Processing VT Strings

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17 April 2025

This is the routine processing of each VT Strings that has been carried out on *opsproc3* to create a consistent set of information about strings.

All directories are relative to *~seisan/projects/Seismicity/VT_strings*.

1. Open the spreadsheet *~seisan/projects/SeismicityDiary/SeismicityDiary.xlsx*.

2. Add a new line to the *Strings* sheet.
   a) The string should be given an ID based on the date and time of the first event in the string. This ID does not change even if the time of the first event changes.
   b) The What column should use one of the keys in the *StringKeys* sheet.

A	B	K	L
ID	**Date time start (UTC)**	**Date time last event (UTC)**	**What**
20250325-2107	2025-03-25 21:07:28	2025-03-25 21:22:42	VT string
20250328-0627	2025-03-28 06:27:55	2025-03-28 06:34:26	Mini VT string
20250331-1914	2025-03-31 19:14:05	2025-03-31 19:28:48	Mini VT string
20250407-0616	2025-04-07 06:16:09	2025-04-07 06:19:16	VT triplet
20250407-2115	2025-04-07 21:15:48	2025-04-07 21:17:53	Mini VT string
20250408-1021	2025-04-08 10:21:02	2025-04-08 10:29:18	Mini VT string
	2025-04-10 21:00:00	2025-04-11 08:40:00	Mixed swarmette

3. Copy the appropriate 20-minute SEISAN data files to the working directory (normally *~seisan/seismo/WOR*).

4. Use *mulpltw* to examine the data. (*mulplt* does not work on *opsproc3*.)

5. Record in the spreadsheet which stations are not working or have problems. The *StringKeys* sheet lists the codes to use.

X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
Checked	**MSCP**	**MSUH**	**MSS1**	**MBFR**	**MBLG**	**MBLY**	**MBRY**	**MBBY**	**MBHA**	**MSMX**	**MBGH**	**MBWH**	**MBWW**
y	X	X	C						X	X			X
y	X	X							X	X			X
y	X	X							X	X			X
y	X	X	C						X	X			X
y	X	X							X	X			X
y	X	X							X	X			X

R	S	T
Nearest station	**Next station**	**Picked Station**
MSS1	MBLY	MSS1
MSS1	MBLY	MSS1
MSS1	MBLY	MSS1
MSS1	MBLY	MSS1
MSS1	MBLY	MSS1
MSS1	MBLY	MSS1

6. Record the nearest and second-nearest stations (the stations with the first and second P arrivals).

7. Record the station that will be used to pick events. This is usually the nearest station.

8. Use *mulpltw* to pick a P time for every event on the chosen station. There is no need to pick the polarity.
   a) Pick all events that can be seen.
   b) After each pick, append the output of mulplt to an, initially new, temporary file named using the string ID, *eg 20250101-1200.tmp*.

   $ cat mulplt.out >> 20250101-1200.tmp

9. After all events have been picked, convert the tmp file to a list of picks.

   $ *mulplt2vtse 20250101-1200*

   a) Copy the following from the output to the spreadsheet:
      - Date time start (UTC)
      - # VTs Total
      - Date time last event (UTC)
   b) Duplicate the Duration cell from a previous string.
   c) *mulplt2vtse* creates two files.
      - *20250101-1200.txt* is the event list used in the processing described here.
      - *20250101-1200-formatted.txt* is used by other software.

```
2019 09 10 11 36 12.2
2019 09 10 11 39 34.7
2019 09 10 11 39 59.7 RF?
2019 09 10 11 40 07.8
2019 09 10 11 40 44.4
2019 09 10 11 40 46.3
2019 09 10 11 40 50.1
2019 09 10 11 42 15.5 LP?
2019 09 10 11 46 42.9
2019 09 10 11 50 49.6
```

10. If there were any non-VT events in the string, they should be marked as such in the event list file by adding, for example, LP or RF at the end of the appropriate line.

11. Move the event list file to *./data/event_lists/0-new.*

12. Create a new directory named using the ID in *./data/seisan_files/0-new.*

13. Move the 20-minute SEISAN data files to the new directory.
    a) These should include the time period from one hour before the first event to one hour after the last event.

14. Create standard plots for the new strings (ie those with files in *0-new*).

    $ cd ./plotStrings

    $ obspy

    $ ./plot0.sh

    $ nobspy

    a) This does the following for each string

        1. Creates standard plots saved in *data/all_plots.*
        2. Saves data as a miniseed file in *data/mseed_files.*
        3. Creates a montage of first arrivals in *data/polarities/plots.*
        4. Moves the files/folders in *0-new* to the parent directories.

15. Examine the montage in *./data/polarities/plots* to determine if events are repeating or not.

    a) If there are too many small and unclear events, delete the appropriate plots and rerun the *montage* command (which was handily printed out by *plot0.sh*).

    b) Move the montage to the parent directory and delete the other plots.

    c) Record if the string has repeating events or not.

U	V	W
Form	**Repeating events**	**Purity [vrlh]**
N	N	v
N		vh?
E	Y	v
		vlh
N	Y	v
E		v
N	Y	v
		vr?

16. If there were any non-VT events in the string, make a record under Purity using the codes listed in the *StringKeys* sheet.

    a) A question mark after a code indicates that it is uncertain the event type was present.

17. Record the Form of the string. Use the keys in the *StringKeys* sheet.

18. Create a single-station plot using *getnPlot.*

    $ getnPlot --tag VT_string --date yyyy-mm-dd --time hh:mm:ss --kind Z --sta MSS1 --pre 1m --dur 10m

    a) Duration of the plot should be one of 60s, 5m, 10m, 20m, 60m, 120m, 180m, 300m.

    b) Move the plot file to *./data/one_station_plots*.

19. Copy MSS1 helicorder plot and multi-station helicorder plots and rename using ID

M	N	O	P	Q
Event file	**Heli plot**	**Multi plot**	**SEISAN files**	**One sta plot**
y	y	y	Y	y
y	y	y	Y	y
y	y	y	Y	y
y	y	y	Y	

    $ fetchHelis.sh 20250101

    *$ renameBeg 20250101-1200--VT_string- *.gif*

    a) Move helicorder plots to ./data/heli_plots.

    b) Record the creation of the plots.

D	E	F	G	H
# VTs SEISAN	# VTs Located	# VTs M>x	# VTs Total	Max ML
0	0		3	
2	2		6	2.0

20. Use *eev* to get the numbers of triggering events, located events and magnitude of largest event in string and add to spreadsheet.

21. If there was any surface activity associated with the string, record it in the appropriate column of the spreadsheet. Use the codes in the *StringKeys* sheet.

22. Add any comments before closing the spreadsheet.

23. Add the string to Webobs Observations.
    a) To generate text for the Observer's Notes field:

    $ cd ./scripts

    $ ./excel2webobs.pl 2>/dev/null

24. [OPTIONAL] Create montage of waveforms and spectrograms.

    $ cd ./plotStrings

    $ ./plotSpecial3Montage.pl

    $ cd ~/tmp—DONT_USE/special3Montage

    $ ./doit.sh

    a) Move plot file to *./data/special3Montage_plots*.

    b) Delete png files.

25. [OPTIONAL] Create additional plots in MATLAB
    a) Move to ./stringAnalysis.

    >> analyseStrings2