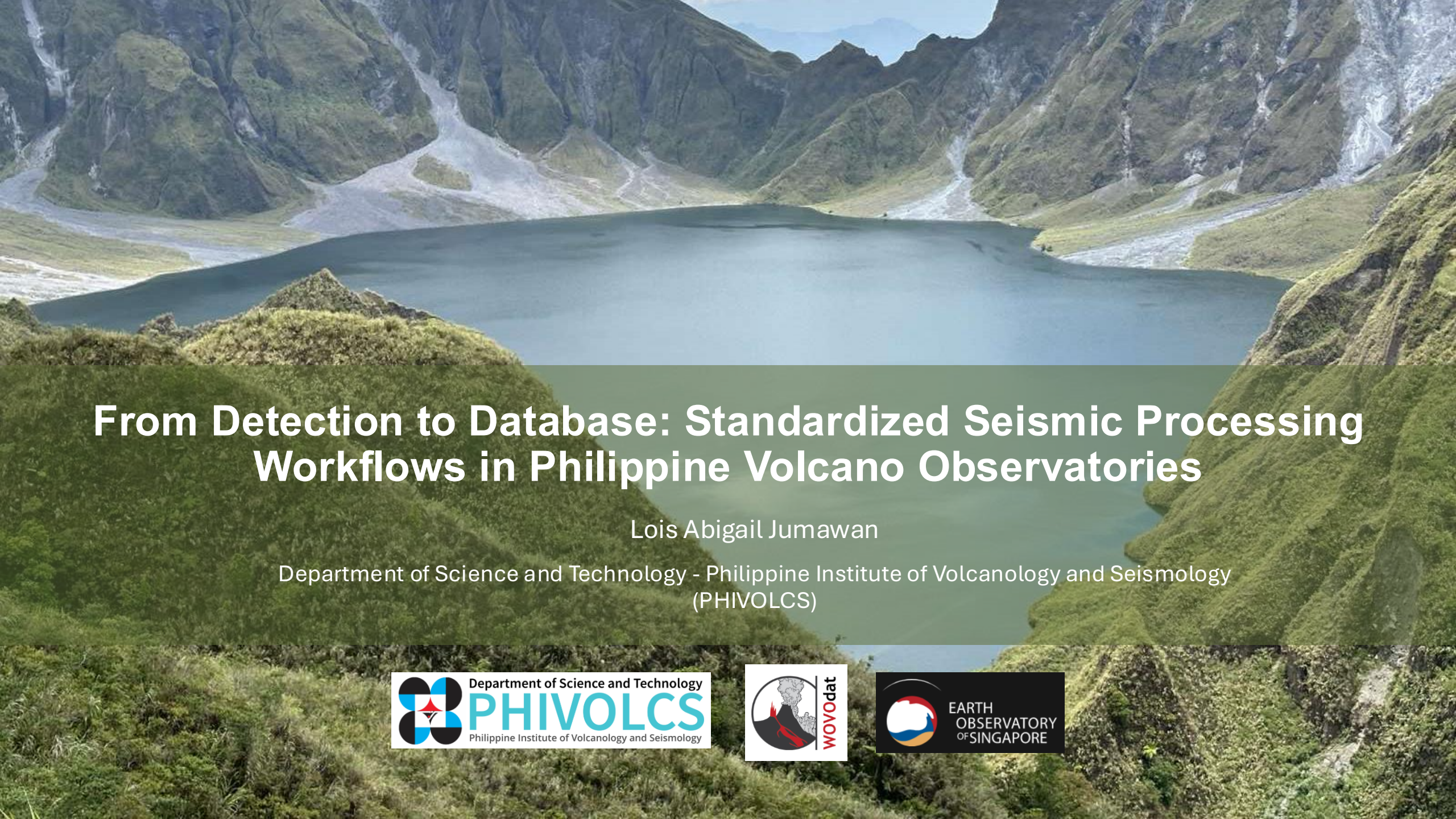


From Detection to Database: Standardized Seismic Processing Workflows in Philippine Volcano Observatories

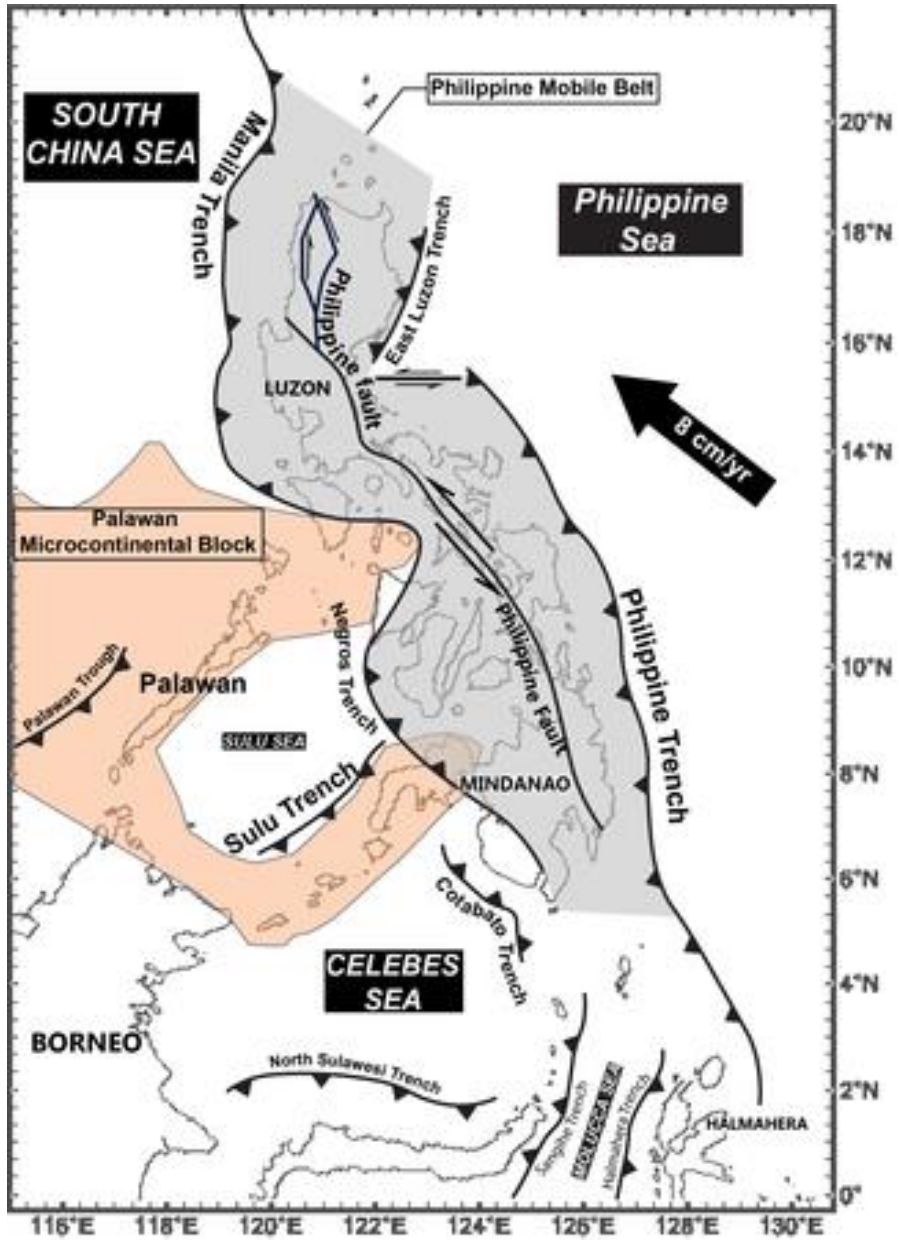
Lois Abigail Jumawan

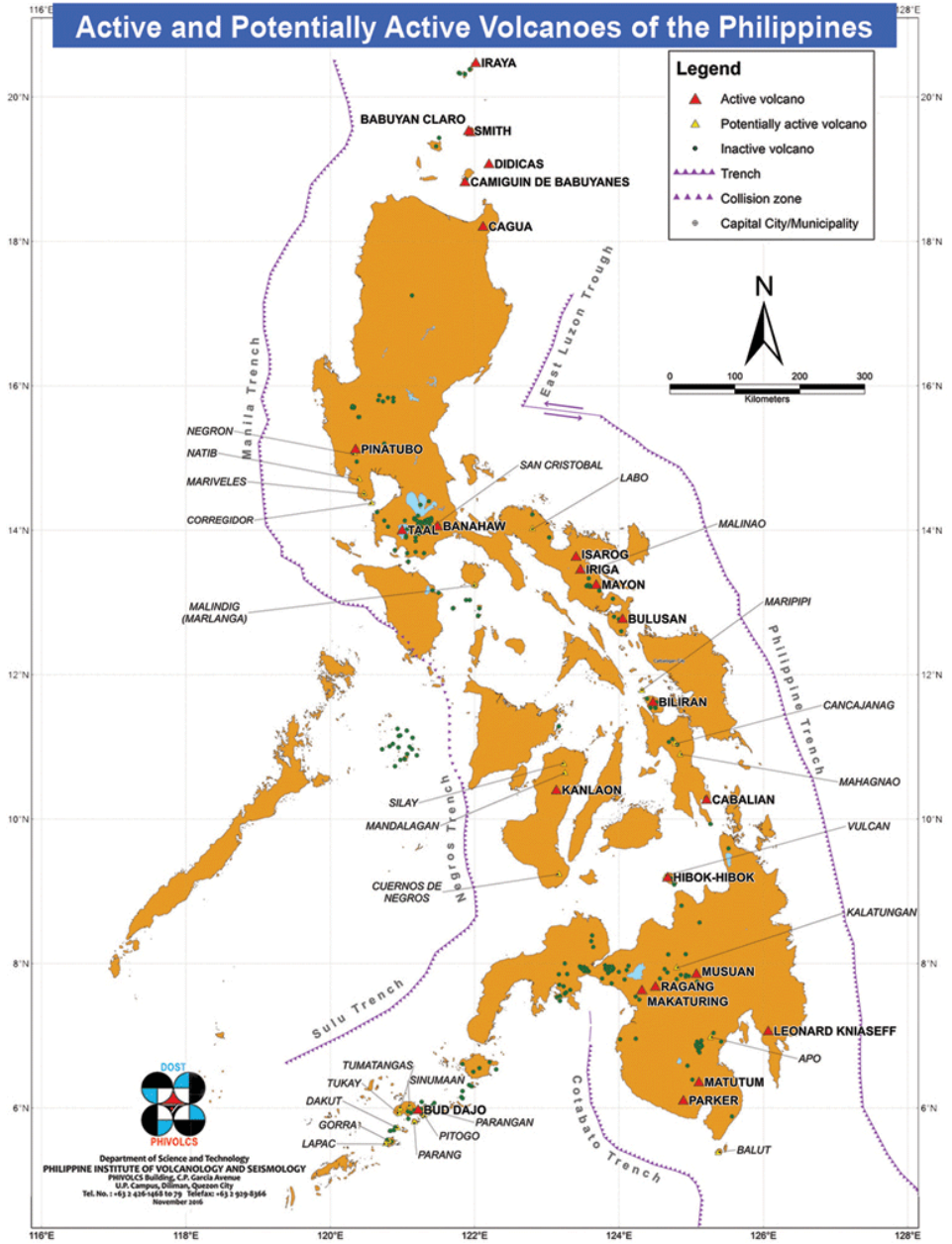
Department of Science and Technology - Philippine Institute of Volcanology and Seismology (PHIVOLCS)

Department of Science and Technology
PHIVOLCS
Philippine Institute of Volcanology and Seismology

WOVOdat

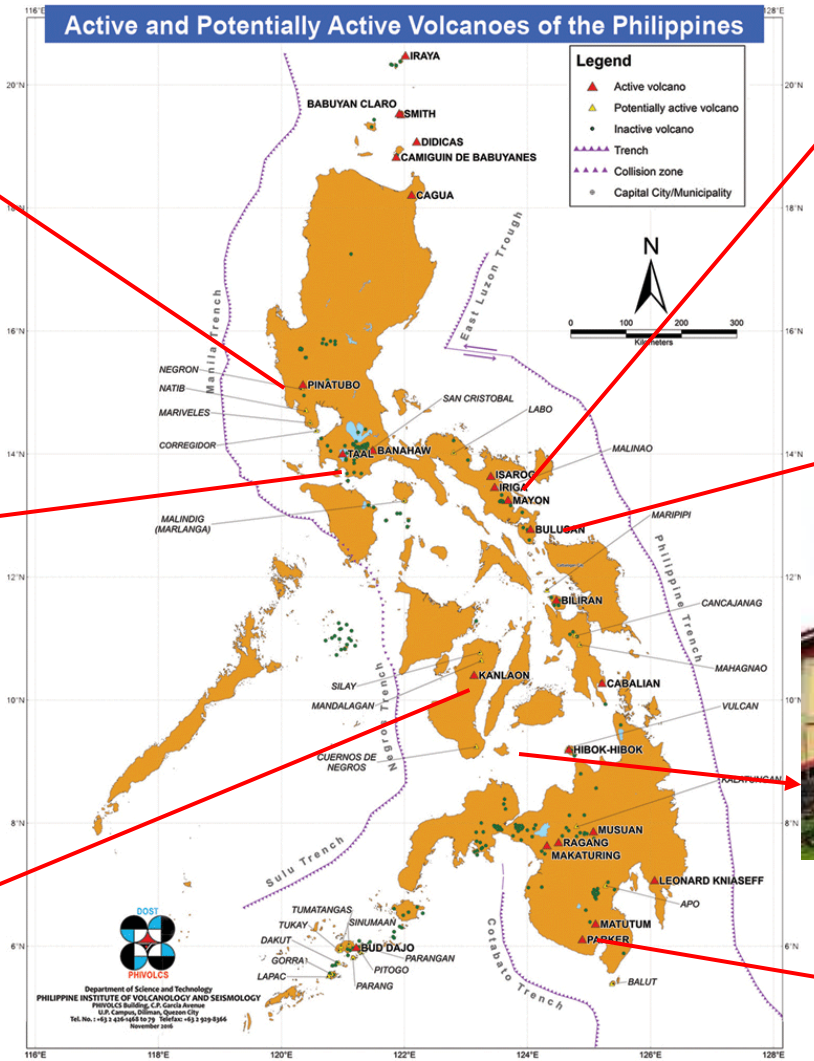
EARTH OBSERVATORY OF SINGAPORE


SOUTH CHINA SEA
Philippine Mobile Belt
Philippine Sea
Manila Trench
Philippine fault
East Luzon Trench
LUZON
8 cm/yr
Palawan Microcontinental Block
Palawan Trough
Palawan
Negros Trench
Philippine Fault
Philippine Trench
SULU SEA
Sulu Trench
MINDANAO
Cotabato Trench
CELEBES SEA
BORNEO
North Sulawesi Trench
HALMAHERA
20°N
18°N
16°N
14°N
12°N
10°N
8°N
6°N
4°N
2°N
0°
116°E
118°E
120°E
122°E
124°E
126°E
128°E
130°E

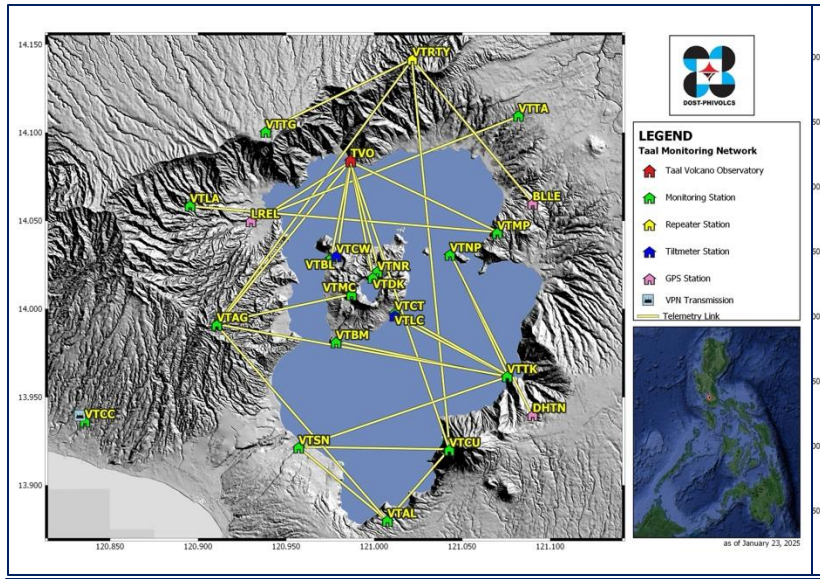

Active and Potentially Active Volcanoes of the Philippines
Legend
Active volcano
Potentially active volcano
Inactive volcano
Trench
Collision zone
Capital City/Municipality
N
0 100 200 300
Kilometers
IRAYA
BABUYAN CLARO
SMITH
DIDICAS
CAMIGUIN DE BABUYANES
CAGUA
NEGRON
NATIB
MARIVELES
CORREGIDOR
PINATUBO
SAN CRISTOBAL
LABO
TAAL
BANAHAW
MALINAO
ISAROG
IRIGA
MAYON
MALINDIG (MARLANGA)
BULUSAN
MARIPIPI
BILIRAN
CANCAJANAG
MAHAGNAO
KANLAON
CABALIAN
SILAY
MANDALAGAN
VULCAN
CUERNOS DE NEGROS
HIBOK-HIBOK
KALATUNGAN
MUSUAN
RAGANG
MAKATURING
LEONARD KNIASEFF
APO
TUMATANGAS
TUKAY
SINUMAAN
MATUTUM
DAKUT
BUD DAJO
PARKER
GORRA
PARANGAN
LAPAC
PITOGO
PARANG
BALUT
East Luzon Trough
Manila Trench
Negros Trench
Philippine Trench
Sulu Trench
Cotabato Trench
DOST
PHIVOLCS
Department of Science and Technology
PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY
PHIVOLCS Building, C.P. Garcia Avenue
U.P. Campus, Diliman, Quezon City
Tel. No. : +63 2 426-1468 to 79 Telefax: +63 2 929-8366
November 2016
20°N
18°N
16°N
14°N
12°N
10°N
8°N
6°N
116°E
118°E
120°E
122°E
124°E
126°E
128°E

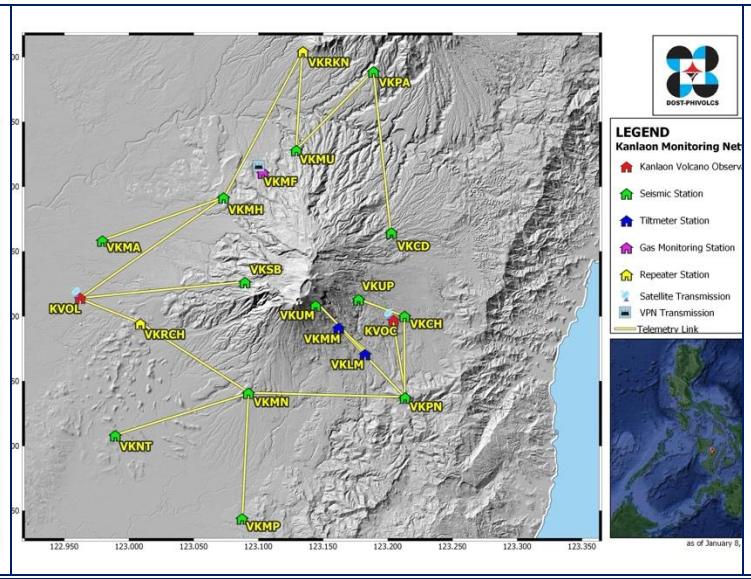
7 Volcano Observatories

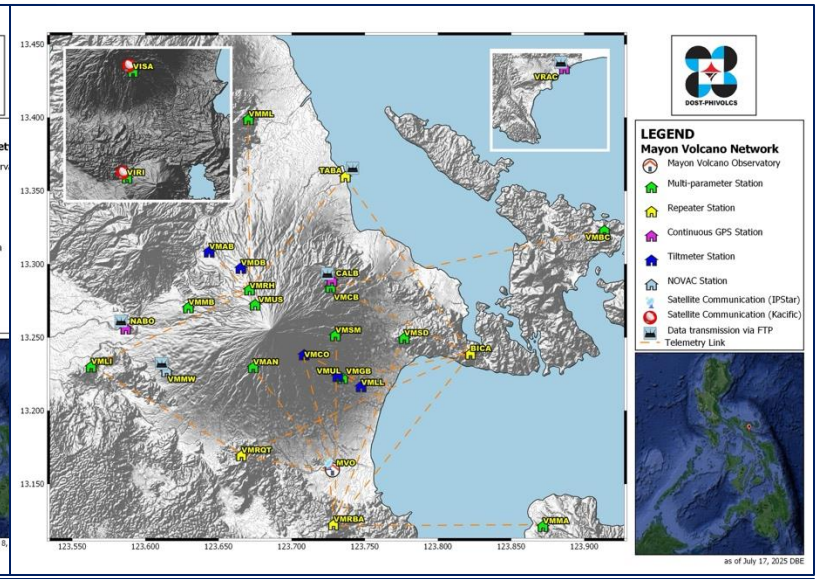
to monitor 12 active volcanoes

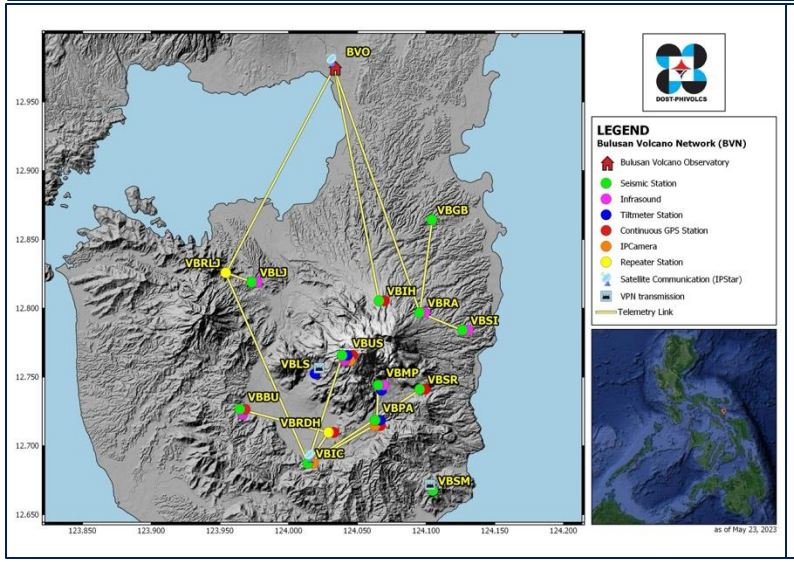


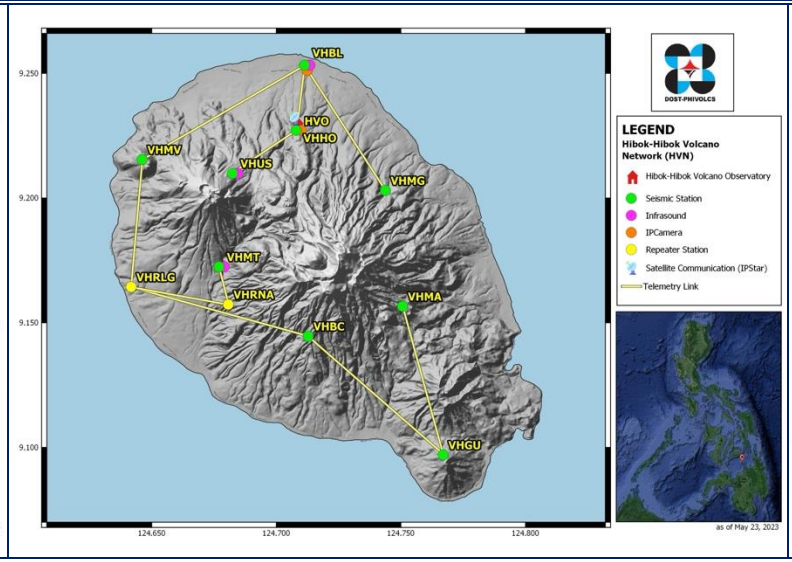
Volcano Monitoring Networks

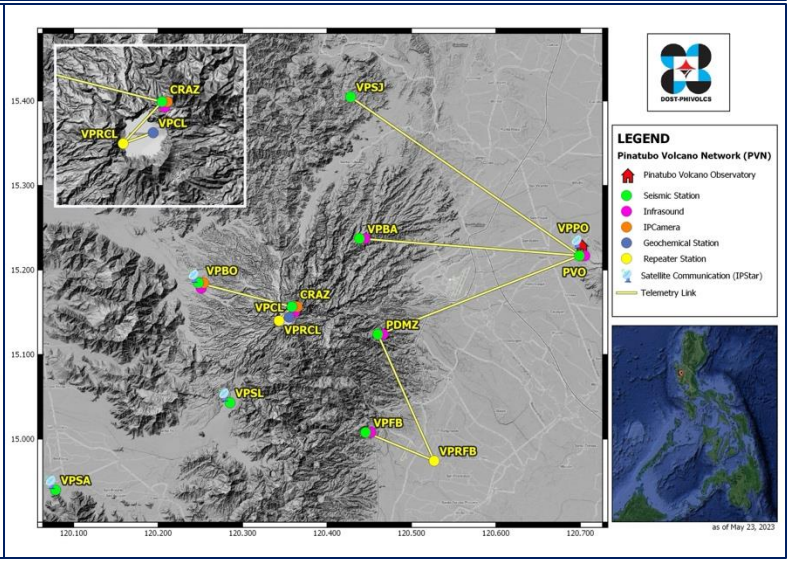


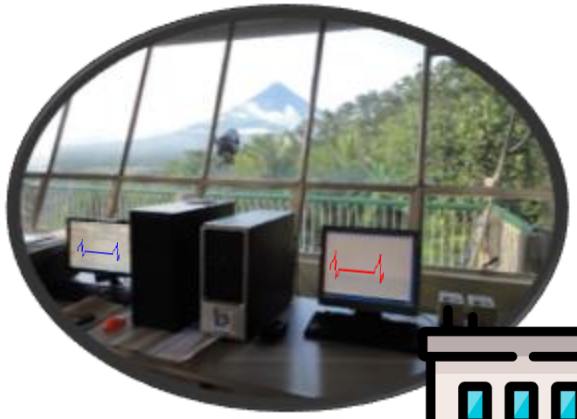












Station w/ LOS

Repeater Station

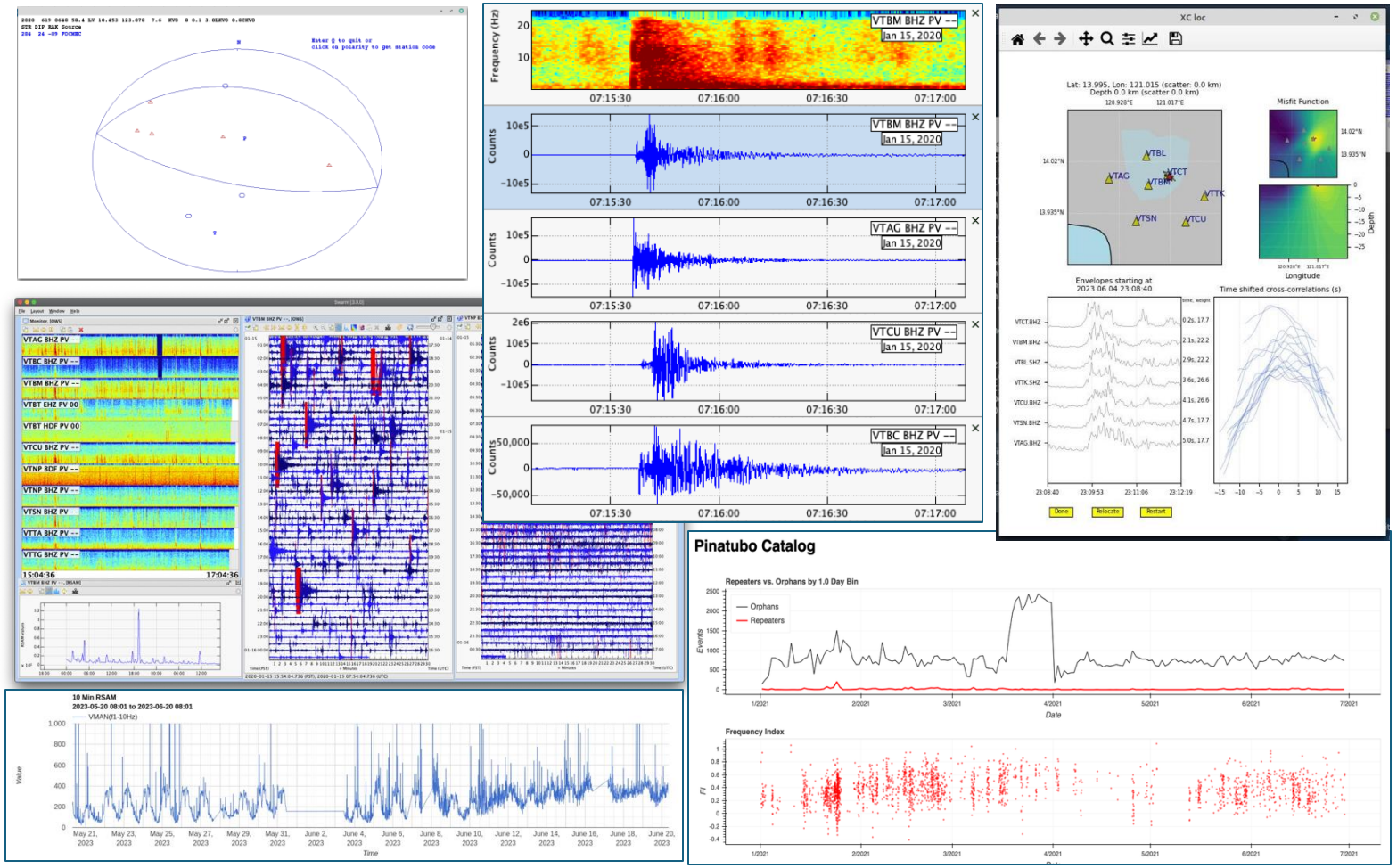
Station

VOLCANO OBSERVATORY

- Manned 24/7
- Main waveform data archive (Seiscomp; miniSEED format)
- Seismic/infrasound monitoring & manual processing

MAIN OFFICE

- Manned 24/7
- Backup/secondary waveform data archive

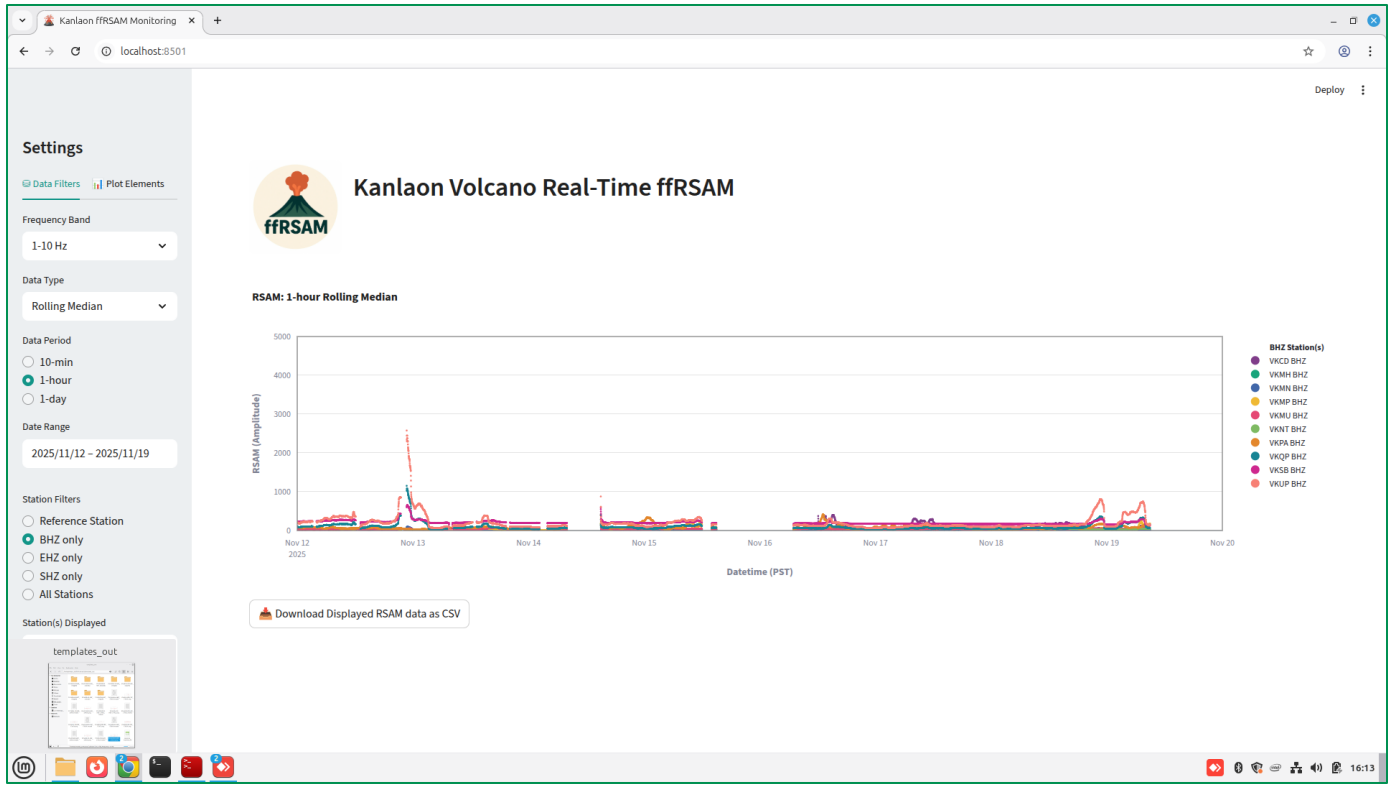


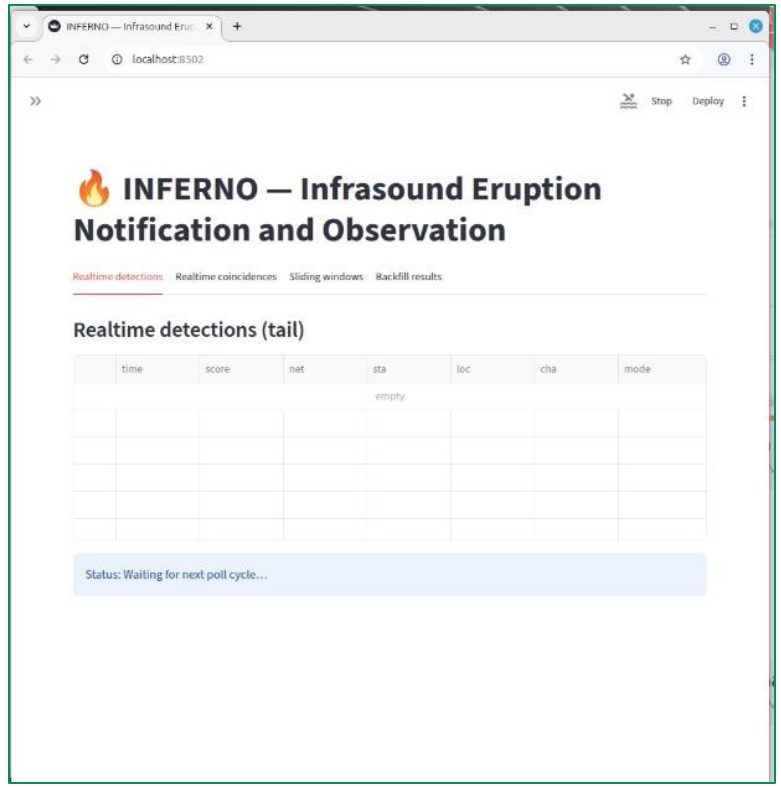
Seismic Monitoring Tools

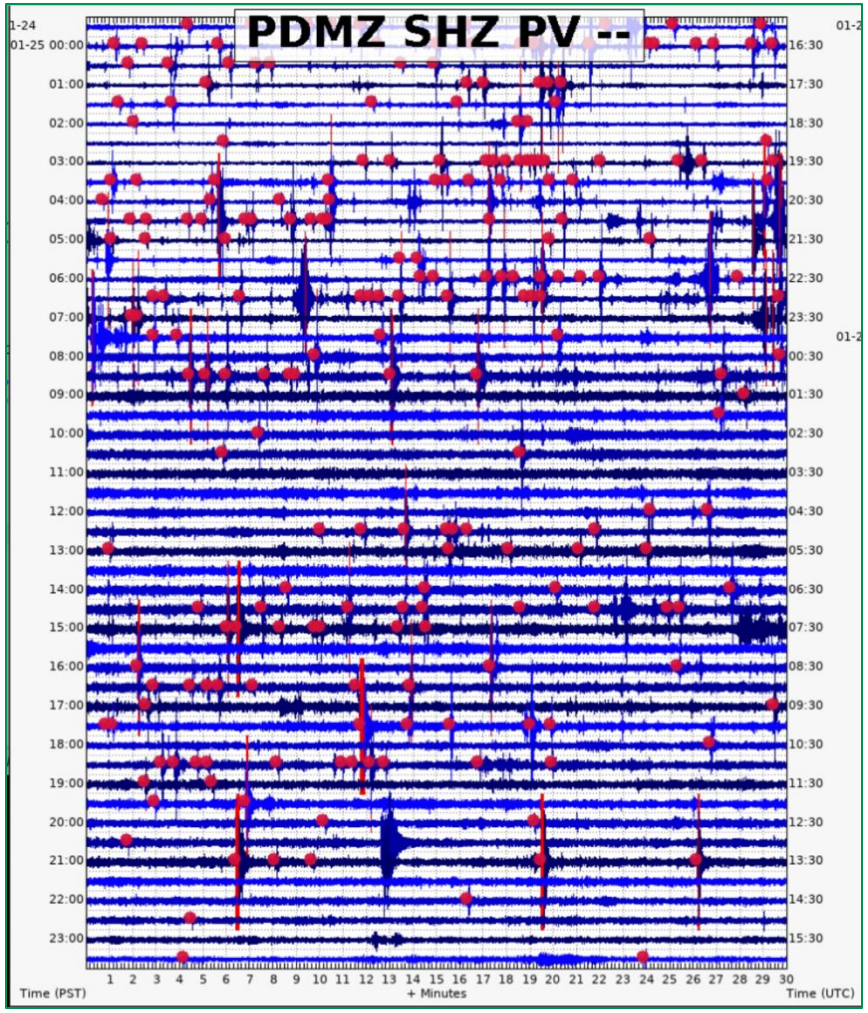
- Swarm
- SeisAn
- Enveloc
- HypoDD
- iPensive
- ffRSAM
- RedPy

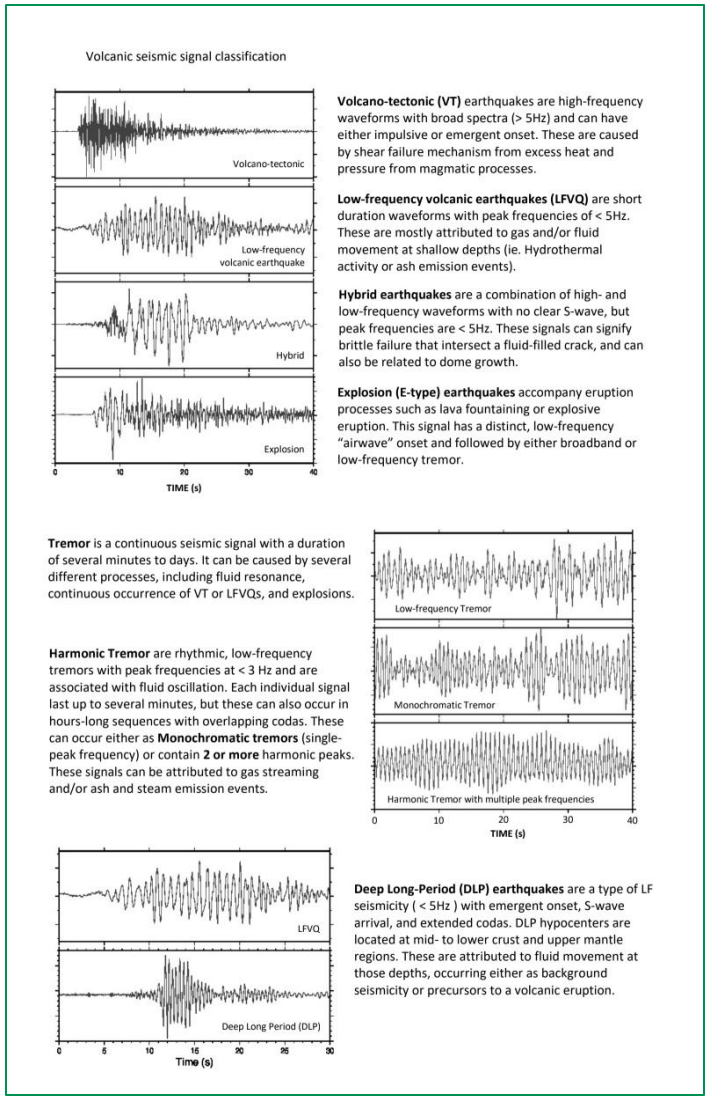
- And more…

Display + Alarms



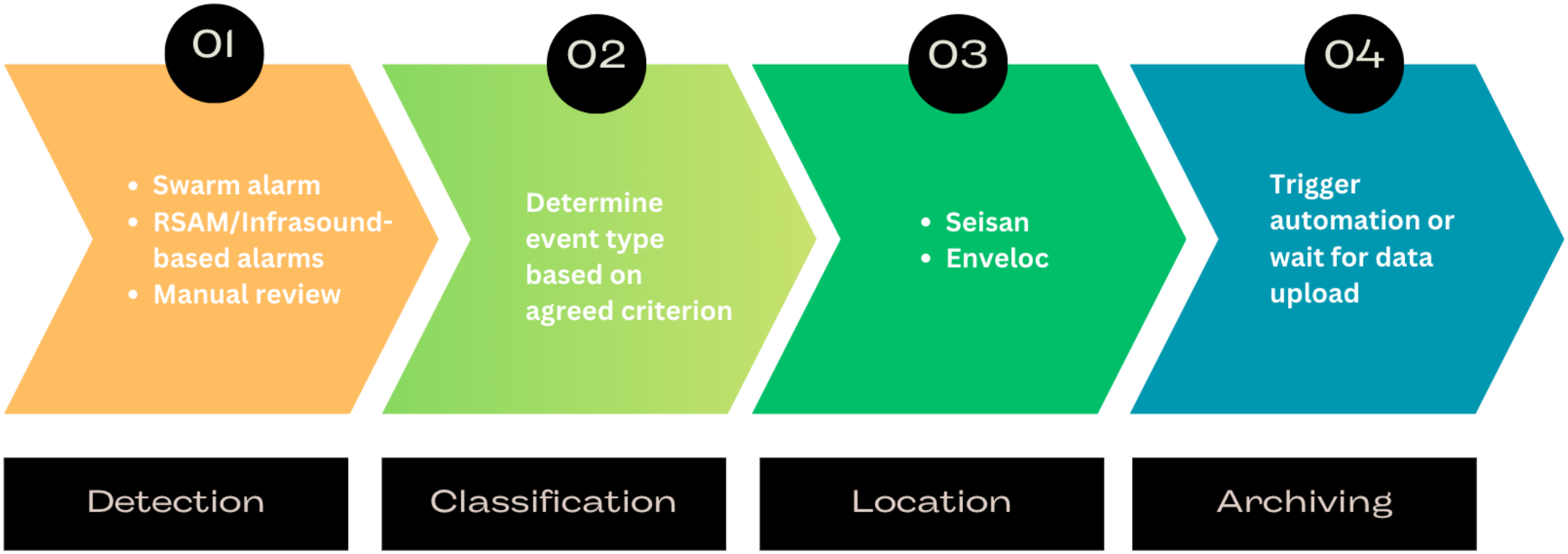




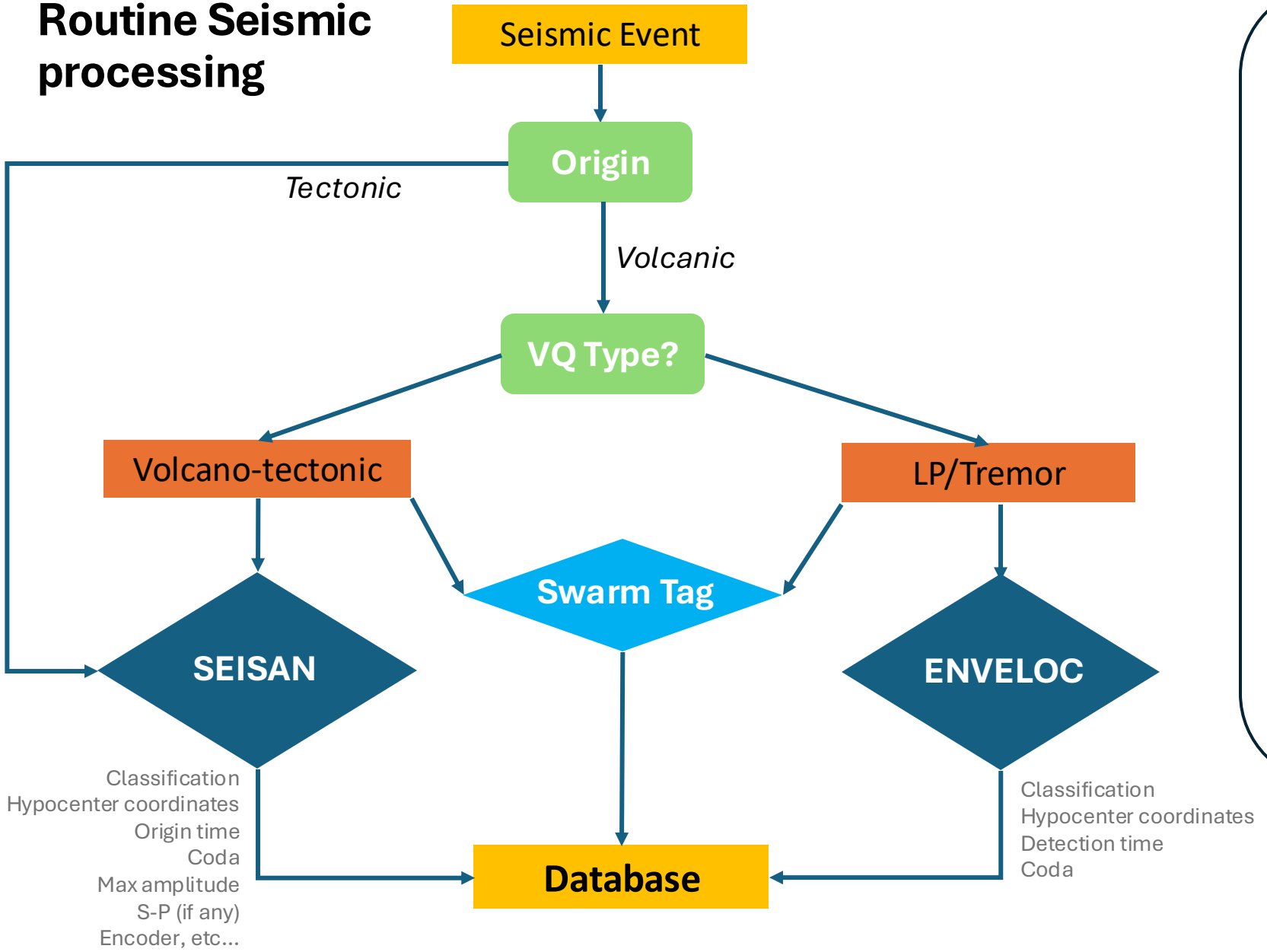


VQ Classes

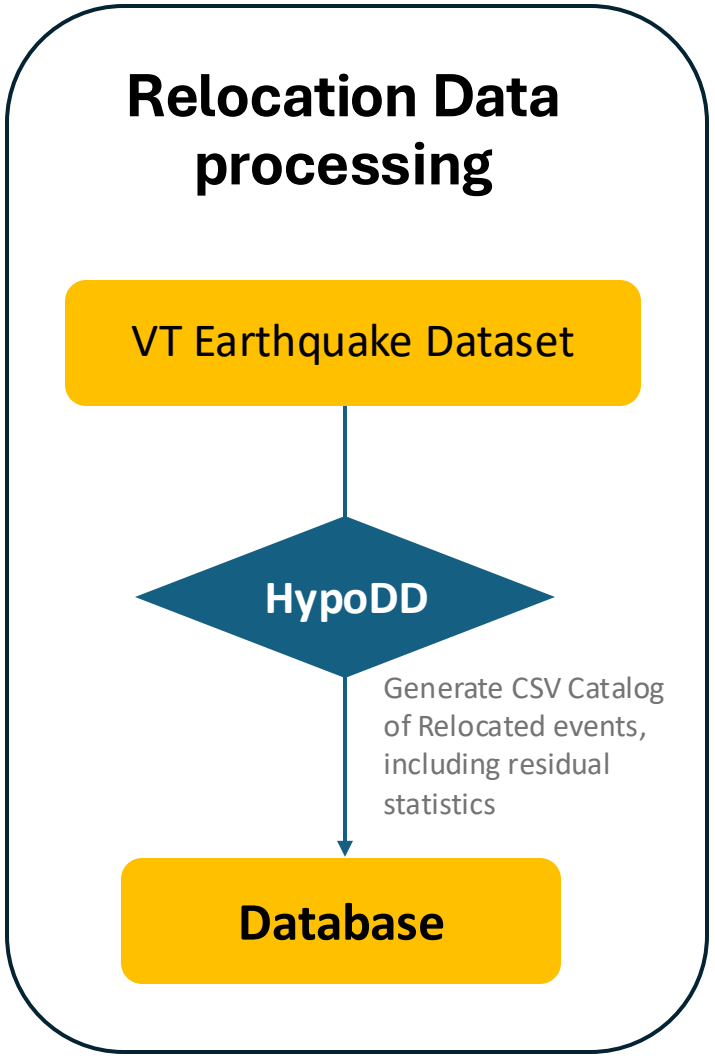
- VT – Volcano-tectonic
- LFVQ – "Low-frequency volcanic earthquake"
- DLP – Deep Long-period
- Hybrid
- Tremor
- Harmonic Tremor
- Tornillo
- E-type


01
• Swarm alarm
• RSAM/Infrasound-based alarms
• Manual review
02
Determine event type based on agreed criterion
03
• Seisan
• Enveloc
04
Trigger automation or wait for data upload
Detection
Classification
Location
Archiving

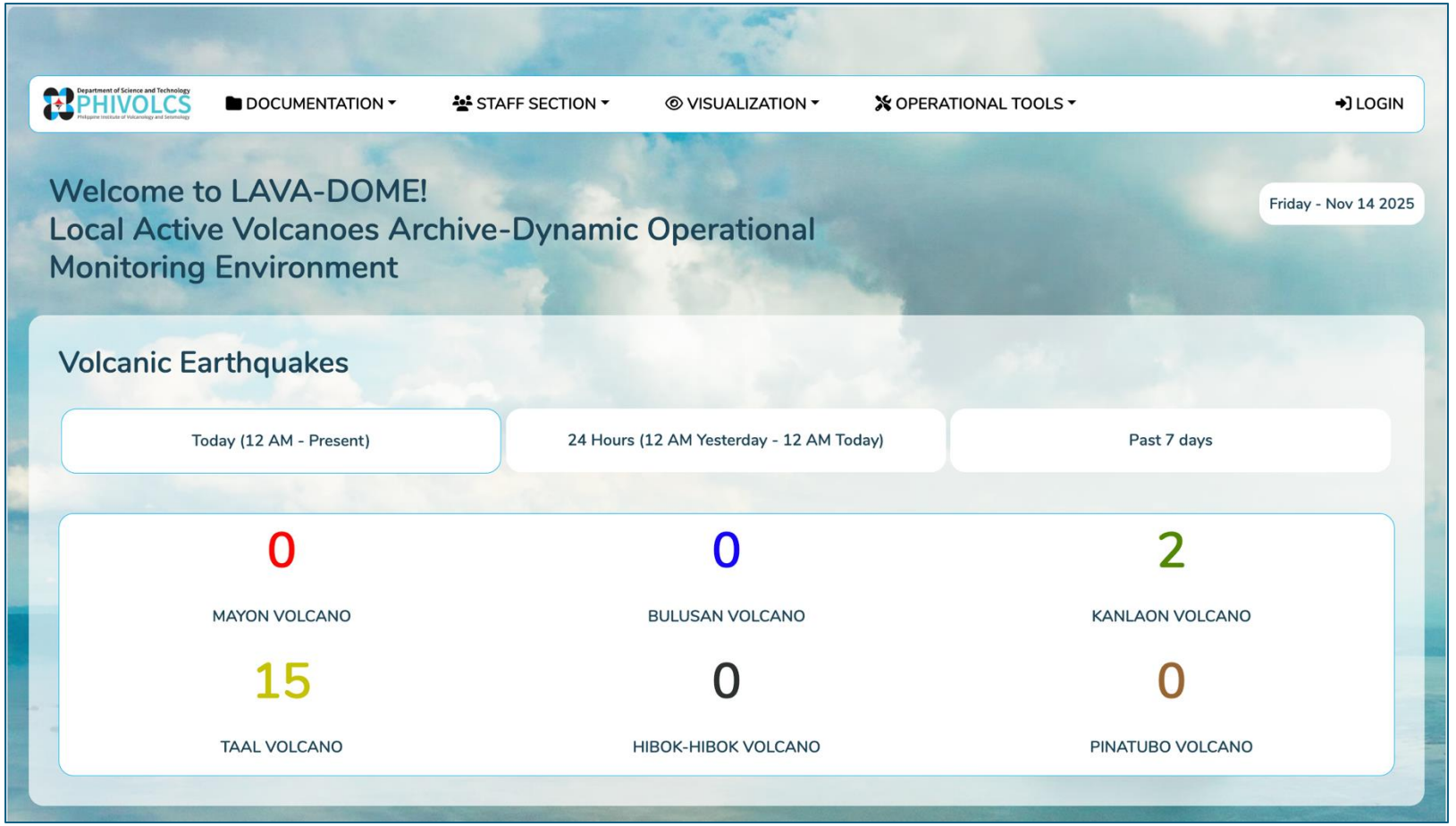
Routine Seismic processing



Relocation Data processing



LAVA-DOME
(**L**ocal **A**ctive **V**olcanoes **A**rchive – **D**ynamic **O**perational **M**onitoring **E**nvironment)

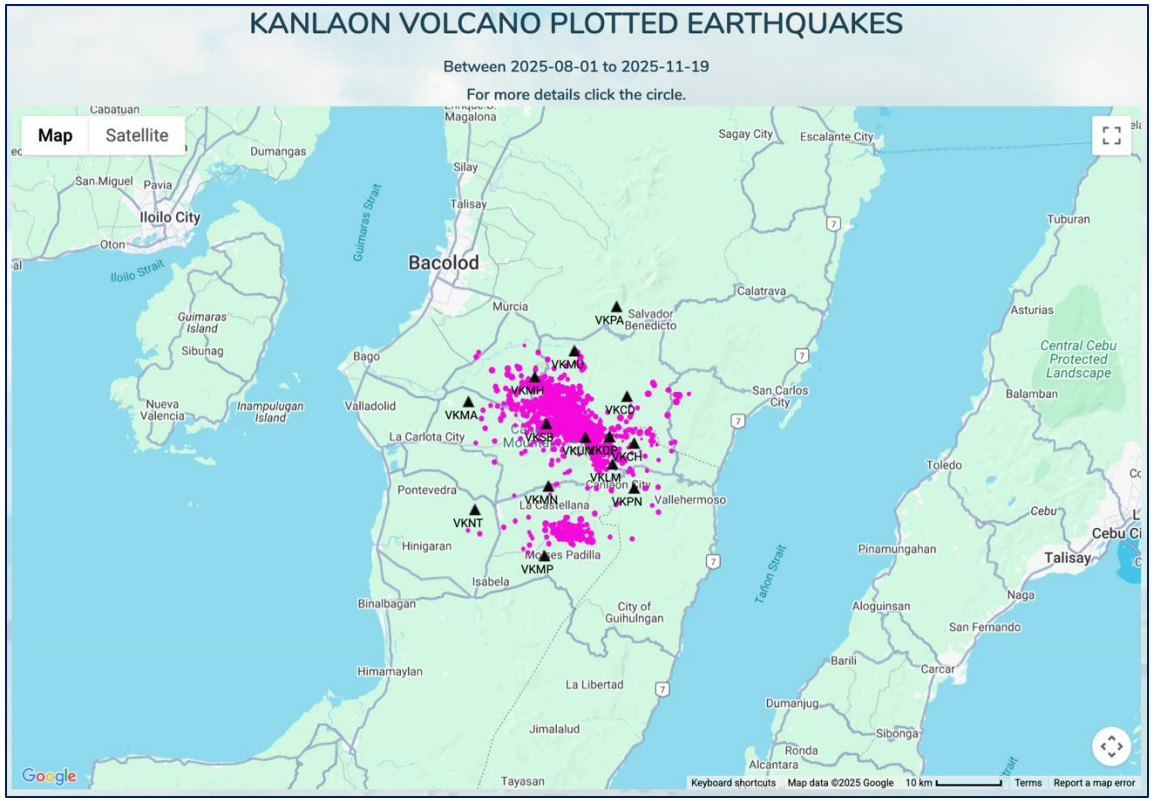


- **Archive of processed monitoring data (seismic, infrasound, deformation, geochemical, visual)**
- Bulletin infographics creation tool
- Philippine Volcanoes information resource

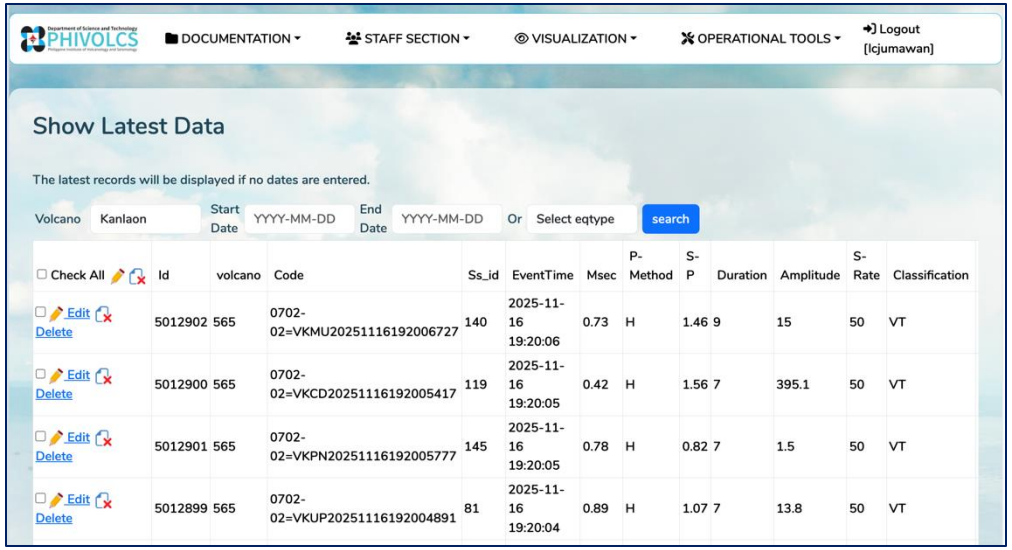
- Accessible to all volcano monitoring personnel in PHIVOLCS
- Fully integrated to SOP

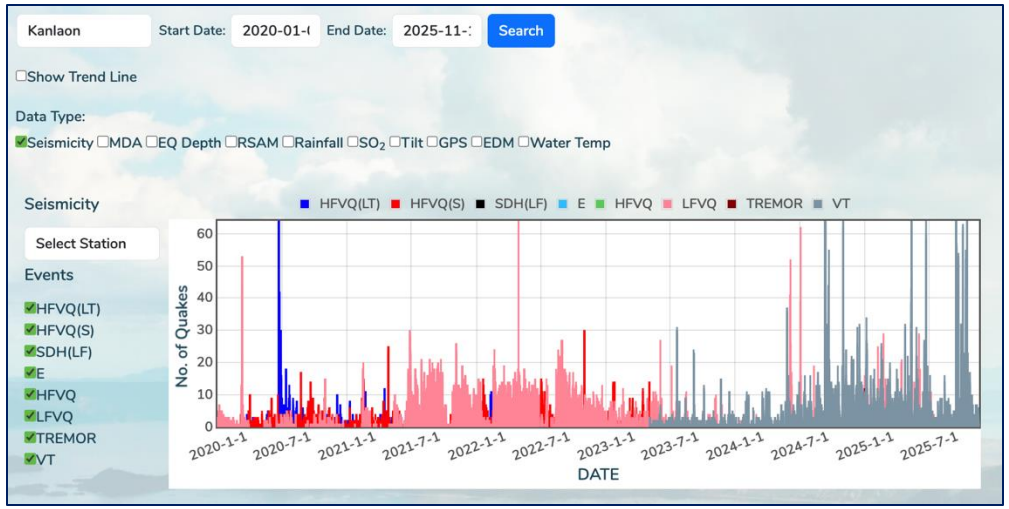
- Seismic data uploading is fully automated (one-click trigger or cron)

Seismicity map



Phase Reading

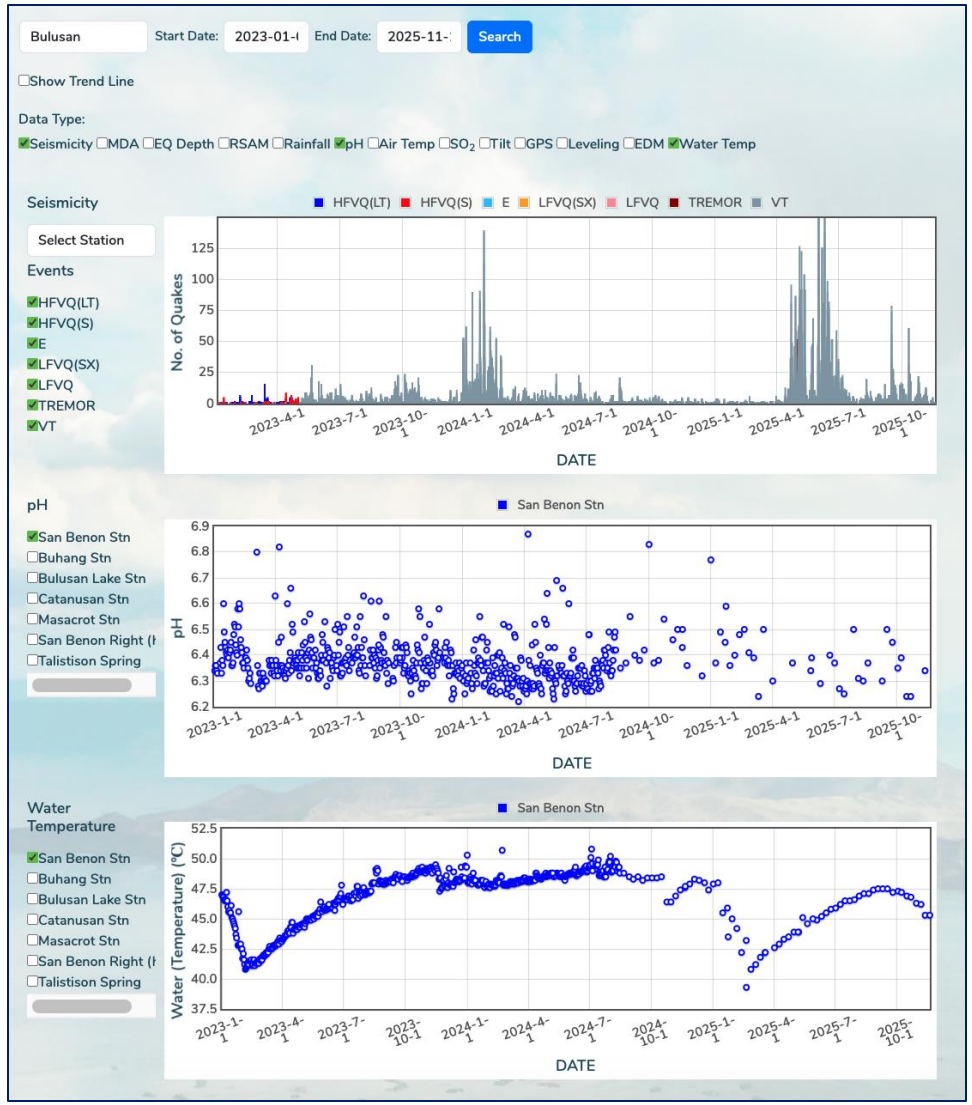




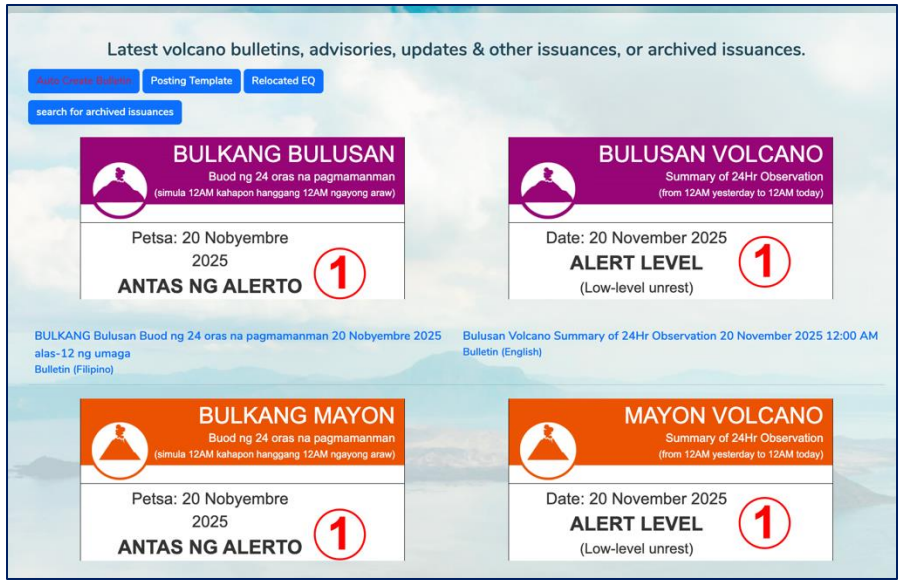
Earthquake counts

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	sd_evs_id	sd_evs_code	ss_id	sd_evs_time	sd_evs_time_	sd_evs_time_	sd_evs_time_	sd_evs_picks	sd_evs_spint	sd_evs_dur	sd_evs_dur_u	sd_evs_dist_	sd_evs_maxa	sd_evs_samp	sd_evs_eqtyp
2	5013905	0702-02=VKMN20251119011953451	80	19/11/2025 01:19	0.45			H	1.59	14			163.9	50	VT
3	5013906	0702-02=VKMH20251119011951393	77	19/11/2025 01:19	0.39			H		14			331.7	50	VT
4	5013907	0702-02=VKSB2025111901195152	78	19/11/2025 01:19	0.52			H	1.29	14			3376.1	50	VT
5	5013902	0702-02=VKNT2025111900404936	167	19/11/2025 00:40	0.36			H		14			9.4	50	VT
6	5013903	0702-02=VKSB2025111900404953	78	19/11/2025 00:40	0.53			H	2.39	12			517.6	50	VT
7	5013904	0702-02=VKQP2025111900404947	190	19/11/2025 00:40	0.47			H	1.84	18			80.6	50	VT
8	5013901	0702-02=VKMN2025111900404803	80	19/11/2025 00:40	0.03			H	1.78	10			240.2	50	VT
9	5013782	0702-02=VKNT2025111818515624	167	18/11/2025 18:51	0.24			H	18.45	49			18.2	50	TQ
10	5013781	0702-02=VKMP2025111818515572	181	18/11/2025 18:51	0.72			H	16.94	49			173.1	50	TQ
11	5013780	0702-02=VKMN2025111818515498	80	18/11/2025 18:51	0.98			H	14.64	47			119	50	TQ
12	5013779	0702-02=VKMH2025111181851535	77	18/11/2025 18:51	0.5			H	13.9	42			97.1	50	TQ
13	5013778	0702-02=VKQP2025111818515246	190	18/11/2025 18:51	0.46			H	14.53	44			360.7	50	TQ

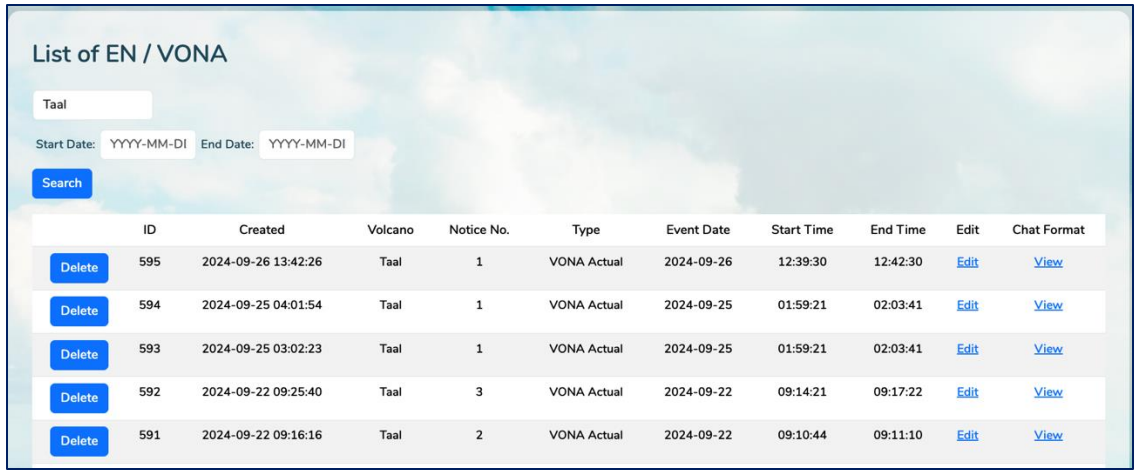
Downloaded data format



Multi-parameter plots



Bulletin creation tool

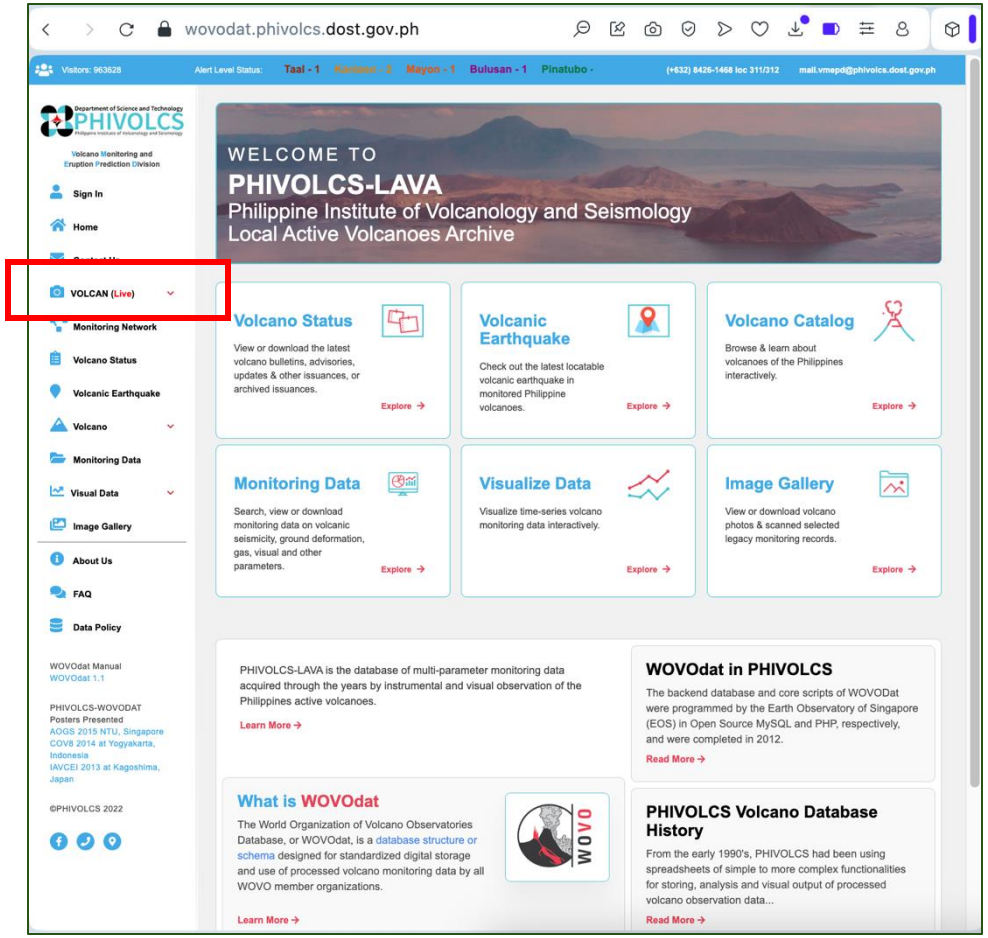


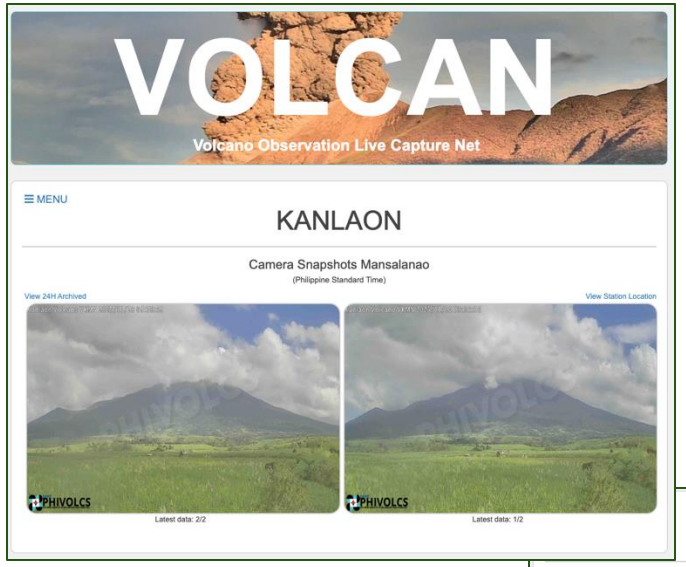
	ID	Created	Volcano	Notice No.	Type	Event Date	Start Time	End Time	Edit	Chat Format
Delete	595	2024-09-26 13:42:26	Taal	1	VONA Actual	2024-09-26	12:39:30	12:42:30	Edit	View
Delete	594	2024-09-25 04:01:54	Taal	1	VONA Actual	2024-09-25	01:59:21	02:03:41	Edit	View
Delete	593	2024-09-25 03:02:23	Taal	1	VONA Actual	2024-09-25	01:59:21	02:03:41	Edit	View
Delete	592	2024-09-22 09:25:40	Taal	3	VONA Actual	2024-09-22	09:14:21	09:17:22	Edit	View
Delete	591	2024-09-22 09:16:16	Taal	2	VONA Actual	2024-09-22	09:10:44	09:11:10	Edit	View

VONA creation and archiving tool

PHIVOLCS-LAVA

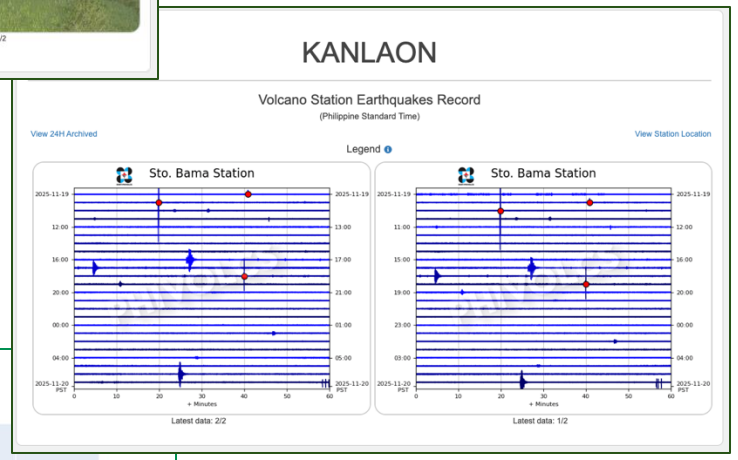
Public website for legacy data and near-realtime data from select stations

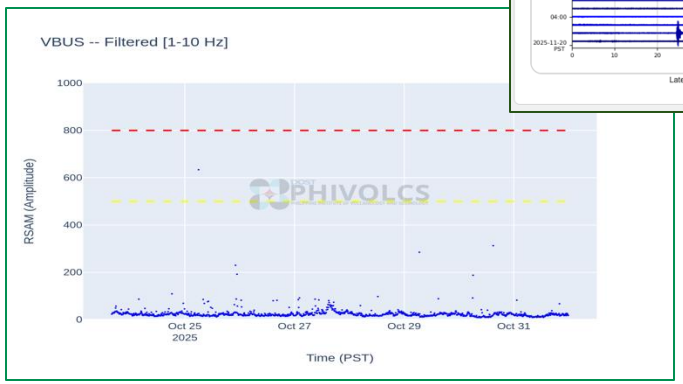




Select station images

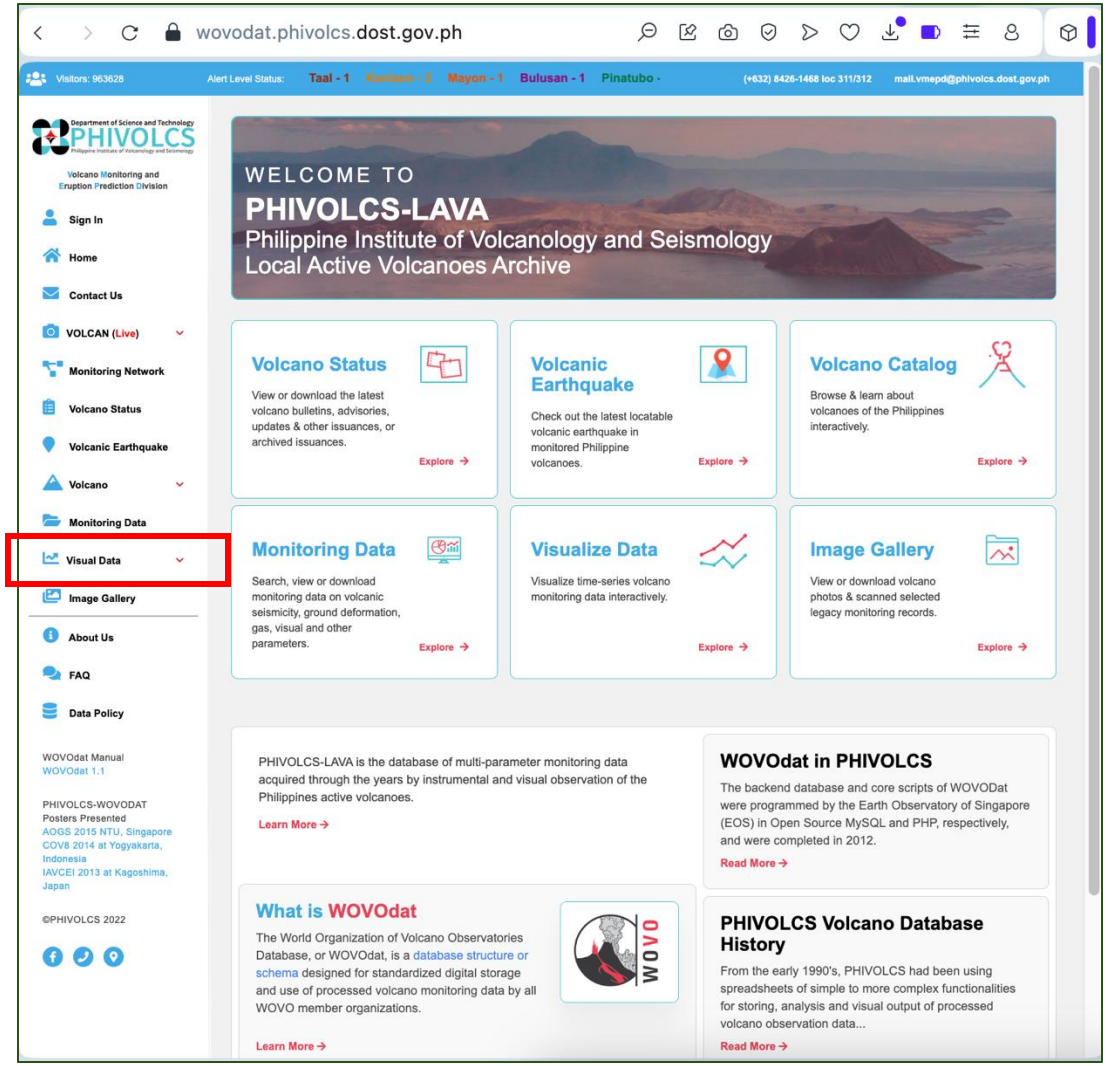
Reference station dayploy

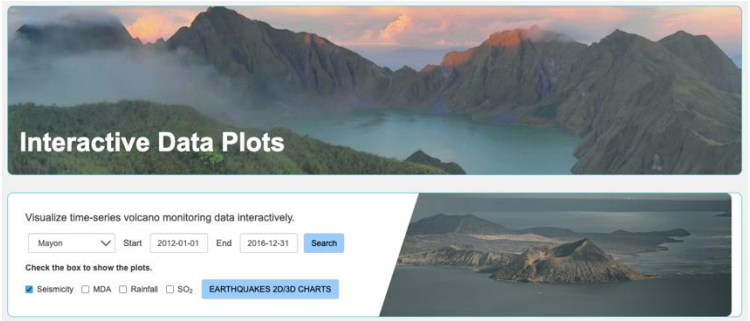


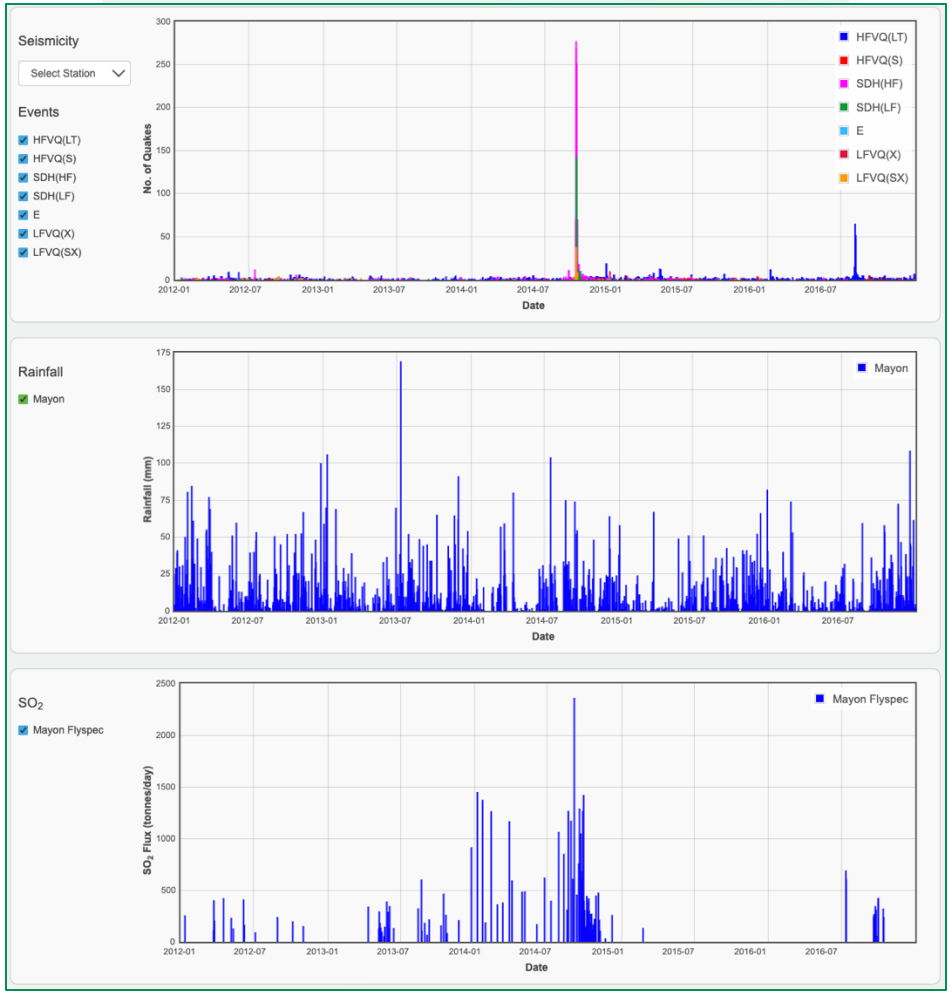


Reference station RSAM

PHIVOLCS-LAVA







Challenges/Future Work

1. Enhance data in database(s) without compromising operations
2. Implement AI or Machine Learning in workflows
3. Adapt new technologies into seismic processing procedures and address compromises made due to limited infrastructure

Thank you