GVMID Data on Volcano Monitoring Infrastructure

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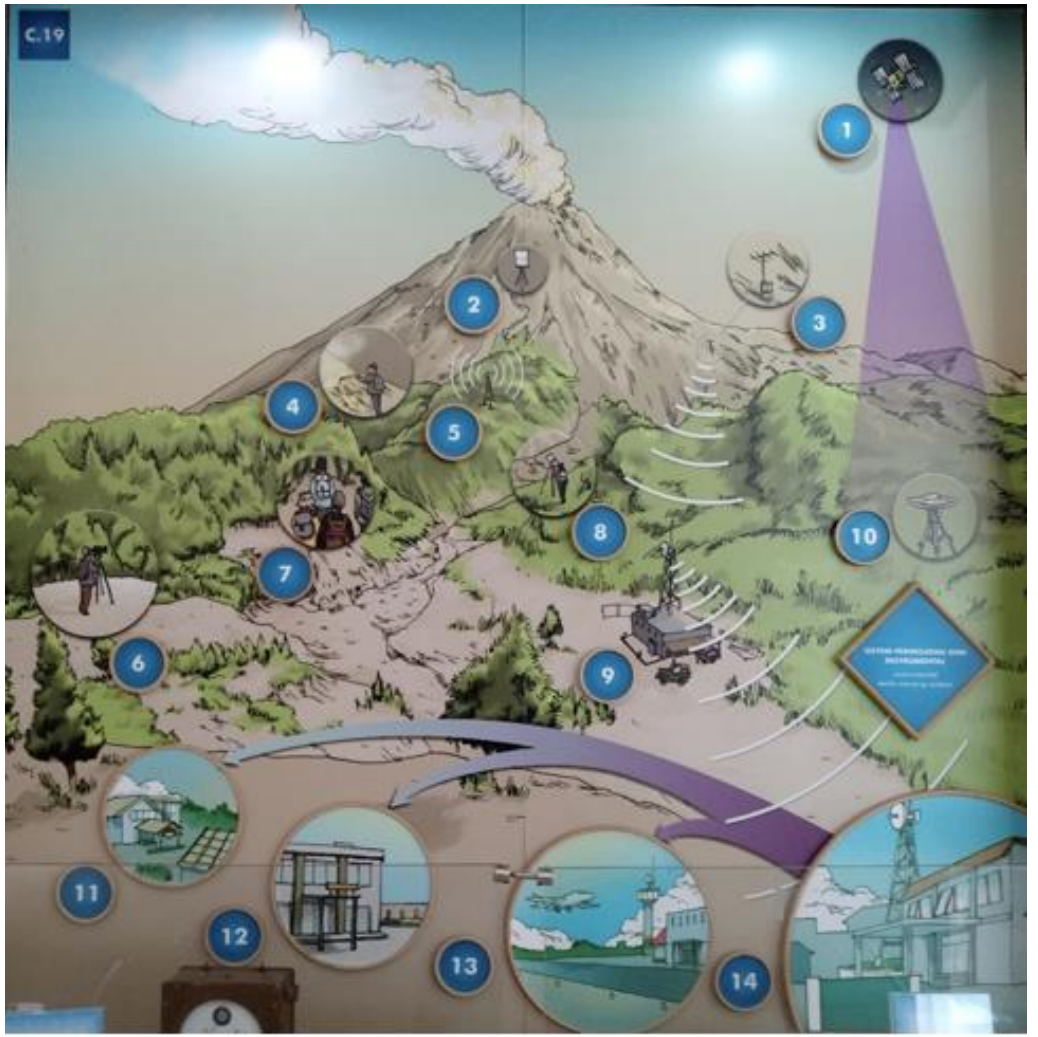
WOVOdat team



Source: Merapi Museum, Yogyakarta

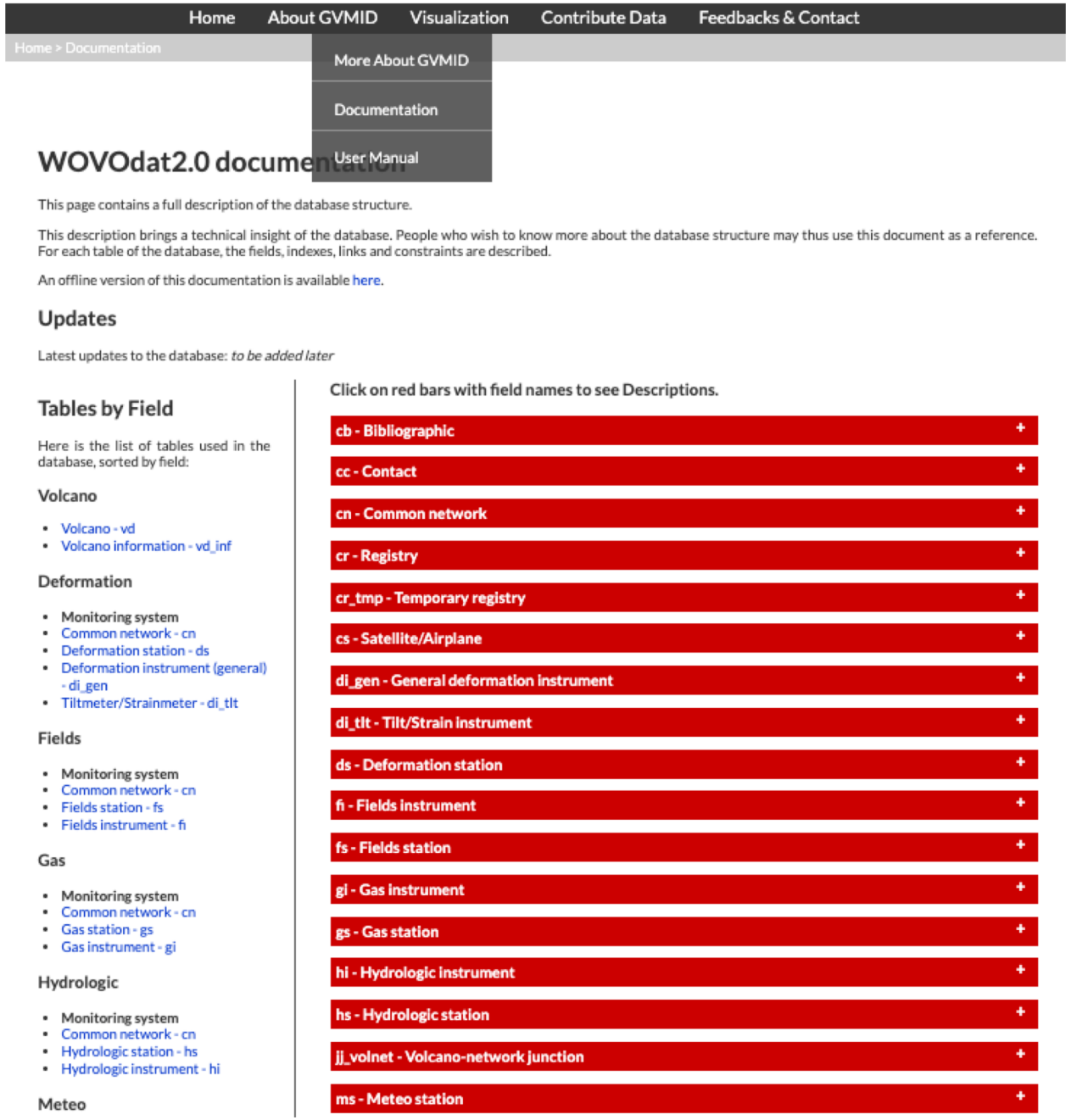
WOVOdat

EARTH OBSERVATORY OF SINGAPORE

NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

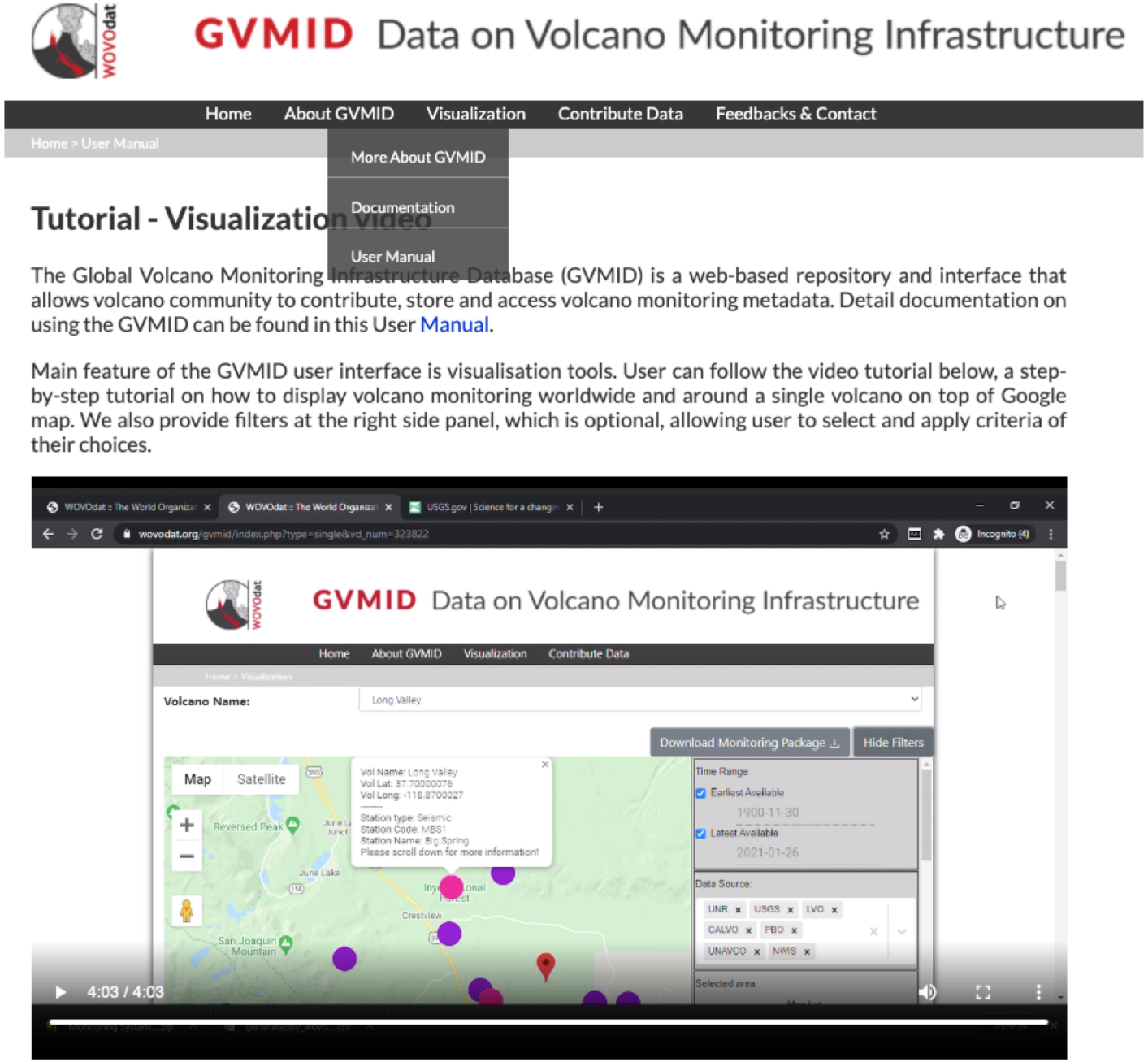
About GVMID > Documentation

- This page contains a full description of the database structure
- All data in GVMID archived and organized in a form of tables
- Detail table structure: the fields, indexes, links and constraints are described.



About GVMID > User Manual

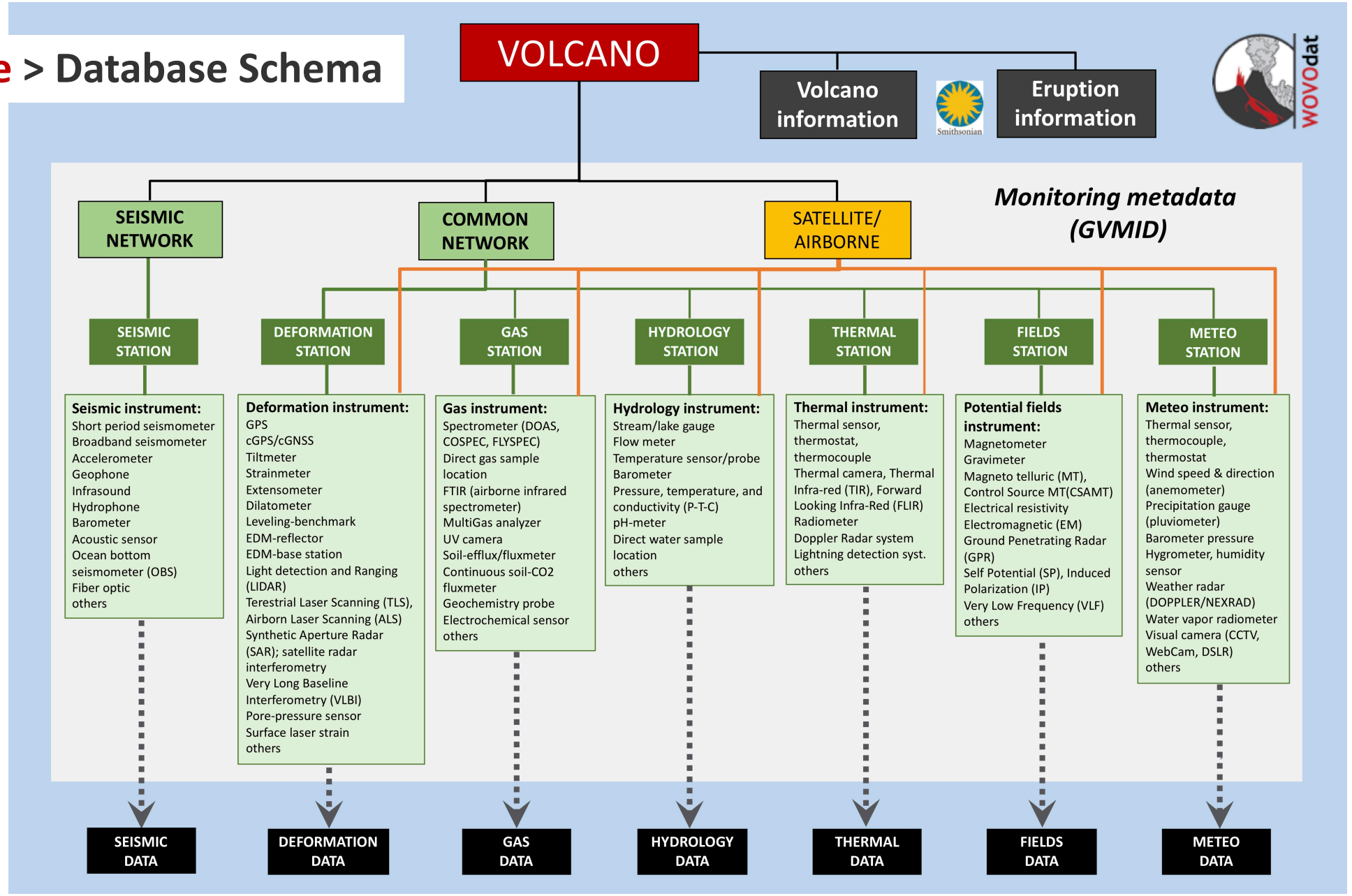
- GVMID User Manual
- Video tutorial:
  - ⇒ Data visualization
  - ⇒ Data search
  - ⇒ Data download



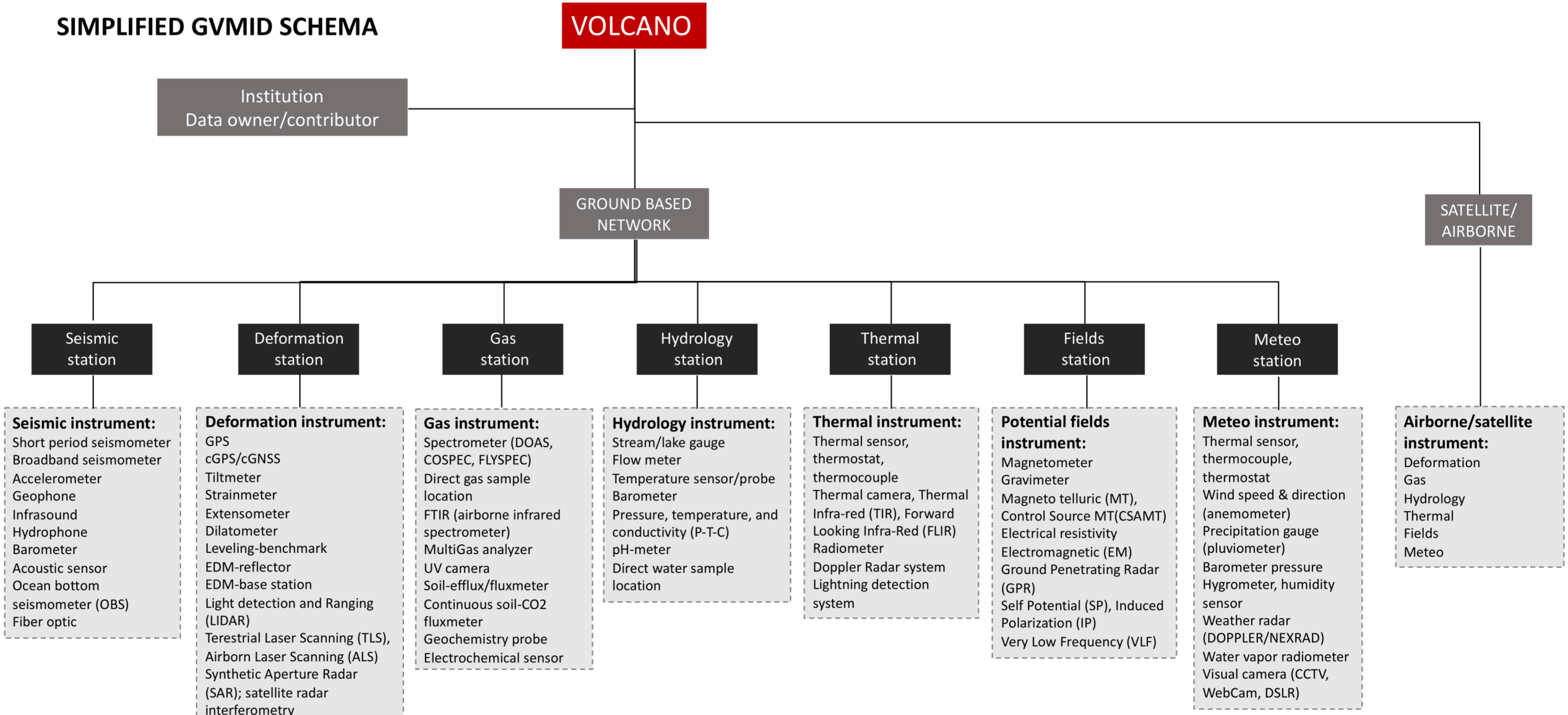
Datasets & Database > Database Schema

GVMID is being built:

- as integral part of WOVOdat, in parallel with other volcanological DBs
- can be linked to other database through *Volcano Number* (VNum, GVP' volcano unique identifier).



SIMPLIFIED GVMID SCHEMA

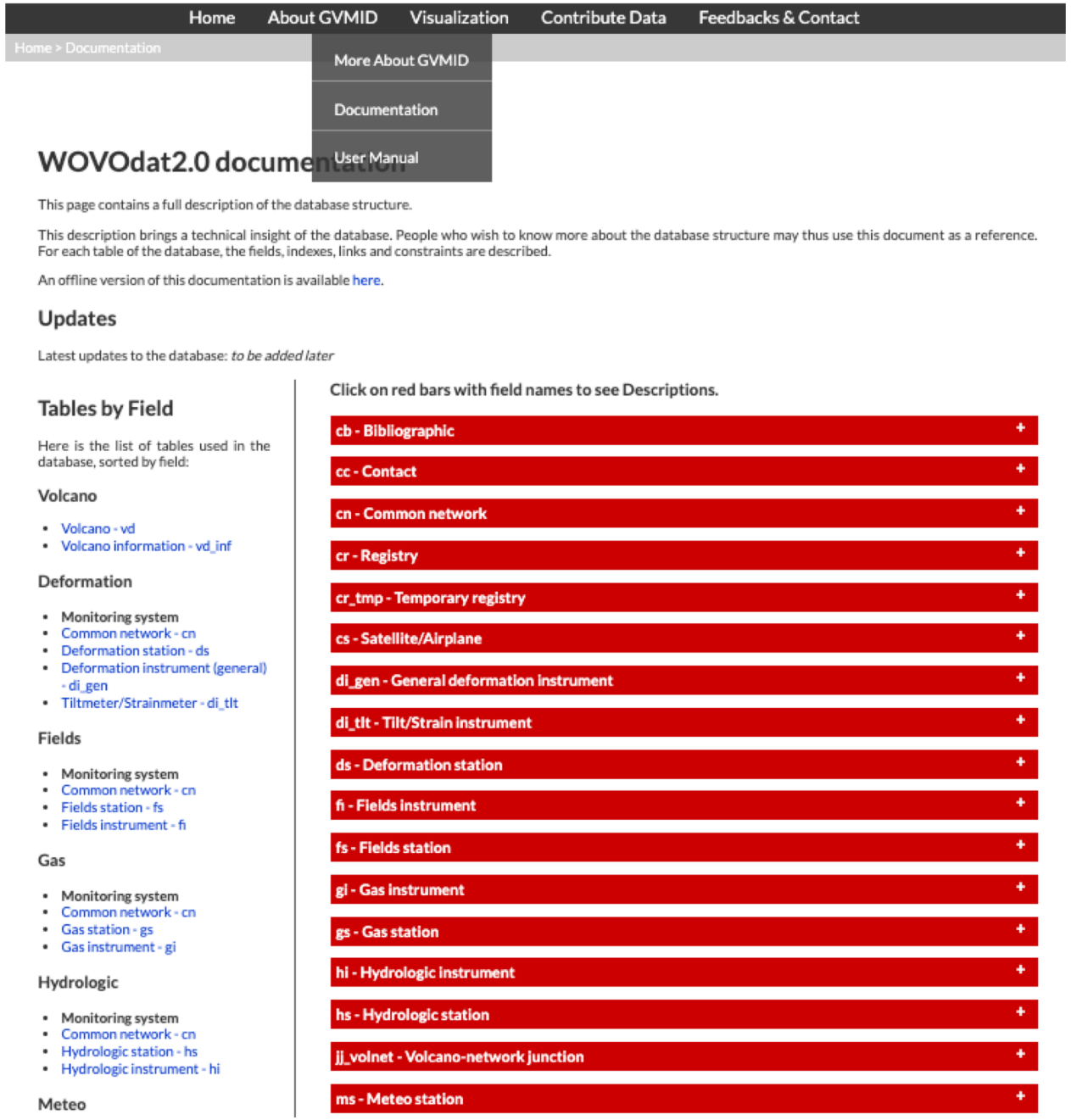


All data will be georeferenced, time stamped, and recorded with data source/owner

Datasets & Database > Table structure

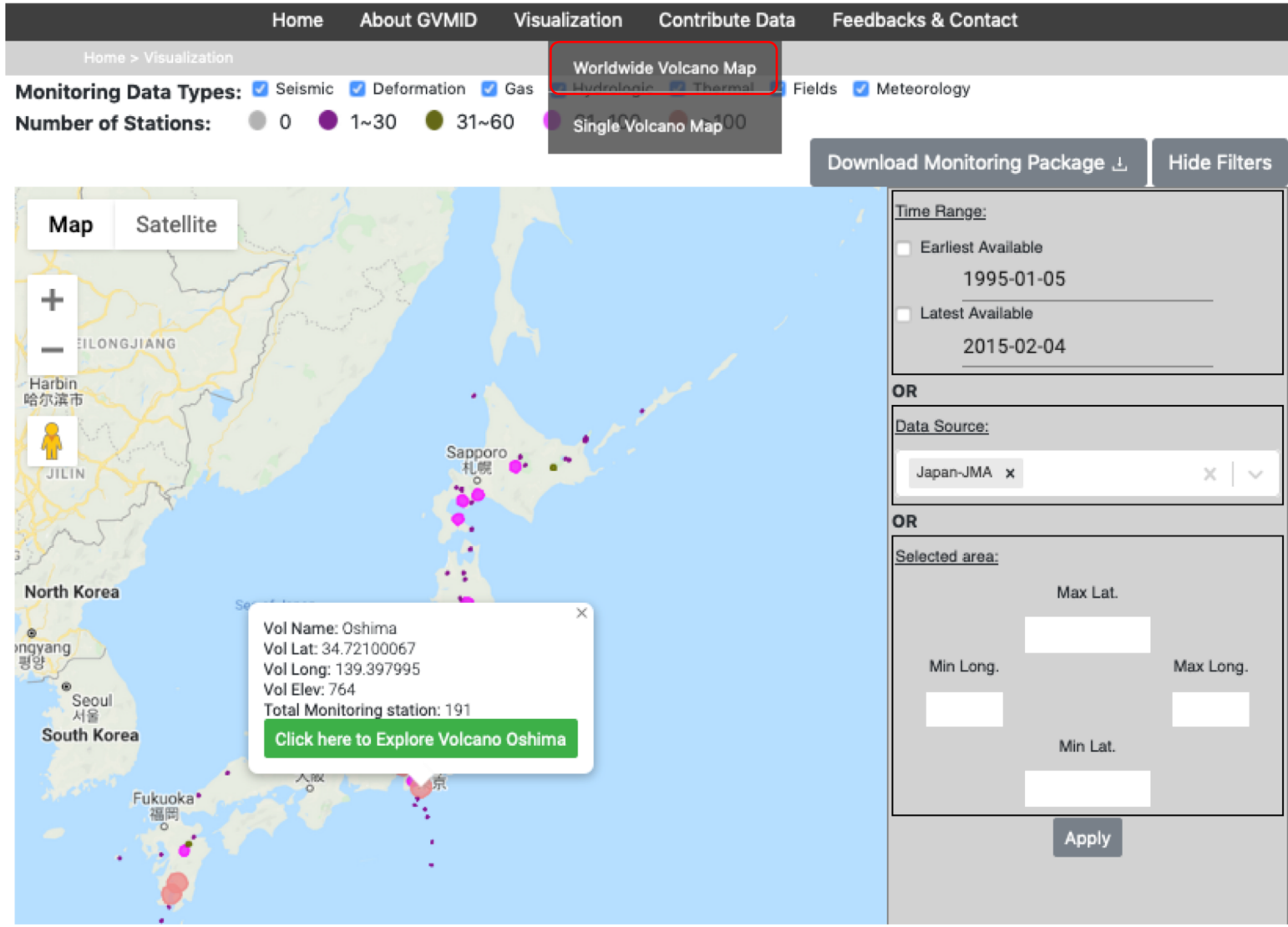
This page contains a full description of the database structure, for each table:

- the fields/elements,
- indexes,
- links and
- constraints



GVMID > Visualization & search

https://wovodat.org/gvmid/index.php?type=world



Currently there are 2 type of visualization level:

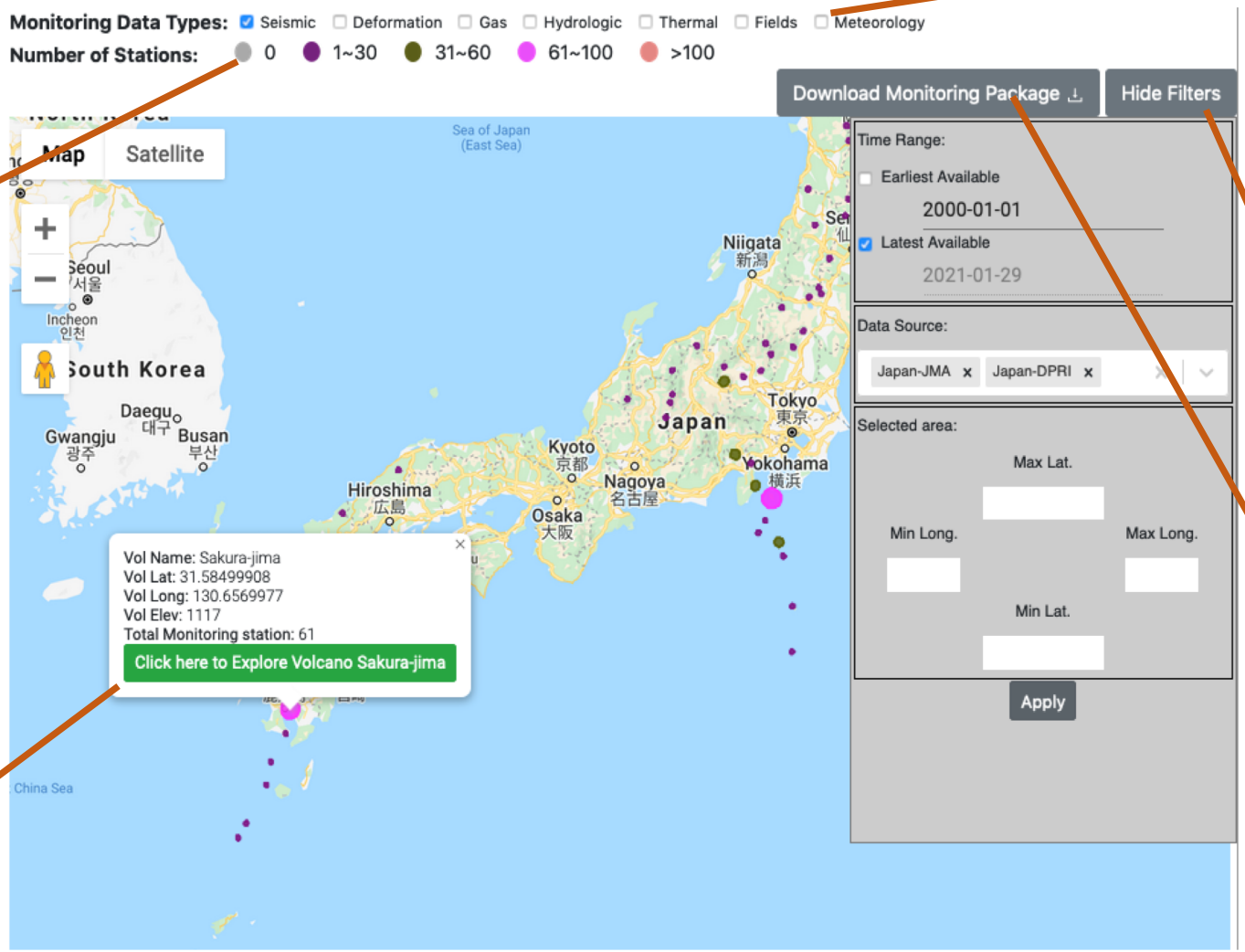
- Worldwide Volcano Map
- Single Volcano

Note:

- *Display all stations within 30km from volcano vent.*
- *No login required*
- *Filters are optional*

GVMID > Visualization& search > Worldwide volcano map

https://wovodat.org/gvmid/index.php?type=world



Check-box to select monitoring system.
- By default all selected
- User can select one or more

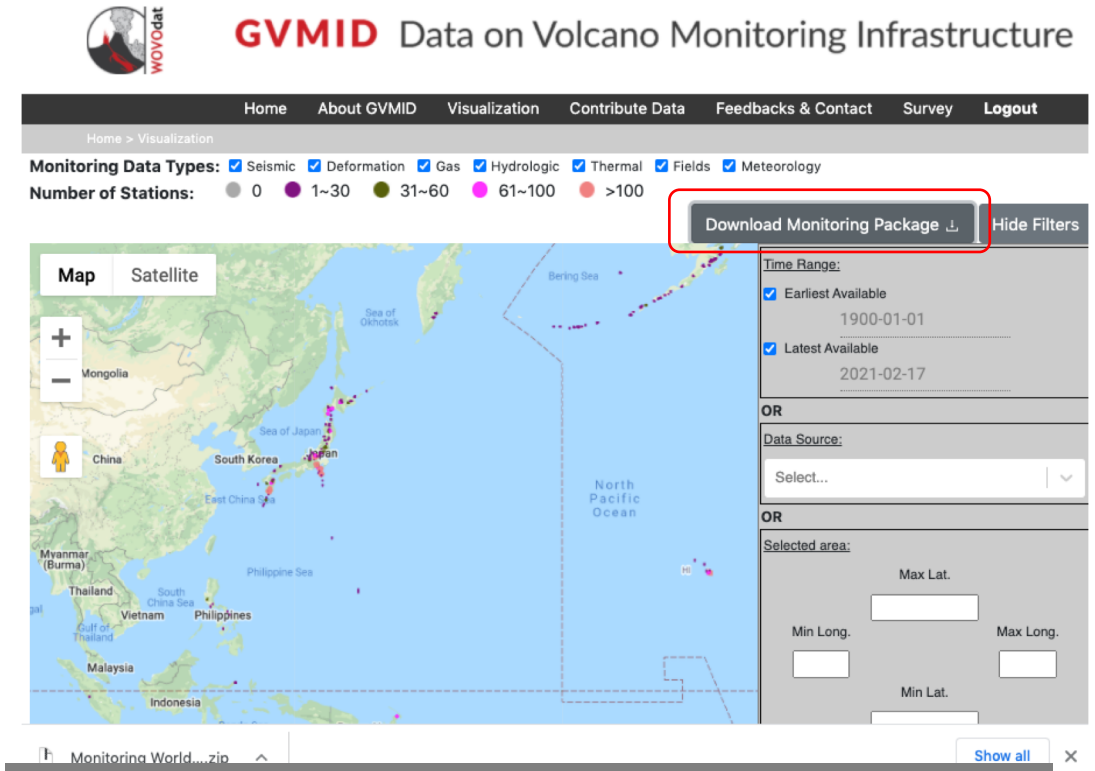
Different color reflects total number of stations of each volcano within 30km from the vent.

Filter function to select by time, data source and area. This is all optional

When clicking at the circle icon, a pop up window of single volcano will appear, directed to single volcano visualization

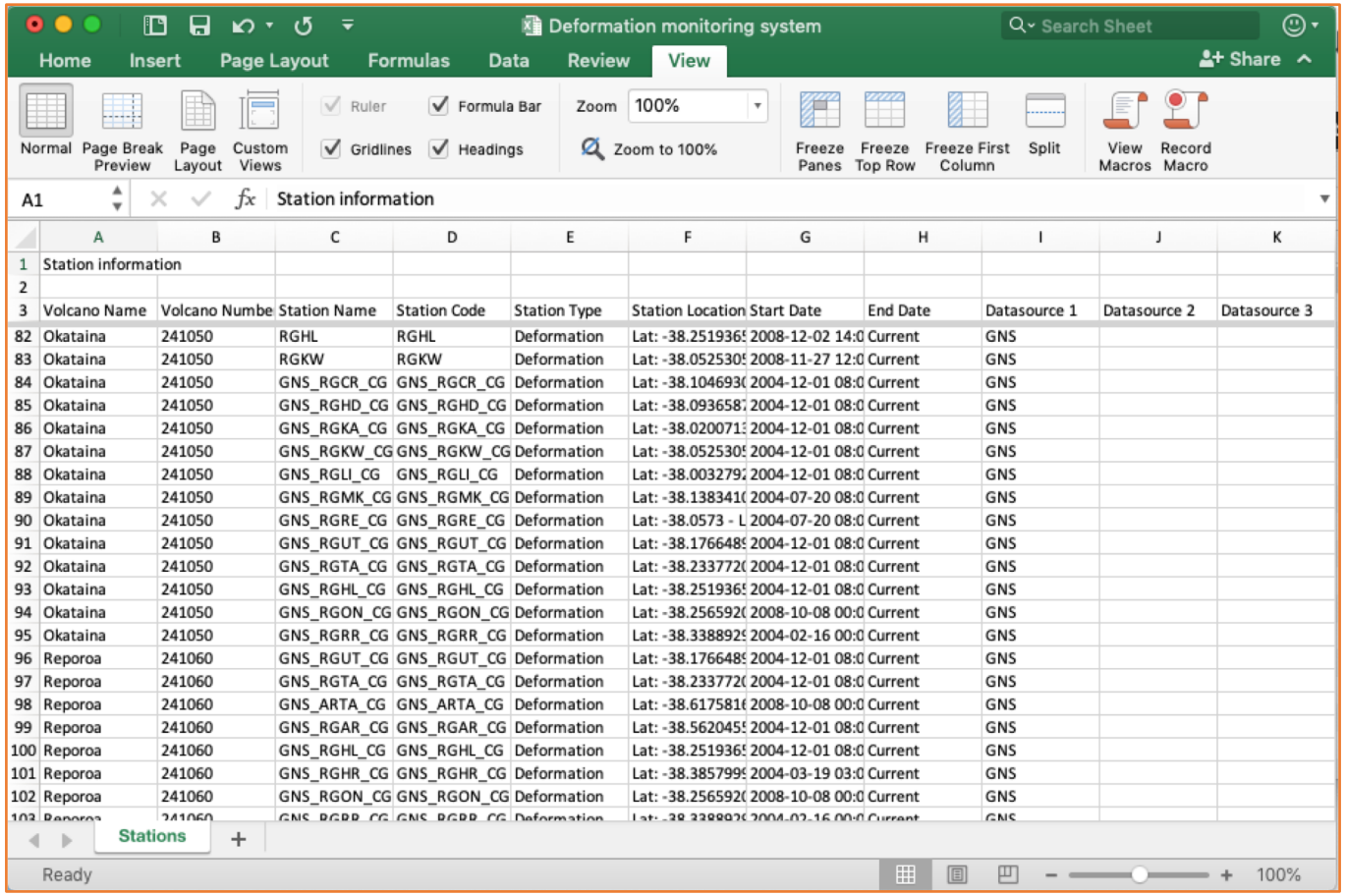
Download package up to station level, based on filter selection. By default, the package contain all data.

GVMID > Download monitoring package > Worldwide volcano map



Monitoring WorldWide System package from wovodat.zip

- Deformation monitoring system.xlsx
- Fields monitoring system.xlsx
- Gas monitoring system.xlsx
- Hydrologic monitoring system.xlsx
- Meteo monitoring system.xlsx
- Seismic monitoring system.xlsx
- Thermal monitoring system.xlsx



	A	B	C	D	E	F	G	H	I	J	K
1	Station information										
2											
3	Volcano Name	Volcano Numbe	Station Name	Station Code	Station Type	Station Location	Start Date	End Date	Datasource 1	Datasource 2	Datasource 3
82	Okataina	241050	RGHL	RGHL	Deformation	Lat: -38.2519365	2008-12-02 14:0	Current	GNS		
83	Okataina	241050	RGKW	RGKW	Deformation	Lat: -38.0525305	2008-11-27 12:0	Current	GNS		
84	Okataina	241050	GNS_RGCR_CG	GNS_RGCR_CG	Deformation	Lat: -38.1046936	2004-12-01 08:0	Current	GNS		
85	Okataina	241050	GNS_RGHD_CG	GNS_RGHD_CG	Deformation	Lat: -38.0936587	2004-12-01 08:0	Current	GNS		
86	Okataina	241050	GNS_RGKA_CG	GNS_RGKA_CG	Deformation	Lat: -38.0200713	2004-12-01 08:0	Current	GNS		
87	Okataina	241050	GNS_RGKW_CG	GNS_RGKW_CG	Deformation	Lat: -38.0525305	2004-12-01 08:0	Current	GNS		
88	Okataina	241050	GNS_RGLI_CG	GNS_RGLI_CG	Deformation	Lat: -38.0032792	2004-12-01 08:0	Current	GNS		
89	Okataina	241050	GNS_RGMK_CG	GNS_RGMK_CG	Deformation	Lat: -38.1383416	2004-07-20 08:0	Current	GNS		
90	Okataina	241050	GNS_RGRE_CG	GNS_RGRE_CG	Deformation	Lat: -38.0573 - L	2004-07-20 08:0	Current	GNS		
91	Okataina	241050	GNS_RGUT_CG	GNS_RGUT_CG	Deformation	Lat: -38.1766485	2004-12-01 08:0	Current	GNS		
92	Okataina	241050	GNS_RGTA_CG	GNS_RGTA_CG	Deformation	Lat: -38.2337726	2004-12-01 08:0	Current	GNS		
93	Okataina	241050	GNS_RGHL_CG	GNS_RGHL_CG	Deformation	Lat: -38.2519365	2004-12-01 08:0	Current	GNS		
94	Okataina	241050	GNS_RGON_CG	GNS_RGON_CG	Deformation	Lat: -38.2565926	2008-10-08 00:0	Current	GNS		
95	Okataina	241050	GNS_RGRR_CG	GNS_RGRR_CG	Deformation	Lat: -38.3388925	2004-02-16 00:0	Current	GNS		
96	Reporoa	241060	GNS_RGUT_CG	GNS_RGUT_CG	Deformation	Lat: -38.1766485	2004-12-01 08:0	Current	GNS		
97	Reporoa	241060	GNS_RGTA_CG	GNS_RGTA_CG	Deformation	Lat: -38.2337726	2004-12-01 08:0	Current	GNS		
98	Reporoa	241060	GNS_ARTA_CG	GNS_ARTA_CG	Deformation	Lat: -38.6175816	2008-10-08 00:0	Current	GNS		
99	Reporoa	241060	GNS_RGAR_CG	GNS_RGAR_CG	Deformation	Lat: -38.5620455	2004-12-01 08:0	Current	GNS		
100	Reporoa	241060	GNS_RGHL_CG	GNS_RGHL_CG	Deformation	Lat: -38.2519365	2004-12-01 08:0	Current	GNS		
101	Reporoa	241060	GNS_RGHR_CG	GNS_RGHR_CG	Deformation	Lat: -38.3857995	2004-03-19 03:0	Current	GNS		
102	Reporoa	241060	GNS_RGON_CG	GNS_RGON_CG	Deformation	Lat: -38.2565926	2008-10-08 00:0	Current	GNS		

Download monitoring package for "worldwide volcano"

- *Zip file with Excel spreadsheet files representing different monitoring techniques*
- *Each monitoring technique will have list of stations*

GVMID > Visualization & search > Single volcano map

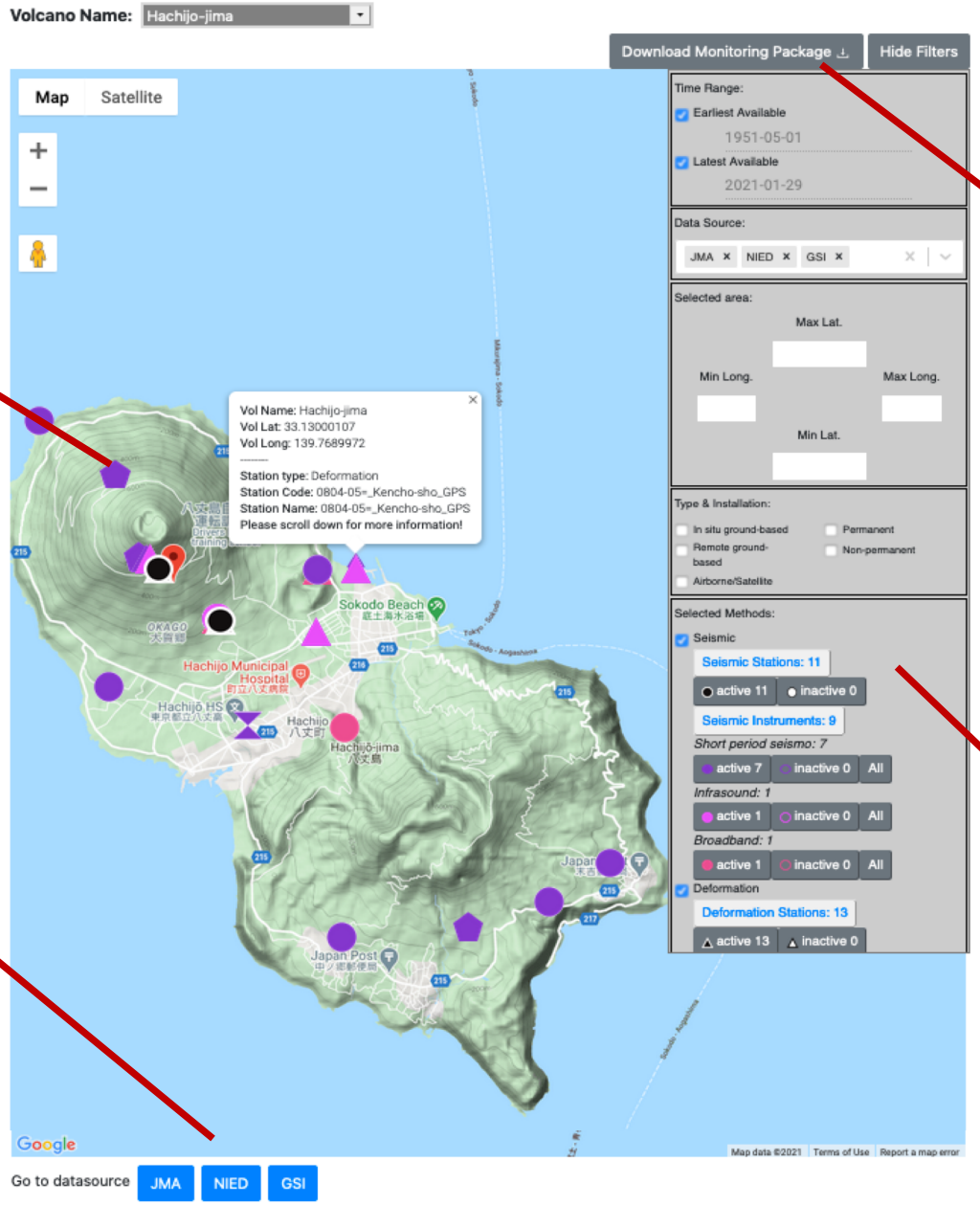
Different icons reflect different station and instrument

Download package up to instrument level, based on filter selection. By default, the package contain all data for selected volcano.

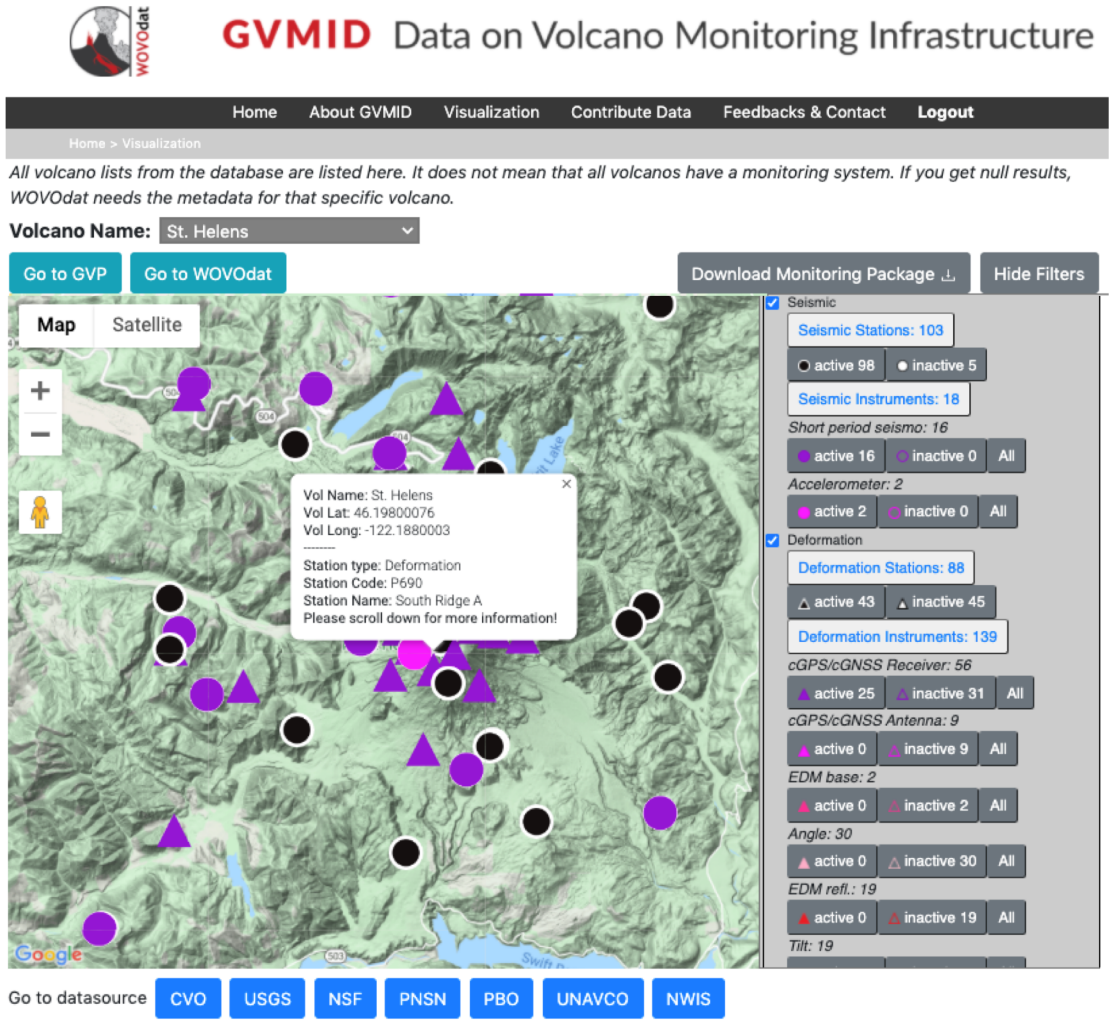
Filter panel to select:
- Time range
- Data source
- Selected area
- Type of installation
- Installation status
- Monitoring method
- instrument type

Link to data contributor

https://wovodat.org/gvmid/index.php?type=single&vd_num=284050



GVMID > Visualization & search > Single volcano map



Station Information

Volcano	St. Helens
Volcano Location	Lat: 46.19800076 - Lon: -122.1880003
Volcano Elevation	2549
Station Type	Deformation
Station Name	South Ridge A
Station Code	P690
Station Location	Lat: 46.1801 - Lon: -122.1898
Station Elevation	2091
Station Installation Type	Permanent
Station Start Date	2005-01-25 12:00:25
Station End Date	Current
Datasource 1	USGS
Datasource 2	CVO
Datasource 3	PBO

Example of single volcano visualization tool for St. Helens displaying popup box of deformation station P690, where cGPS/cGNSS and tiltmeter instruments were installed.

General Instruments:

Name	Type	Type Abbrev.	Installation Place	Start Date	End Date	Description
P690_CGPSD	cGPS/cGNSS Receiver	cGPS/cGNSS Receiver	In situ ground-based	2005-01-25 12:00:00	Current	

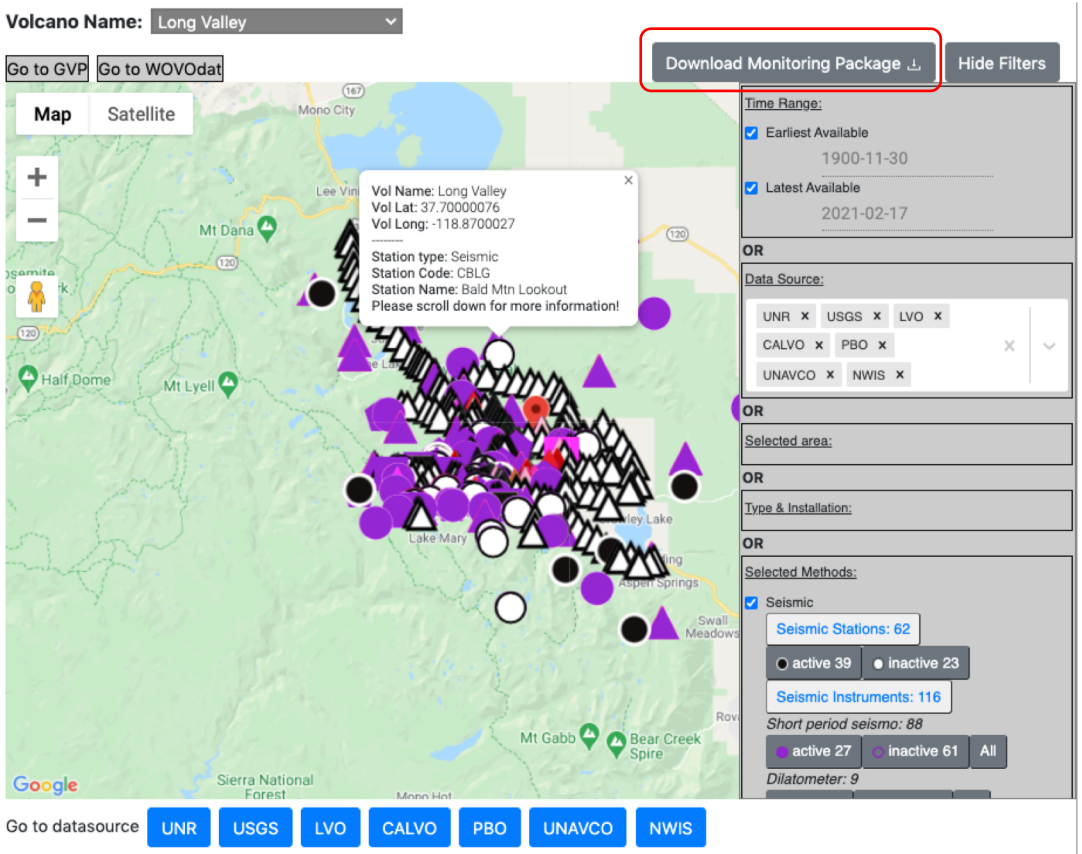
Tilt Instruments:

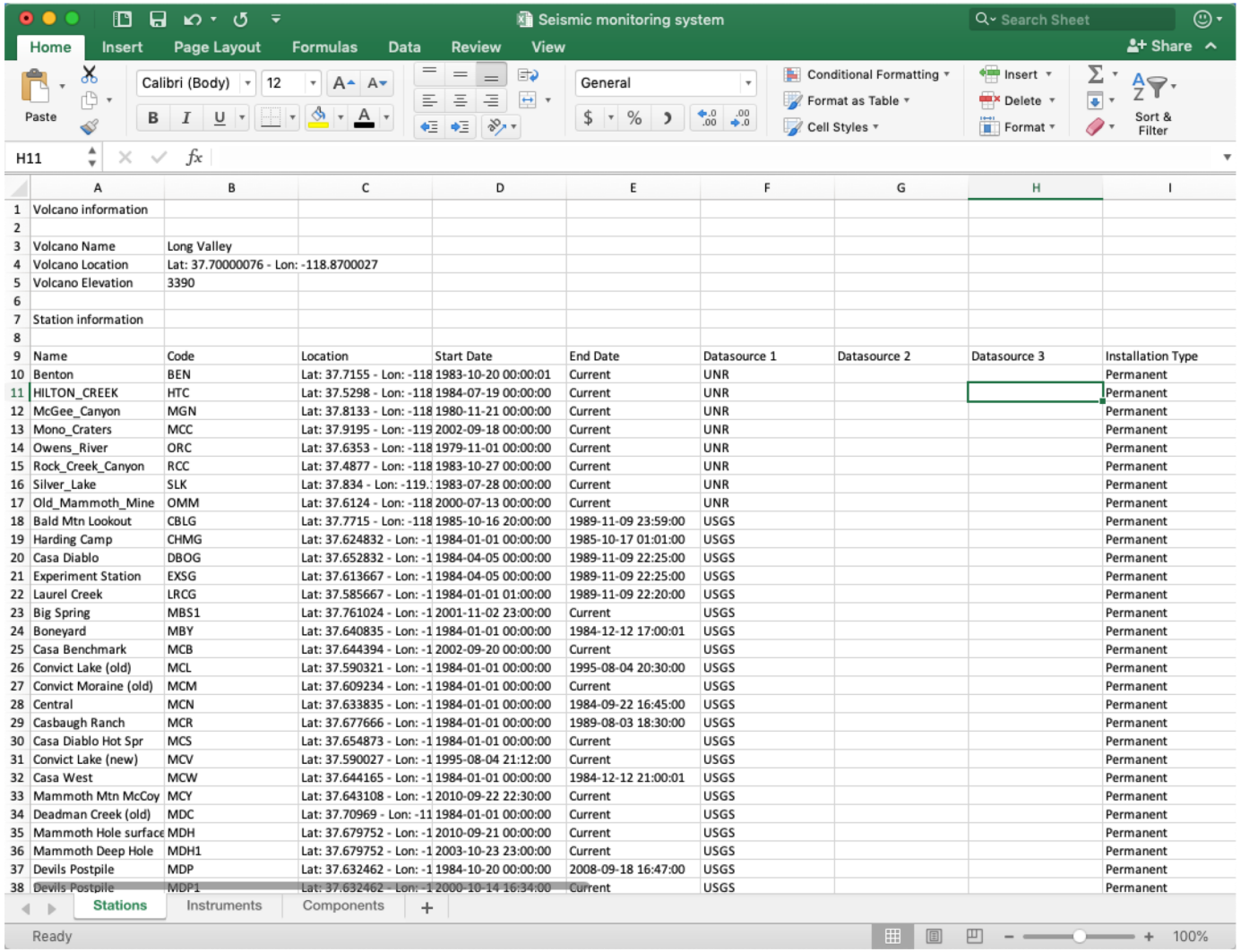
Name	Type	Type Abbrev.	Installation Place	Start Date	End Date	Description
P690_BTS	Tiltmeter	Tilt	In situ ground-based	2005-02-01 12:00:00	Current	

Export to CSV

To download data:
- *the detail information on selected station and instrument by clicking blue button **"Export to CSV"***
- *the entire monitoring infrastructure metadata of the volcano by clicking at **"Download Monitoring Package"***

GVMID > Download monitoring package > Single volcano map





	A	B	C	D	E	F	G	H	I
1	Volcano information								
2									
3	Volcano Name	Long Valley							
4	Volcano Location	Lat: 37.70000076 - Lon: -118.8700027							
5	Volcano Elevation	3390							
6									
7	Station information								
8									
9	Name	Code	Location	Start Date	End Date	Datasource 1	Datasource 2	Datasource 3	Installation Type
10	Benton	BEN	Lat: 37.7155 - Lon: -118	1983-10-20 00:00:01	Current	UNR			Permanent
11	HILTON_CREEK	HTC	Lat: 37.5298 - Lon: -118	1984-07-19 00:00:00	Current	UNR			Permanent
12	McGee_Canyon	MGN	Lat: 37.8133 - Lon: -118	1980-11-21 00:00:00	Current	UNR			Permanent
13	Mono_Craters	MCC	Lat: 37.9195 - Lon: -119	2002-09-18 00:00:00	Current	UNR			Permanent
14	Owens_River	ORC	Lat: 37.6353 - Lon: -118	1979-11-01 00:00:00	Current	UNR			Permanent
15	Rock_Creek_Canyon	RCC	Lat: 37.4877 - Lon: -118	1983-10-27 00:00:00	Current	UNR			Permanent
16	Silver_Lake	SLK	Lat: 37.834 - Lon: -119.	1983-07-28 00:00:00	Current	UNR			Permanent
17	Old_Mammoth_Mine	OMM	Lat: 37.6124 - Lon: -118	2000-07-13 00:00:00	Current	UNR			Permanent
18	Bald Mtn Lookout	CBLG	Lat: 37.7715 - Lon: -118	1985-10-16 20:00:00	1989-11-09 23:59:00	USGS			Permanent
19	Harding Camp	CHMG	Lat: 37.624832 - Lon: -1	1984-01-01 00:00:00	1985-10-17 01:01:00	USGS			Permanent
20	Casa Diablo	DBOG	Lat: 37.652832 - Lon: -1	1984-04-05 00:00:00	1989-11-09 22:25:00	USGS			Permanent
21	Experiment Station	EXSG	Lat: 37.613667 - Lon: -1	1984-04-05 00:00:00	1989-11-09 22:25:00	USGS			Permanent
22	Laurel Creek	LRCG	Lat: 37.585667 - Lon: -1	1984-01-01 01:00:00	1989-11-09 22:20:00	USGS			Permanent
23	Big Spring	MBS1	Lat: 37.761024 - Lon: -1	2001-11-02 23:00:00	Current	USGS			Permanent
24	Boneyard	MBY	Lat: 37.640835 - Lon: -1	1984-01-01 00:00:00	1984-12-12 17:00:01	USGS			Permanent
25	Casa Benchmark	MCB	Lat: 37.644394 - Lon: -1	2002-09-20 00:00:00	Current	USGS			Permanent
26	Convict Lake (old)	MCL	Lat: 37.590321 - Lon: -1	1984-01-01 00:00:00	1995-08-04 20:30:00	USGS			Permanent
27	Convict Moraine (old)	MCM	Lat: 37.609234 - Lon: -1	1984-01-01 00:00:00	Current	USGS			Permanent
28	Central	MCN	Lat: 37.633835 - Lon: -1	1984-01-01 00:00:00	1984-09-22 16:45:00	USGS			Permanent
29	Casbaugh Ranch	MCR	Lat: 37.677666 - Lon: -1	1984-01-01 00:00:00	1989-08-03 18:30:00	USGS			Permanent
30	Casa Diablo Hot Spr	MCS	Lat: 37.654873 - Lon: -1	1984-01-01 00:00:00	Current	USGS			Permanent
31	Convict Lake (new)	MCV	Lat: 37.590027 - Lon: -1	1995-08-04 21:12:00	Current	USGS			Permanent
32	Casa West	MCW	Lat: 37.644165 - Lon: -1	1984-01-01 00:00:00	1984-12-12 21:00:01	USGS			Permanent
33	Mammoth Mtn McCoy	MCY	Lat: 37.643108 - Lon: -1	2010-09-22 22:30:00	Current	USGS			Permanent
34	Deadman Creek (old)	MDC	Lat: 37.70969 - Lon: -11	1984-01-01 00:00:00	Current	USGS			Permanent
35	Mammoth Hole surface	MDH	Lat: 37.679752 - Lon: -1	2010-09-21 00:00:00	Current	USGS			Permanent
36	Mammoth Deep Hole	MDH1	Lat: 37.679752 - Lon: -1	2003-10-23 23:00:00	Current	USGS			Permanent
37	Devils Postpile	MDP	Lat: 37.632462 - Lon: -1	1984-10-20 00:00:00	2008-09-18 16:47:00	USGS			Permanent
38	Devils Postpile	MDP1	Lat: 37.632462 - Lon: -1	2000-10-14 16:34:00	Current	USGS			Permanent

Monitoring System package from wovodat.zip

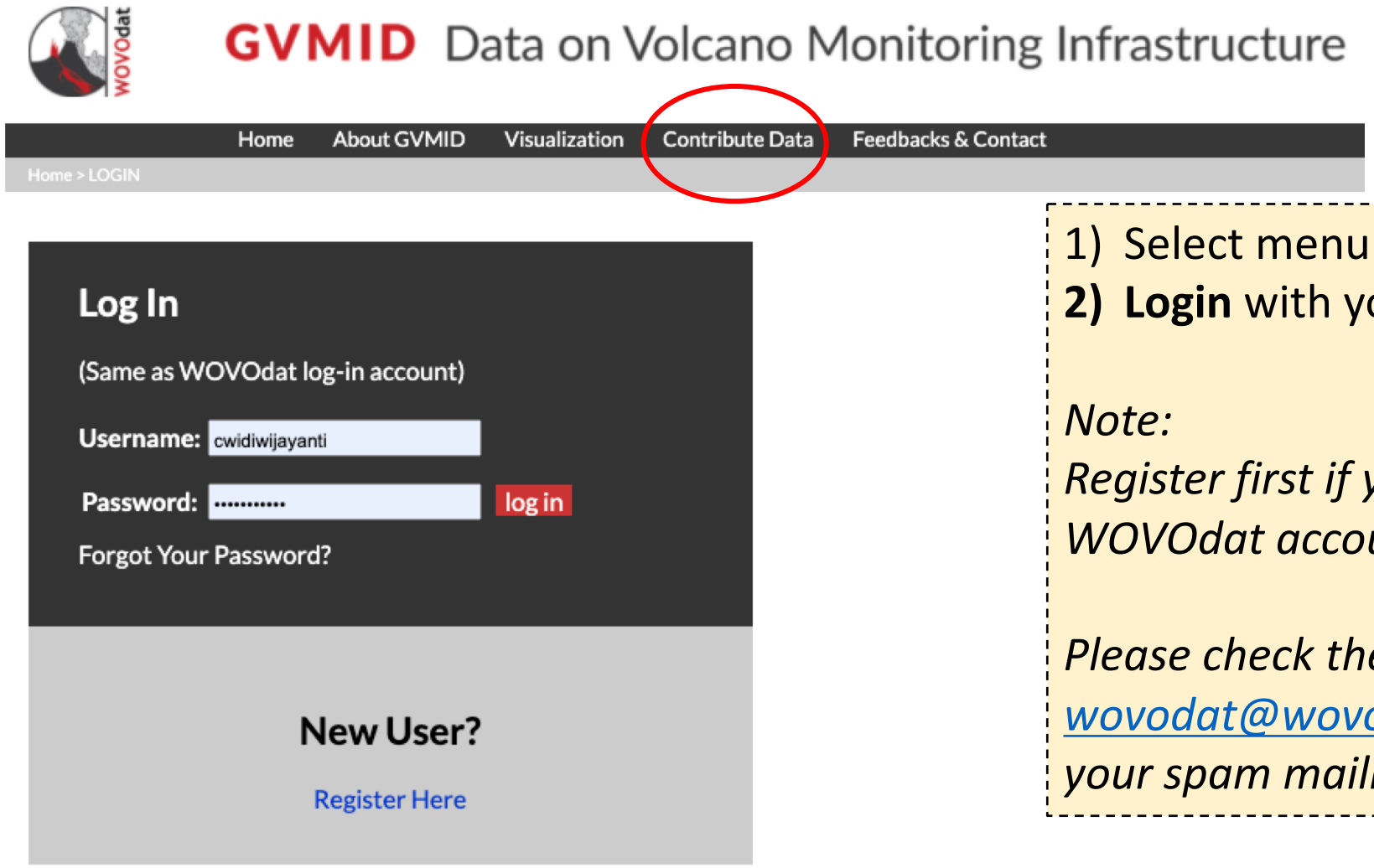
- Deformation monitoring system.xlsx
- Fields monitoring system.xlsx
- Gas monitoring system.xlsx
- Hydrologic monitoring system.xlsx
- Meteo monitoring system.xlsx
- Seismic monitoring system.xlsx
- Thermal monitoring system.xlsx

Download monitoring package for "single volcano"

- *Zip file with Excel spreadsheet files representing different monitoring techniques*
- *Each monitoring technique will have list of stations & instruments*

GVMID > Contribute Data

https://wovodat.org/populate/index_gvmid.php



1) Select menu **"Contribute Data"**
2) **Login** with your **user account**

Note:
Register first if you haven't create an account; WOVOdat account works here

Please check the email confirmation from wovodat@wovodat.org, it might be stored to your spam mailbox

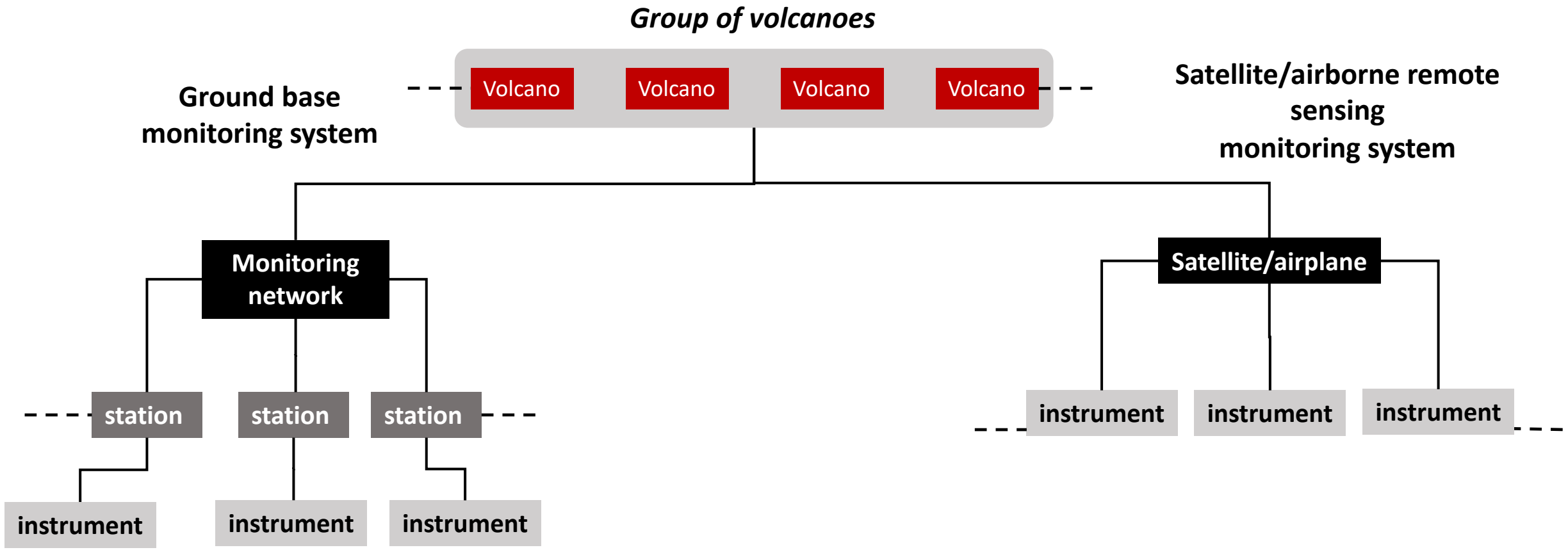
GVMID > Contibute Data > Submit Data

https://wovodat.org/populate/gvmid_input.php

As anticipation of various data formats coming from different observatories, we provide interactive tools for users to submit data following an **Excel spreadsheet template format**

But you can as well upload the data with your own format, we will contact you when more information needed.

Datasets & Database > MySQL relational database management system



Data in GVMID is organized in a MySQL hierarchical relational database management system where all available infrastructure/metadata in a specific volcano will be linked through "volcano" as the parent table.

Datasets & Database > MySQL table schema & structure

cn - Common network

Common network code
Common network name
Common network type
Volcano-1 ID
Volcano-2 ID
…
Start time
End time
Time difference to UTC
Description
Owner-1 ID
Owner-2 ID
Load date
Publish date
Data loader ID
Reference
…

ds – Deformation station

Station code
Station name
Instrument list
Network ID
Station latitude
Station Longitude
Station elevation
Installation type
…
Start time
End time
Time difference to UTC
Description
Owner-1 ID
Owner-2 ID
Load date
Publish date
Data loader ID
Reference
…

di_gen – General deformation instrument

instrument code
instrument name
Instrument type
Instrument description
Station ID
Installation location/type
…
Start time
End time
Time difference to UTC
Owner-1 ID
Owner-2 ID
Load date
Publish date
Data loader ID
Reference
…

csi_gen – satellite/airborne instrument

instrument code
Instrument name
Instrument type
Instrument description
Spatial resolution
Swath width
Pixel size
Cycle/repeatability
Instrument operator
Satellite/airplane ID
Volcano-1 ID
Volcano-2 ID
…
Start time
End time
Time difference to UTC
Owner-1 ID
Owner-2 ID
Load date
Publish date
Data loader ID
Reference
…

cs – Satellite/Airplane

Satellite/airplane code
Satellite/airplane name
Orbital type
Orbital height
Operator
Mission
Instrument list
COSPAR ID
SATCAT no
…
Start time
End time
Temporal resolution
Description
Owner-1 ID
Owner-2 ID
Load date
Publish date
Data loader ID
Reference
…

All data will be georeferenced, time stamped, and recorded with data source/owner

Datasets & Database > Monitoring methods & instrument types

STATION

Seismic:
1. Short period seismometer
2. Broadband seismometer
3. Accelerometer
4. Geophone
5. Infrasound
6. Hydrophone
7. Barometer
8. Acoustic sensor
9. Ocean bottom seismometer (OBS)
10. Fiber optic

Gas:
1. Spectrometer (DOAS, COSPEC, FLYSPEC)
2. Direct gas sample location
3. FTIR (airborne infrared spectrometer)
4. MultiGas analyzer
5. UV camera
6. Soil-efflux/fluxmeter
7. Continuous soil-CO2 fluxmeter
8. Geochemistry probe
9. Electrochemical sensor

Meteorology:
1. Thermal sensor, thermocouple, thermostat
2. Wind speed & direction (anemometer)
3. Precipitation gauge (pluviometer)
4. Barometer pressure
5. Hygrometer, humidity sensor
6. Weather radar (DOPPLER/NEXRAD)
7. Water vapor radiometer

Hydrology:
1. Stream/lake gauge
2. Flow meter
3. Temperature sensor/probe
4. Barometer
5. Pressure, temperature, and conductivity (P-T-C)
6. pH-meter
7. Direct water sample location

Deformation:
1. GPS
2. cGPS/cGNSS
3. Tiltmeter
4. Strainmeter
5. Extensometer
6. Dilatometer
7. Leveling-benchmark
8. EDM-reflector
9. EDM-base station
10. Light detection and Ranging (LIDAR)
11. Terestrial Laser Scanning (TLS), Airborn Laser Scanning (ALS)
12. Synthetic Aperture Radar (SAR); satellite radar interferometry
13. Very Long Baseline Interferometry (VLBI)
14. Pore-pressure sensor
15. Surface laser strain

Potential fields:
1. Magnetometer
2. Gravimeter
3. Magneto telluric (MT), Control Source MT(CSAMT)
4. Electrical resistivity
5. Electromagnetic (EM)
6. Ground Penetrating Radar (GPR)
7. Self Potential (SP), Induced Polarization (IP)
8. Very Low Frequency (VLF)

Thermal:
1. Thermal sensor, thermostat, thermocouple
2. Thermal camera, Thermal Infra-red (TIR), Forward Looking Infra-Red (FLIR)
3. Radiometer
4. Doppler Radar system
5. Lightning detection system
6. Visual camera (CCTV, WebCam, DSLR, High resolution camera)

Datasets & Database > Operational & installation type

OPERATIONAL: Active or inactive

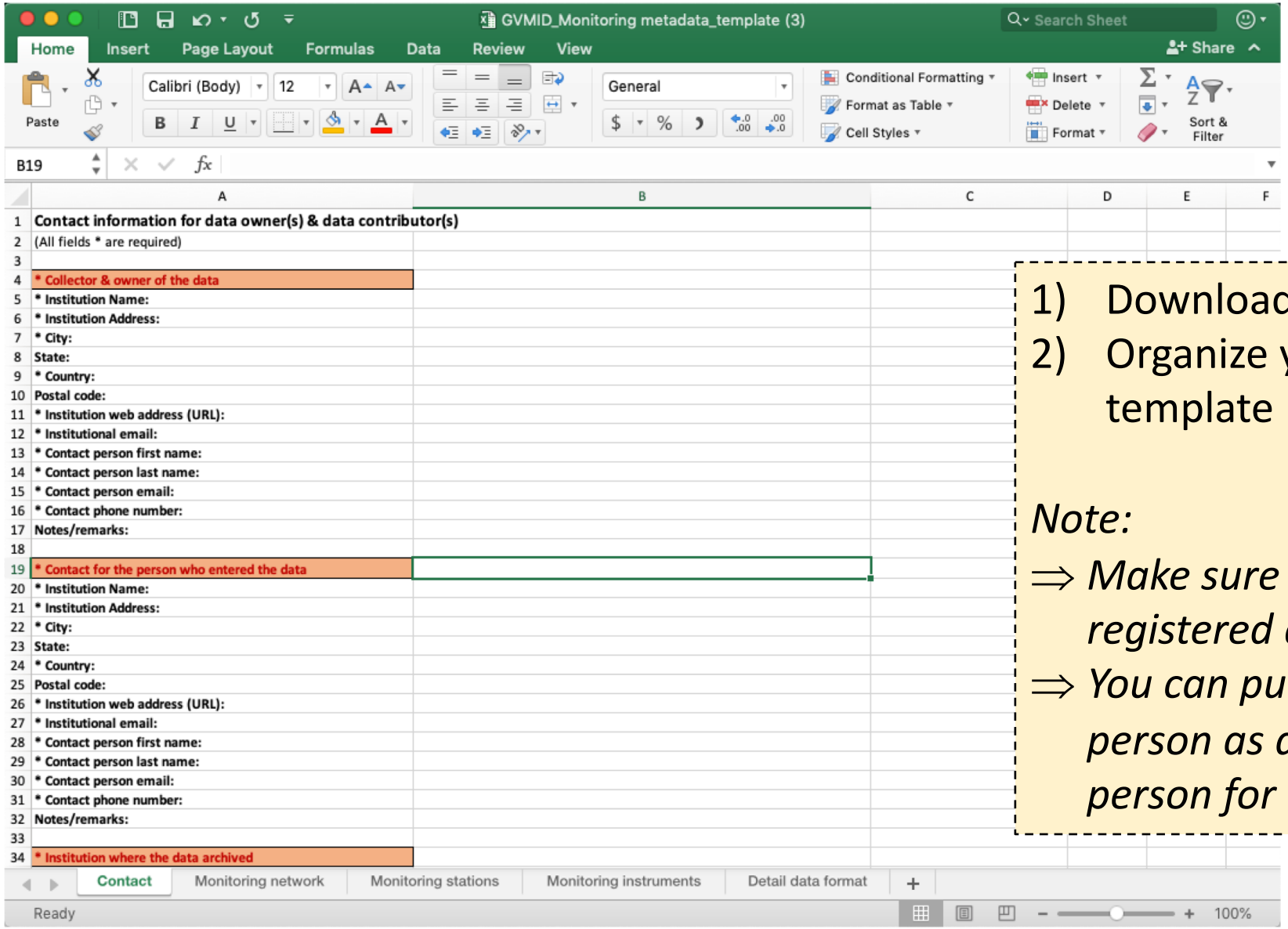
➢ *This will be recorded & reflected in the start-time and end-time of station's and instrument's operational time*

INSTALLATION TYPE

- ***Station:***
  - permanent
  - non-permanent

- ***Instrument:***
  - **<u>In situ ground-based (station location)</u>**
    surface, subsurface, shallow borehole, deep borehole, cave/tunnel, submerged/submarine/under water
    ⇒ permanent (continuous, periodical, benchmark points)
    ⇒ non-permanent (temporary; rapid deployment/experimental/mapping)
  - **<u>Remote ground-based (station location)</u>**
    terrestrial
    e.g. Light detection and Ranging (LIDAR), Terestrial Laser Scanning (TLS), ground-based Synthetic Aperture Radar (SAR), Scan DOAS
  - **<u>Airborne/satellite (no location. Instead it will use volcano location)</u>**
    airborne (UAV/drone, airplane, satellite)
    e.g. Airborn Laser Scanning (ALS); satellite radar interferometry; airborne Flyspec

GVMID > Contibute Data > Submit Data > Spreadsheet template



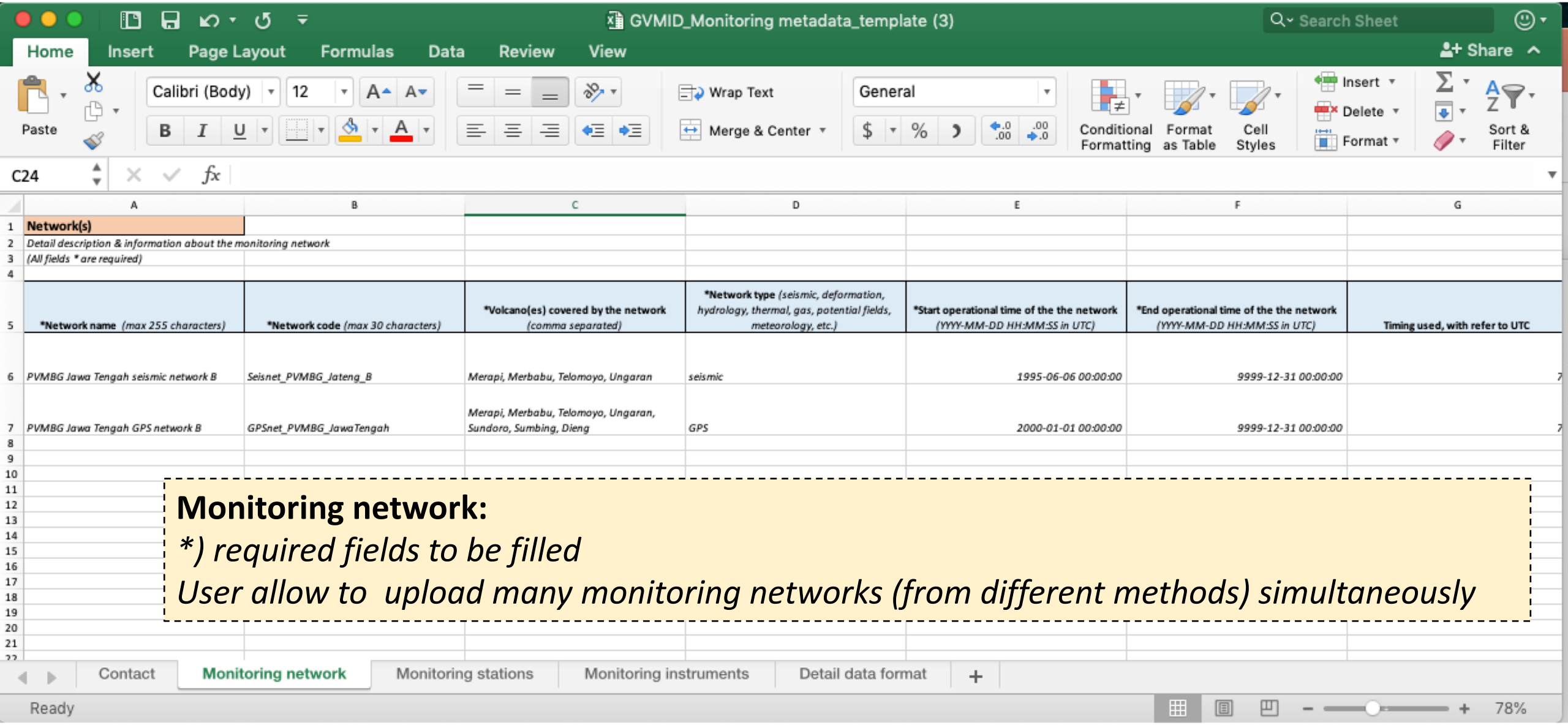
1) Download spreadsheet template
2) Organize your data following the template

Note:

⇒ *Make sure your institution is already registered as data contributor/owner*

⇒ *You can put your name or assigned other person as data uploader and contact person for the data*

GVMID > Contibute Data > Submit Data > Spreadsheet template



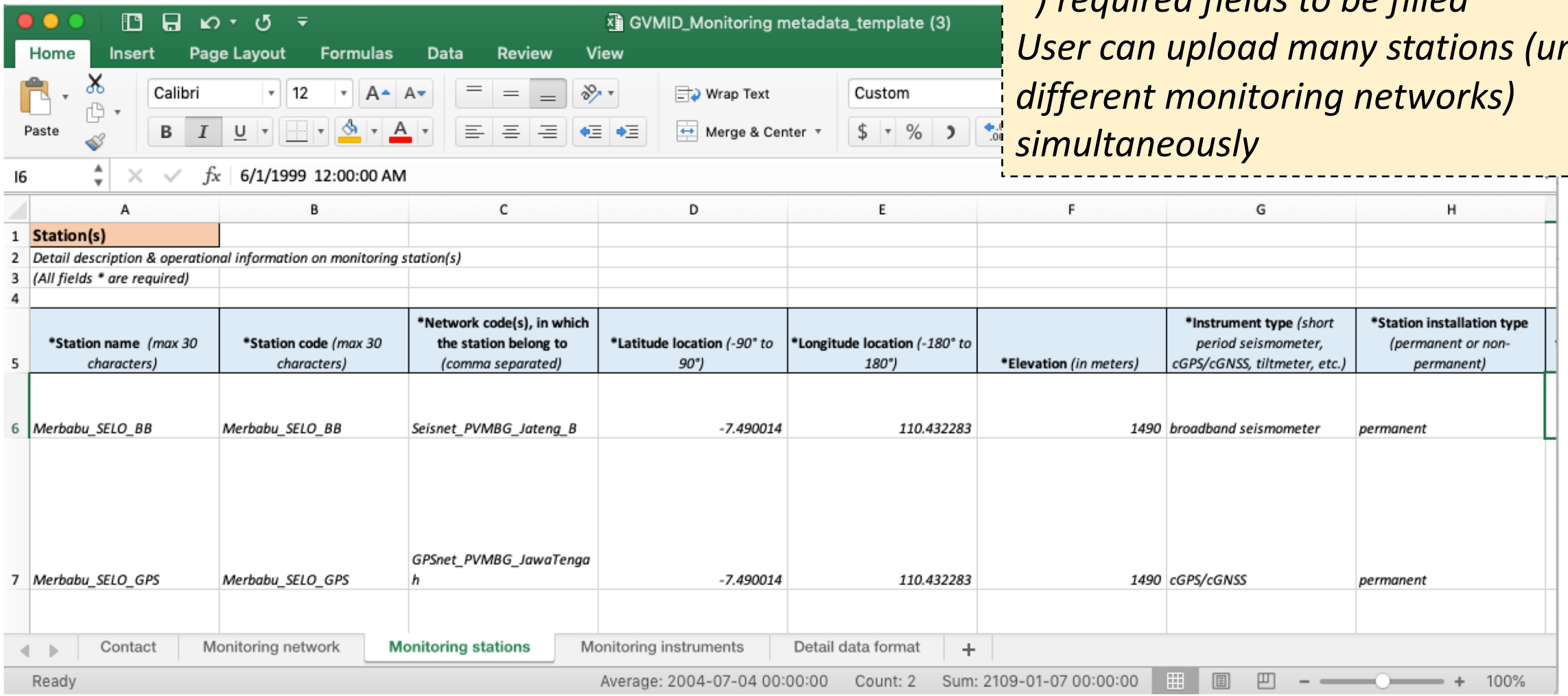
Monitoring network:

**) required fields to be filled*

User allow to upload many monitoring networks (from different methods) simultaneously

GVMID > Contibute Data > Submit Data > Spreadsheet template

Monitoring station:
**) required fields to be filled*
User can upload many stations (under different monitoring networks) simultaneously



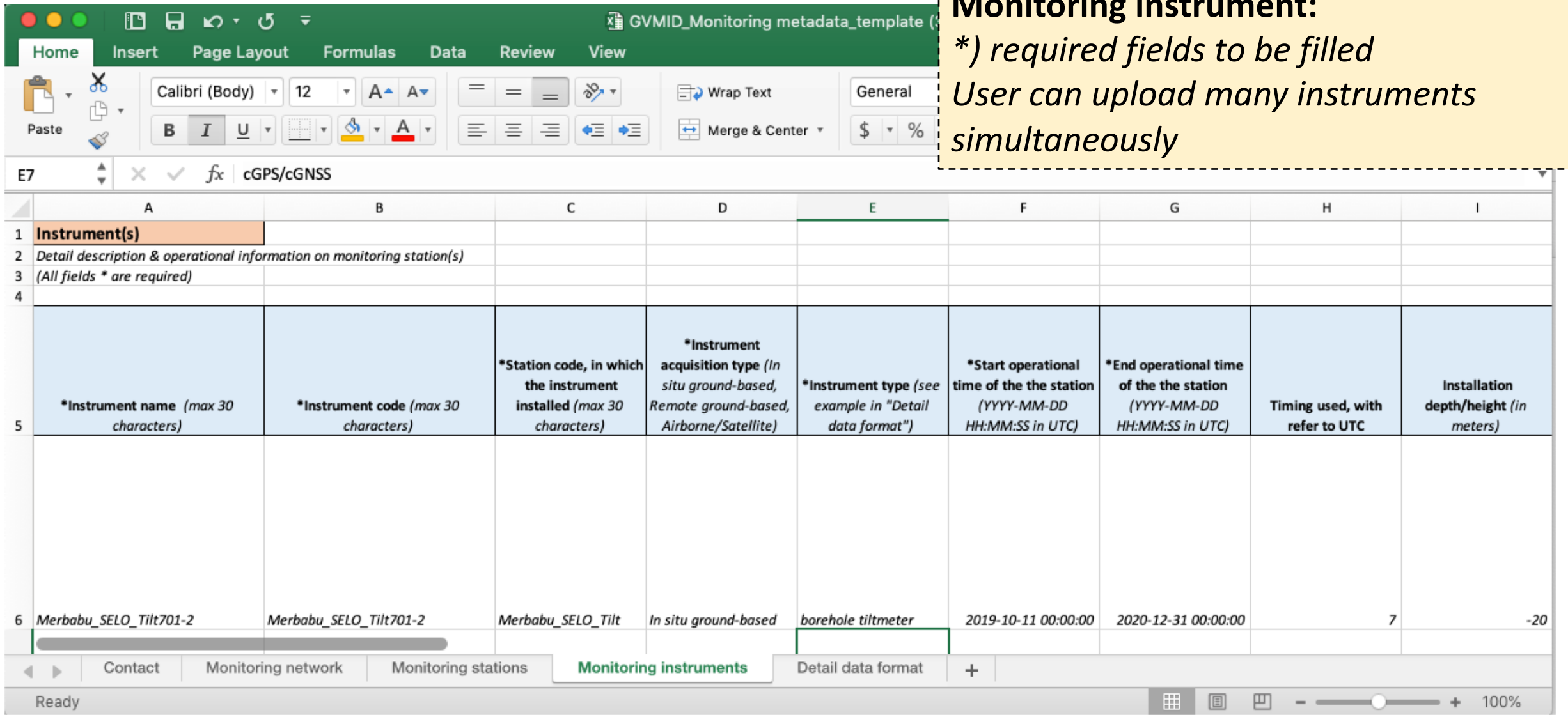
	A	B	C	D	E	F	G	H
1	**Station(s)**							
2	*Detail description & operational information on monitoring station(s)*							
3	*(All fields * are required)*							
4								
5	***Station name** *(max 30 characters)*	***Station code** *(max 30 characters)*	***Network code(s), in which the station belong to** *(comma separated)*	***Latitude location** *(-90° to 90°)*	***Longitude location** *(-180° to 180°)*	***Elevation** *(in meters)*	***Instrument type** *(short period seismometer, cGPS/cGNSS, tiltmeter, etc.)*	***Station installation type** *(permanent or non-permanent)*
6	*Merbabu_SELO_BB*	*Merbabu_SELO_BB*	*Seisnet_PVMBG_Jateng_B*	*-7.490014*	*110.432283*	*1490*	*broadband seismometer*	*permanent*
7	*Merbabu_SELO_GPS*	*Merbabu_SELO_GPS*	*GPSnet_PVMBG_JawaTengah*	*-7.490014*	*110.432283*	*1490*	*cGPS/cGNSS*	*permanent*

Contact | Monitoring network | Monitoring stations | Monitoring instruments | Detail data format

Ready — Average: 2004-07-04 00:00:00 Count: 2 Sum: 2109-01-07 00:00:00 100%

GVMID > Contibute Data > Submit Data > Spreadsheet template

Monitoring instrument:
**) required fields to be filled*
User can upload many instruments simultaneously

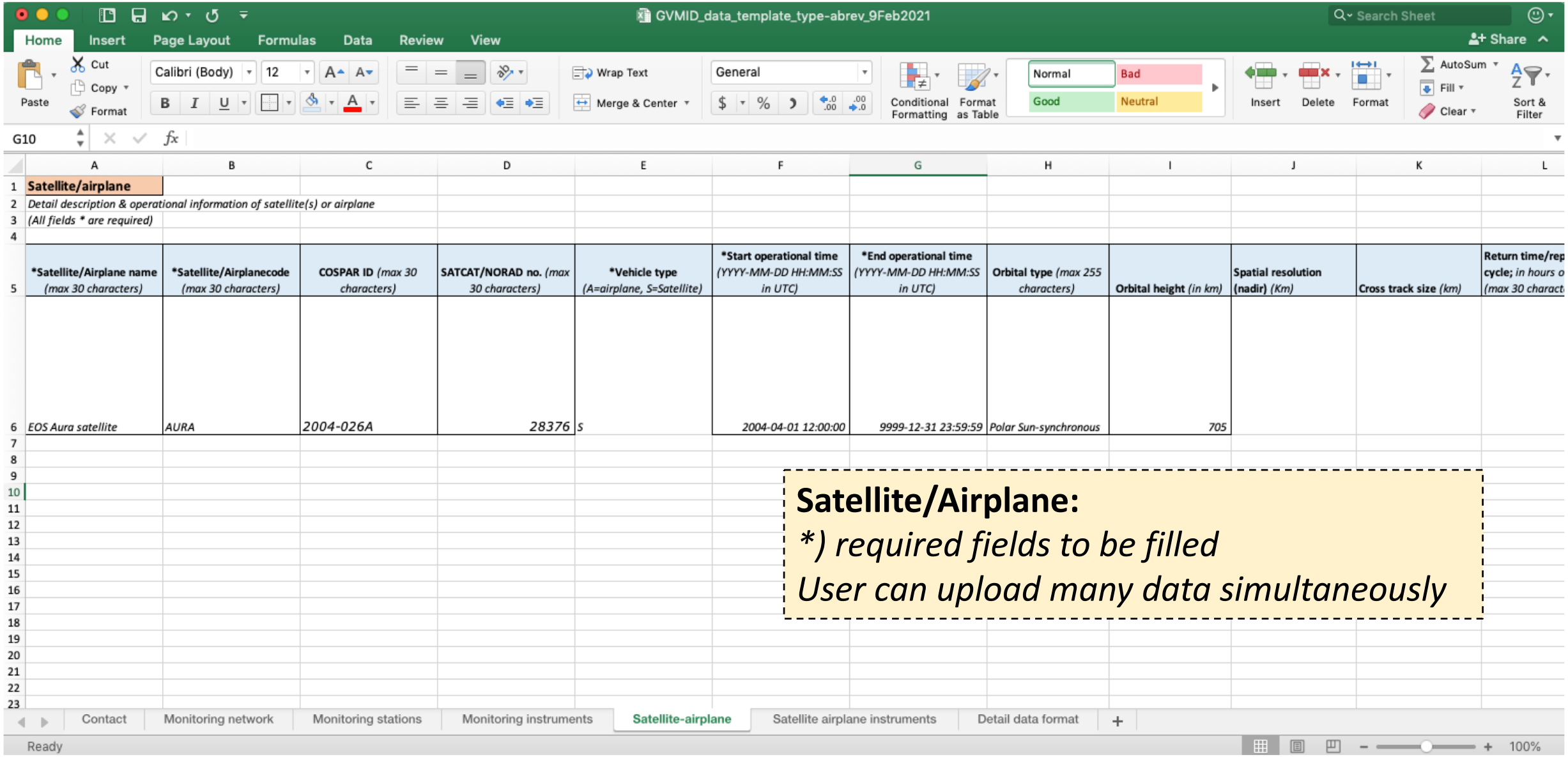


	A	B	C	D	E	F	G	H	I
1	**Instrument(s)**								
2	*Detail description & operational information on monitoring station(s)*								
3	*(All fields * are required)*								
4									
5	***Instrument name** (max 30 characters)*	***Instrument code** (max 30 characters)*	***Station code, in which the instrument installed** (max 30 characters)*	***Instrument acquisition type** (In situ ground-based, Remote ground-based, Airborne/Satellite)*	***Instrument type** (see example in "Detail data format")*	***Start operational time of the the station** (YYYY-MM-DD HH:MM:SS in UTC)*	***End operational time of the the station** (YYYY-MM-DD HH:MM:SS in UTC)*	**Timing used, with refer to UTC**	**Installation depth/height** *(in meters)*
6	*Merbabu_SELO_Tilt701-2*	*Merbabu_SELO_Tilt701-2*	*Merbabu_SELO_Tilt*	*In situ ground-based*	*borehole tiltmeter*	*2019-10-11 00:00:00*	*2020-12-31 00:00:00*	*7*	*-20*

Contact | Monitoring network | Monitoring stations | Monitoring instruments | Detail data format

Ready 100%

GVMID > Contibute Data > Submit Data > Spreadsheet template



GVMID_data_template_type-abrev_9Feb2021

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Satellite/airplane**											
2	*Detail description & operational information of satellite(s) or airplane*											
3	*(All fields * are required)*											
4												
5	***Satellite/Airplane name** *(max 30 characters)*	***Satellite/Airplanecode** *(max 30 characters)*	**COSPAR ID** *(max 30 characters)*	**SATCAT/NORAD no.** *(max 30 characters)*	***Vehicle type** *(A=airplane, S=Satellite)*	***Start operational time** *(YYYY-MM-DD HH:MM:SS in UTC)*	***End operational time** *(YYYY-MM-DD HH:MM:SS in UTC)*	**Orbital type** *(max 255 characters)*	**Orbital height** *(in km)*	**Spatial resolution (nadir)** *(Km)*	**Cross track size** *(km)*	**Return time/rep cycle;** *in hours o (max 30 charact*
6	*EOS Aura satellite*	*AURA*	*2004-026A*	*28376*	*S*	*2004-04-01 12:00:00*	*9999-12-31 23:59:59*	*Polar Sun-synchronous*	*705*			
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23												

Contact | Monitoring network | Monitoring stations | Monitoring instruments | Satellite-airplane | Satellite airplane instruments | Detail data format

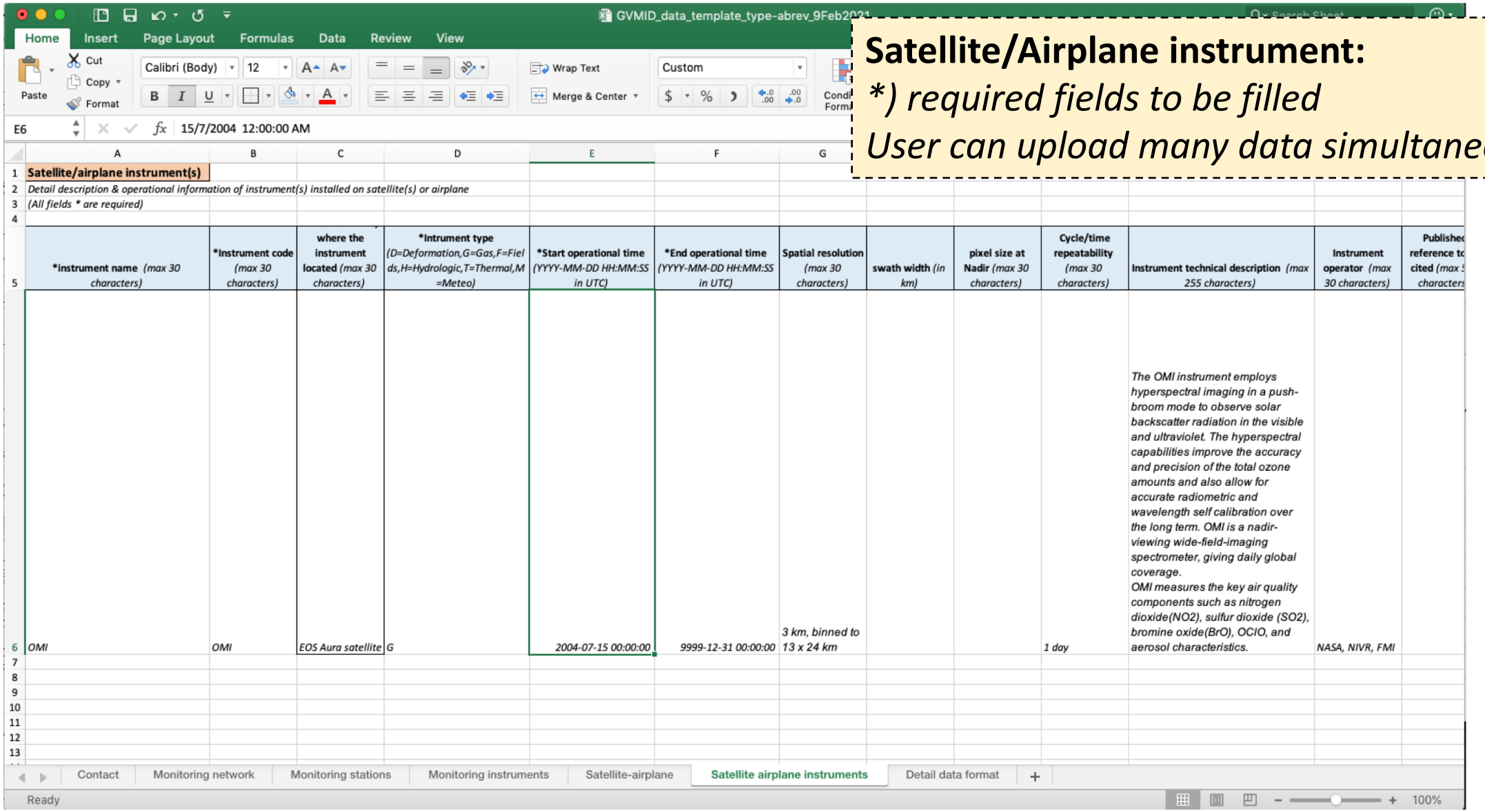
Ready

Satellite/Airplane:

**) required fields to be filled*

User can upload many data simultaneously

GVMID > Contibute Data > Submit Data > Spreadsheet template



Satellite/Airplane instrument:

**) required fields to be filled*

User can upload many data simultaneously

GVMID > Contibute Data > Upload Data

https://wovodat.org/populate/gvmid_input.php

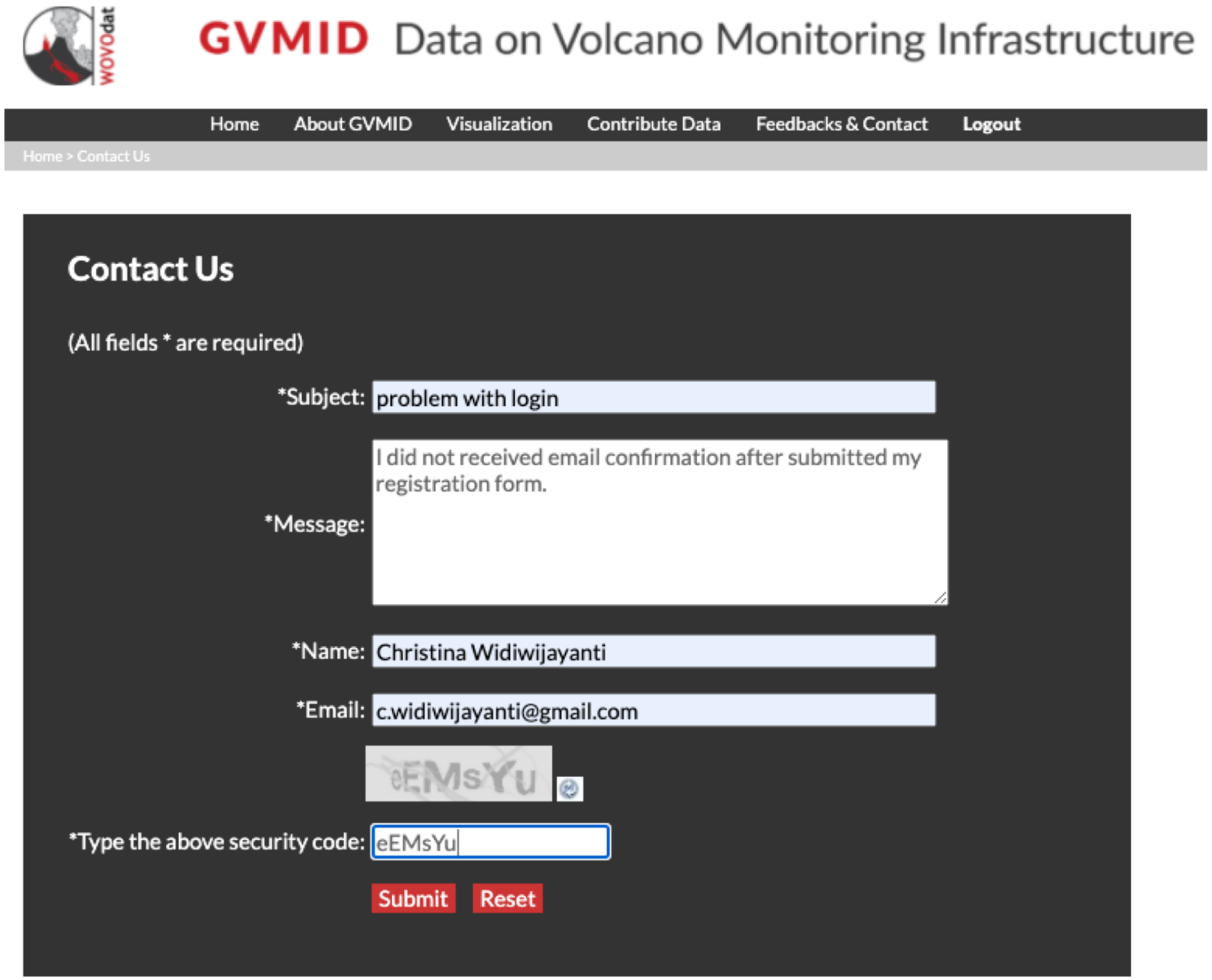
When spreadsheet ready, upload using online form. GVMID developer's team will help convert and upload them into the database.

Note:
Make sure to write down your contact details and your institutional affiliation before submitting the file. This will facilitate tracking the data.

Feedbacks & contact us

If user wish to contact GVMID developer' team or to give any feedback to improve the GVMID web interface functionality and design, database schema and format structure, or documentation, *please fill in the online form and complete with your full name and email address.* :

https://wovodat.org/populate/contact_us_form_gvmid.php

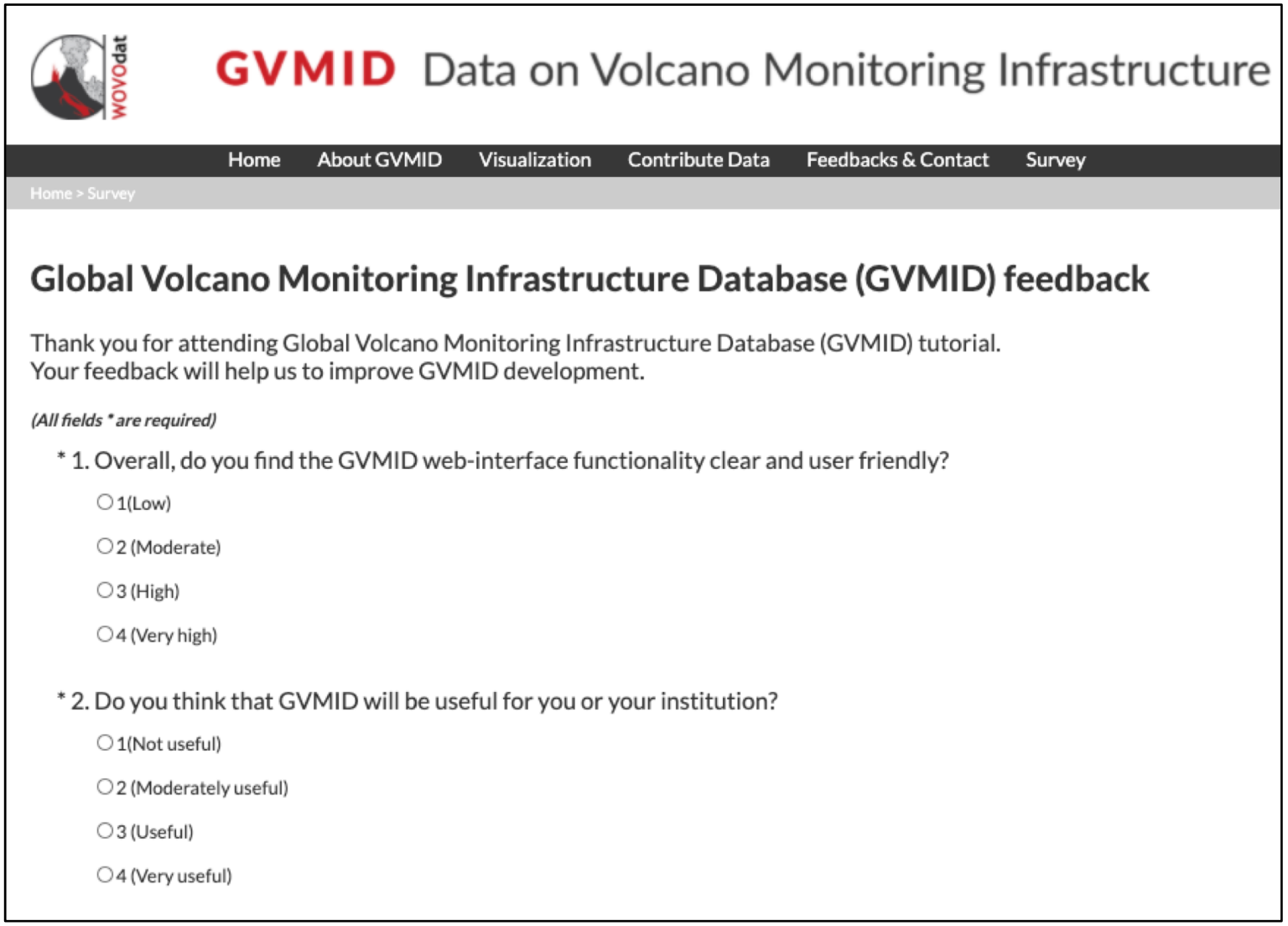


Online survey

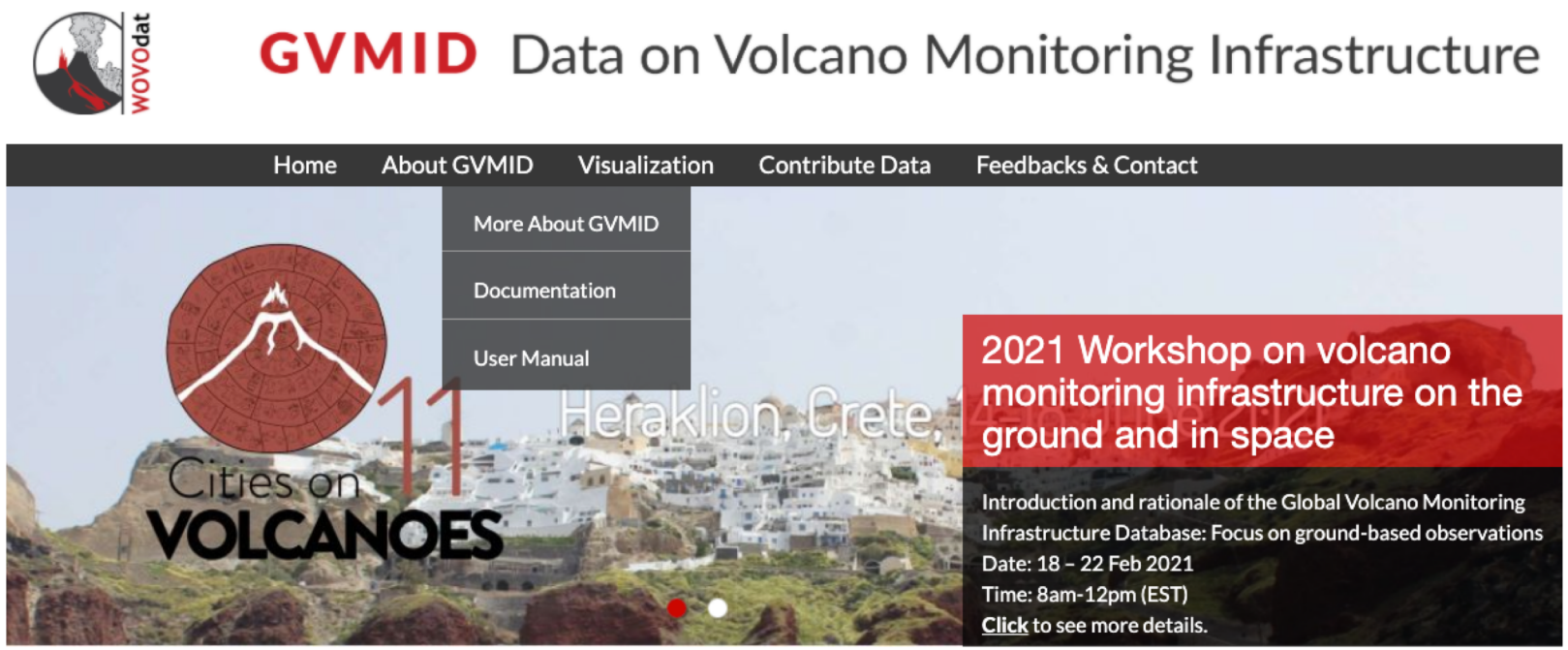
https://wovodat.org/populate/survery.php

Please fill in the survey,
All those mark with (*) are required.

Thank you



Thank you!
Looking forward to your feedback and contribution!



The Global Volcano Monitoring Infrastructure Database **GVMID**, is aimed at documenting and improving capabilities of volcano monitoring from the ground and space. GVMID is closely related to WOVOdat and WOVO (World Organization of Volcano Observatories), and presently hosted at the Earth Observatory of Singapore.