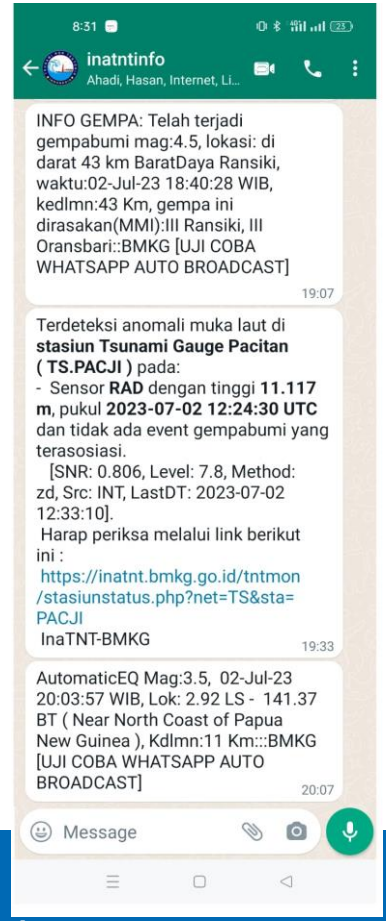
Alert Level: 8.850	Method: sl
SNR: 0.728	Source: Internal (InaTNT)

Ts(AIC)	2023-07-02 12:26:00UTC
Ts	2023-07-02 12:32:00UTC
Last Samp. Time	2023-07-02 12:50:00UTC
ID	1688302502046

Last Sea Level Anomaly Alerts (Auto Update)

ID	CHANNEL	TS_AIC	TS	WH	LAST_DATA	LEVEL	METHOD	SNR	EVENT_ASSOC	SRC	
1688302502046	T1.SANA.RAD1	2023-07-02 12:26:00	2023-07-02 12:32:00	-0.073	2023-07-02 12:50:00	8.850	sl	0.728	None	INT	View
1688301212530	TS.PACJI.RAD	2023-07-02 12:24:30	2023-07-02 12:32:40	11.117	2023-07-02 12:33:10	7.801	zd	0.806	None	INT	View
1688298629728	TS.PACJI.RAD	2023-07-02 11:49:00	2023-07-02 11:40:10	11.235	2023-07-02 11:50:10	7.719	zd	2.037	None	INT	View
1688298271339	TS.PACJI.RAD	2023-07-02 11:42:40	2023-07-02 11:39:50	11.236	2023-07-02 11:44:10	7.604	zd	1.467	None	INT	View
1688298198108	TS.PACJI.RAD	2023-07-02 11:39:20	2023-07-02 11:39:50	11.236	2023-07-02 11:43:00	7.706	zd	1.431	None	INT	View
1688297655495	WL.AWSSTA2225.RAD	2023-07-02 11:14:00	2023-07-02 11:23:00	-0.148	2023-07-02 11:34:00	8.652	sl	-0.933	None	INT	View
1688297415485	TS.PACJI.RAD	2023-07-02 11:29:20	2023-07-02 11:29:30	5.431	2023-07-02 11:30:00	32.082	sl	0.085	None	INT	View
1688297256524	TO.PAGO.PWL	2023-07-02 11:09:00	2023-07-02 11:16:00	0.084	2023-07-02 11:21:00	8.083	sl	1.498	None	INT	View
1688297004432	T1.SRBY.RAD1	2023-07-02 10:40:00	2023-07-02 10:40:00	0.078	2023-07-02 11:20:00	8.207	sl	-0.232	None	INT	View
1688291502900	T2.JYPR.RAD1	2023-07-02 09:51:10	2023-07-02 09:51:20	-1.452	2023-07-02 09:51:35	9.954	sl	-0.251	None	INT	View
1688290401261	T1.PRGI.PRS1	2023-07-02 09:24:01	2023-07-02 09:25:14	-0.083	2023-07-02 09:26:12	7.655	zd	1.587	None	INT	View
1688289841878	T1.PRGI.PRS1	2023-07-02 09:13:04	2023-07-02 09:16:14	0.300	2023-07-02 09:21:06	8.319	sl	0.361	None	INT	View
1688289841855	T1.PRGI.PRS2	2023-07-02 09:13:04	2023-07-02 09:15:01	0.253	2023-07-02 09:21:06	8.061	sl	0.316	None	INT	View
1688289610532	T1.PRGI.PRS2	2023-07-02 09:05:03	2023-07-02 09:11:07	0.198	2023-07-02 09:15:01	8.358	sl	-0.618	None	INT	View
1688289546958	T1.PRGI.PRS2	2023-07-02 09:04:04	2023-07-02 09:13:04	0.198	2023-07-02 09:15:01	9.923	sl	-1.059	None	INT	View

AUTOMATIC SEA LEVEL ANOMALY ALERT MESSAGE VIA WHATSAPP



Observed Case

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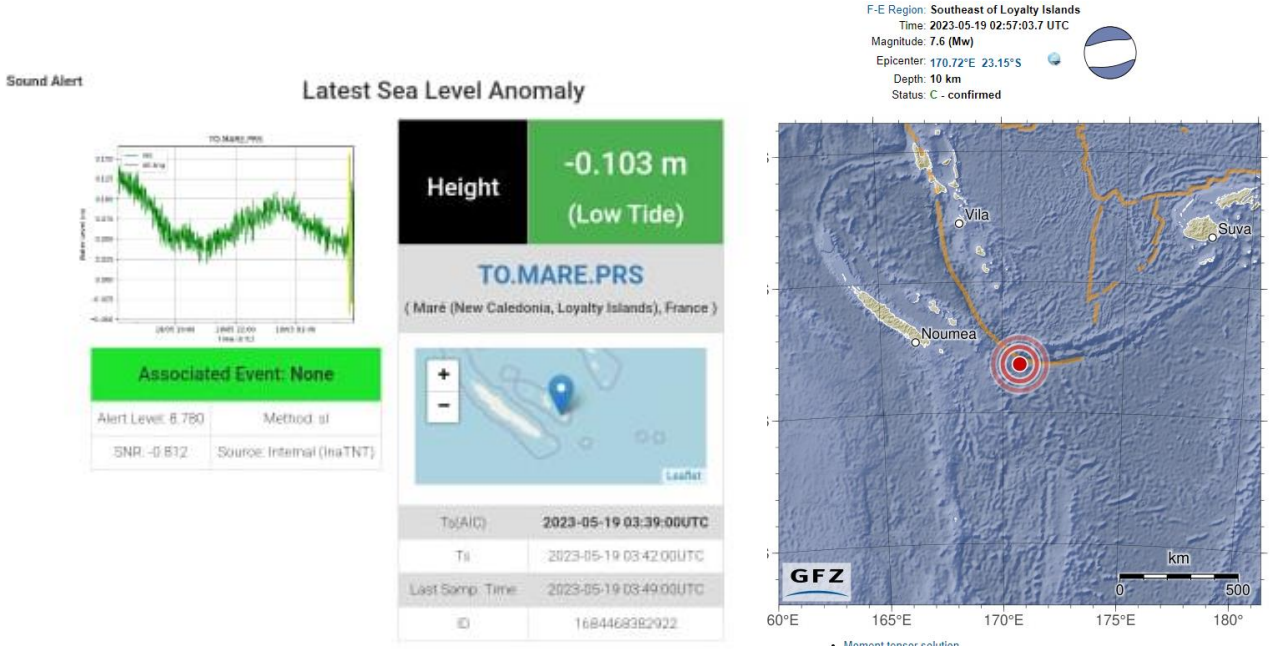
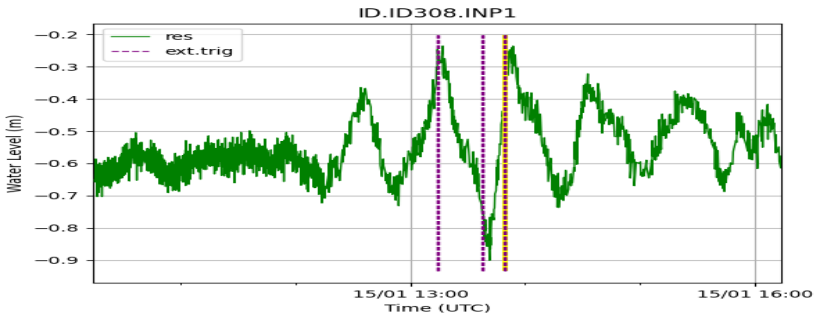
DETECTED TSUNAMI TRIGGERED BY EARTHQUAKE MAGNITUDE 7.7 QUAKE OFF NEW CALEDONIA IN INATNT ON 29 MAY 2023



DETECTED METEOTSUNAMI / RISSAGA PHENOMENON FROM 15 JANUARY 2022 HUNGA TONGA VOLCANIC ERUPTION BLAST IN INATNT SYSTEM



The small tsunami was detected caused by the atmospheric disturbance in IDSL Sensor in Prigi, East Java

Mareogram Playback/Simulation : Example how Internal TDA InaTNT detects Tsunami Palu 28 September 2018 Wave in Pantoloan TG

STA/LTA Parameters : NS = 300 seconds
NL = 18000 seconds

Threshold ON = 8
Threshold OFF = 6

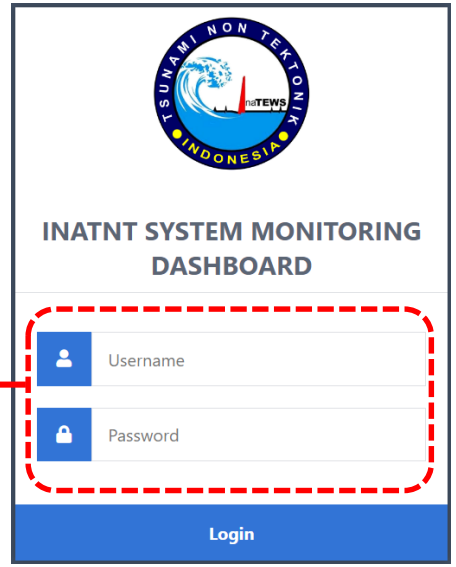
Indonesia Tsunami Non-Tectonic (InaTNT) for Indian Ocean

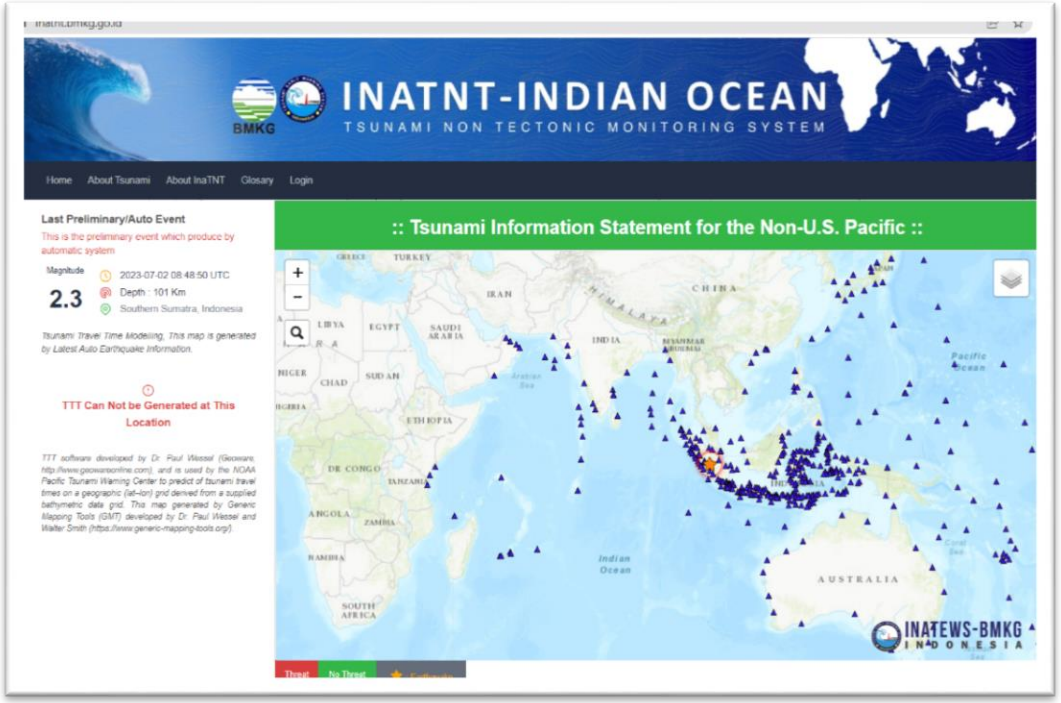
unesco
Intergovernmental Oceanographic Commission

How to access?

URL address:
https://inatnt.bmkg.go.id

The user name and password are equal with the user name and password for accessing TSP Indonesia password protected web





Recommended web browser apps:

Firefox chrome

unesco
Intergovernmental
Oceanographic
Commission

THANK YOU