

## **What is This Dataset?**

Seismic events in the vicinity of the Garner Valley Downhole Array site (<http://nees.ucsb.edu/facilities/GVDA>) that have generated surface motions greater than about 10cm/s/s for the period from Aug-2006 to summer of 2016 are presented in this dataset.

The data is from all the borehole accelerometers of the main array, from 501m to the surface. Data in Miniseed, SAC and comma-separated-ascii formats are included.

While event data for all sites in UCSB's Earthquake Engineering Group portfolio are available through our data portal (<http://nees.ucsb.edu/data-portal>) this dataset is different in that it makes available the vertical and one working horizontal component of the deepest (501m) accelerometer along with the vector aligned components of all the other available borehole sensors.

*[Aside note about the single, non-true-compass aligned 501m horizontal channel:*

*When the 501m sensors was installed it was not possible to ensure its orthogonal (horizontal) X and Y components were aligned with true north/east. The alignment of the horizontal components was subsequently determined by event analysis (beyond the scope of this document).*

*Knowing the actual alignment, with two orthogonal components its obviously possible to computationally generate a true-north/true-east set of data for the sensor. However, one of the two horizontal components has failed (the remaining horizontal component is at 166.9° true)*

*The other accelerometers on-site have working horizontal components, thus we can calculate the horizontal component from those sensors that align with the one working 501m channel. Thats what this dataset is really about!]*

### **A note about data-sampling and sensor noise**

All sensors in this dataset were sampled at 200 samples-per-second with an 80Hz (80% Nyquist) anti-alias input filter.

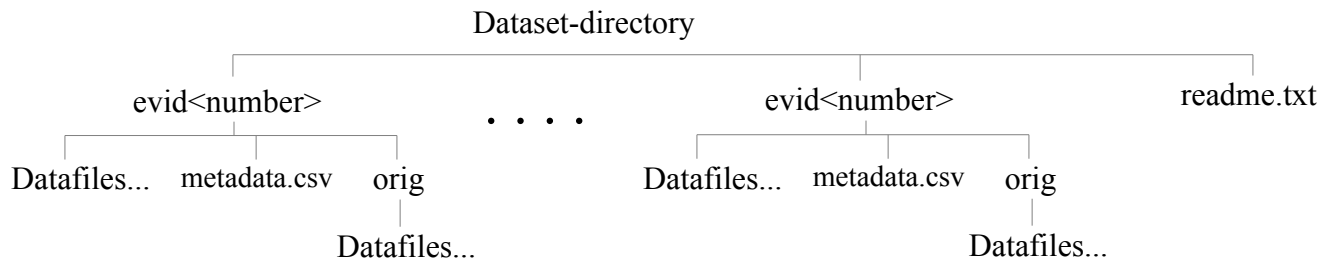
The 501m accelerometer used as the reference channel is an older technology Kinometrics FBA23DH. This older electronics along with a very long cable (500m+ down the hole and the haul back to the data-acquisition system) allows the sensors data-channels pick-up ambient 60Hz noise from a local power-substation. Substantially better (seismic)signal-to-(background)noise can be achieved by filtering out this 60Hz.

## Directory Structure

Data for each event is stored in a directory named with the event-ID (evid), with this top-level readme file describing the details of each event.

The data files in the event directory are named for the sensor/channel. The files with “.msd” are miniseed (in raw 'counts'), the “.sac” files are SAC format and the “.csv” are ascii data with a column for time and one column per sensor-channel (the csv filename represents the 'reference' channel-name that defines the direction for that set of data). A metadata.csv file gives various per-channel metadata.

In each of the event directories there is also a sub-directory named “orig”. This directory contains the original channel data for all channels (in many cases it is the same as the data in the main event directory). In many cases the data from the horizontal channels of the accelerometers has been vector-rotated to align to the available 501m channel but some users may still want to be able to see the original tri-ax data from those accelerometers.



## Event List

Evid#11327386	at	2013/06/28	17:45:48	:	M3.4	located	5.43km	(15.60km deep)	azmith	203deg	from the	GVDA site.
Evid#10701413	at	2010/06/13	03:09:20	:	M4.2	located	40.18km	(5.60km deep)	azmith	140deg	from the	GVDA site.
Evid#37510616	at	2016/01/06	14:42:35	:	M4.4	located	37.87km	(16.70km deep)	azmith	329deg	from the	GVDA site.
Evid#11407682	at	2013/12/30	23:44:21	:	M3.6	located	6.46km	(19.60km deep)	azmith	302deg	from the	GVDA site.
Evid#15237073	at	2012/10/28	07:47:03	:	M3.9	located	13.23km	(19.40km deep)	azmith	281deg	from the	GVDA site.
Evid#10893381	at	2011/02/15	20:55:47	:	M2.9	located	8.27km	(14.60km deep)	azmith	251deg	from the	GVDA site.
Evid#10827021	at	2010/10/27	00:20:38	:	M2.1	located	21.09km	(10.00km deep)	azmith	334deg	from the	GVDA site.
Evid#10321561	at	2008/05/01	03:55:36	:	M4.2	located	32.31km	(10.80km deep)	azmith	141deg	from the	GVDA site.
Evid#15332633	at	2013/04/25	18:59:44	:	M3.1	located	6.72km	(16.90km deep)	azmith	248deg	from the	GVDA site.
Evid#10530013	at	2010/01/16	12:03:26	:	M4.3	located	43.67km	(13.90km deep)	azmith	312deg	from the	GVDA site.
Evid#14403792	at	2008/11/17	17:41:37	:	M3.8	located	26.16km	(11.50km deep)	azmith	223deg	from the	GVDA site.
Evid#14491232	at	2009/07/26	04:54:04	:	M3.5	located	5.84km	(14.00km deep)	azmith	227deg	from the	GVDA site.
Evid#15001500	at	2011/06/14	08:25:41	:	M3.6	located	6.65km	(18.10km deep)	azmith	291deg	from the	GVDA site.
Evid#14403732	at	2008/11/17	12:35:42	:	M4.1	located	25.64km	(12.20km deep)	azmith	223deg	from the	GVDA site.
Evid#14383980	at	2008/07/29	18:42:16	:	M5.4	located	105.50km	(14.70km deep)	azmith	288deg	from the	GVDA site.
Evid#14607652	at	2010/04/04	22:40:42	:	M7.2	located	206.41km	(10.00km deep)	azmith	141deg	from the	GVDA site.
Evid#10225585	at	2007/01/08	03:05:35	:	M2.8	located	9.33km	(19.20km deep)	azmith	238deg	from the	GVDA site.
Evid#10353485	at	2008/10/11	19:33:59	:	M3.0	located	3.82km	(16.50km deep)	azmith	274deg	from the	GVDA site.
Evid#14995172	at	2011/06/03	05:45:24	:	M3.1	located	6.58km	(12.90km deep)	azmith	236deg	from the	GVDA site.
Evid#10701405	at	2010/06/13	03:08:57	:	M4.9	located	39.76km	(12.50km deep)	azmith	143deg	from the	GVDA site.
Evid#11379194	at	2013/10/16	13:43:42	:	M2.9	located	4.06km	(17.10km deep)	azmith	286deg	from the	GVDA site.
Evid#15296281	at	2013/03/11	16:56:06	:	M4.7	located	27.31km	(13.10km deep)	azmith	133deg	from the	GVDA site.
Evid#30557759	at	2010/04/04	22:41:13	:	M6.6	located	131.03km	(6.00km deep)	azmith	146deg	from the	GVDA site.
Evid#37511280	at	2016/01/09	11:43:11	:	M3.3	located	9.32km	(13.60km deep)	azmith	264deg	from the	GVDA site.
Evid#14372916	at	2008/06/03	23:06:33	:	M3.0	located	5.48km	(16.20km deep)	azmith	268deg	from the	GVDA site.
Evid#14745580	at	2010/06/15	04:26:58	:	M5.7	located	128.60km	(5.40km deep)	azmith	147deg	from the	GVDA site.
Evid#14285852	at	2007/04/18	22:23:12	:	M3.6	located	25.65km	(11.30km deep)	azmith	163deg	from the	GVDA site.
Evid#37374687	at	2016/06/10	08:04:39	:	M5.2	located	34.08km	(12.30km deep)	azmith	141deg	from the	GVDA site.
Evid#12334595	at	2008/06/03	23:06:33	:	M2.4	located	4.81km	(16.90km deep)	azmith	285deg	from the	GVDA site.
Evid#10736069	at	2010/07/07	23:53:34	:	M5.4	located	32.53km	(14.00km deep)	azmith	148deg	from the	GVDA site.

## GVDA Site overview

The Garner Valley Downhole Array (GVDA) is a ground motion research site in a seismically active region in Southern California. It is located in a narrow valley within the Peninsular Ranges Batholith 23 km east of Hemet and 20km southwest of Palm Springs and is just 7 km from the San Jacinto fault and 35 km from the San Andreas fault.

The locations of the accelerometers whose data is included in this dataset as can be seen in the layout

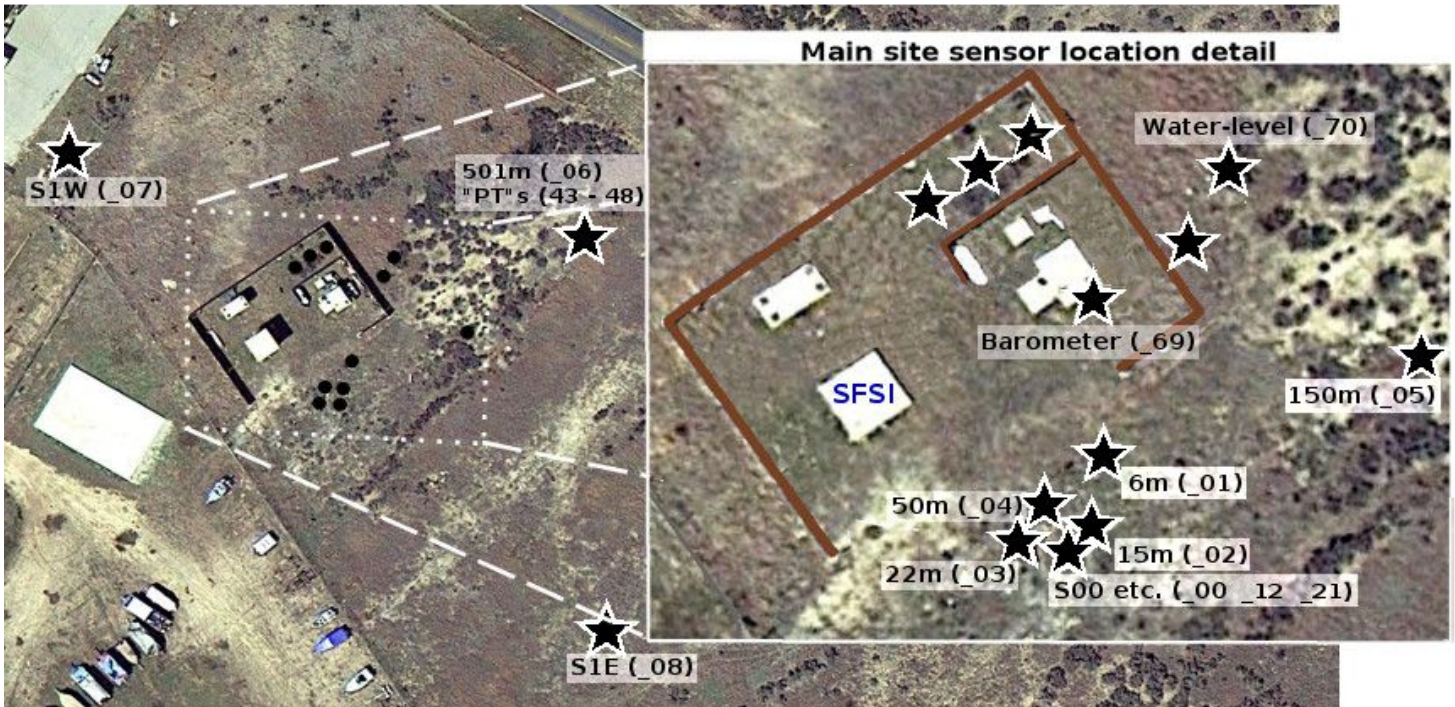
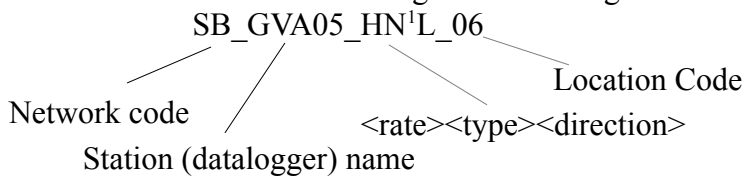


diagram:

Sensors are named in the files using SEED naming convention:

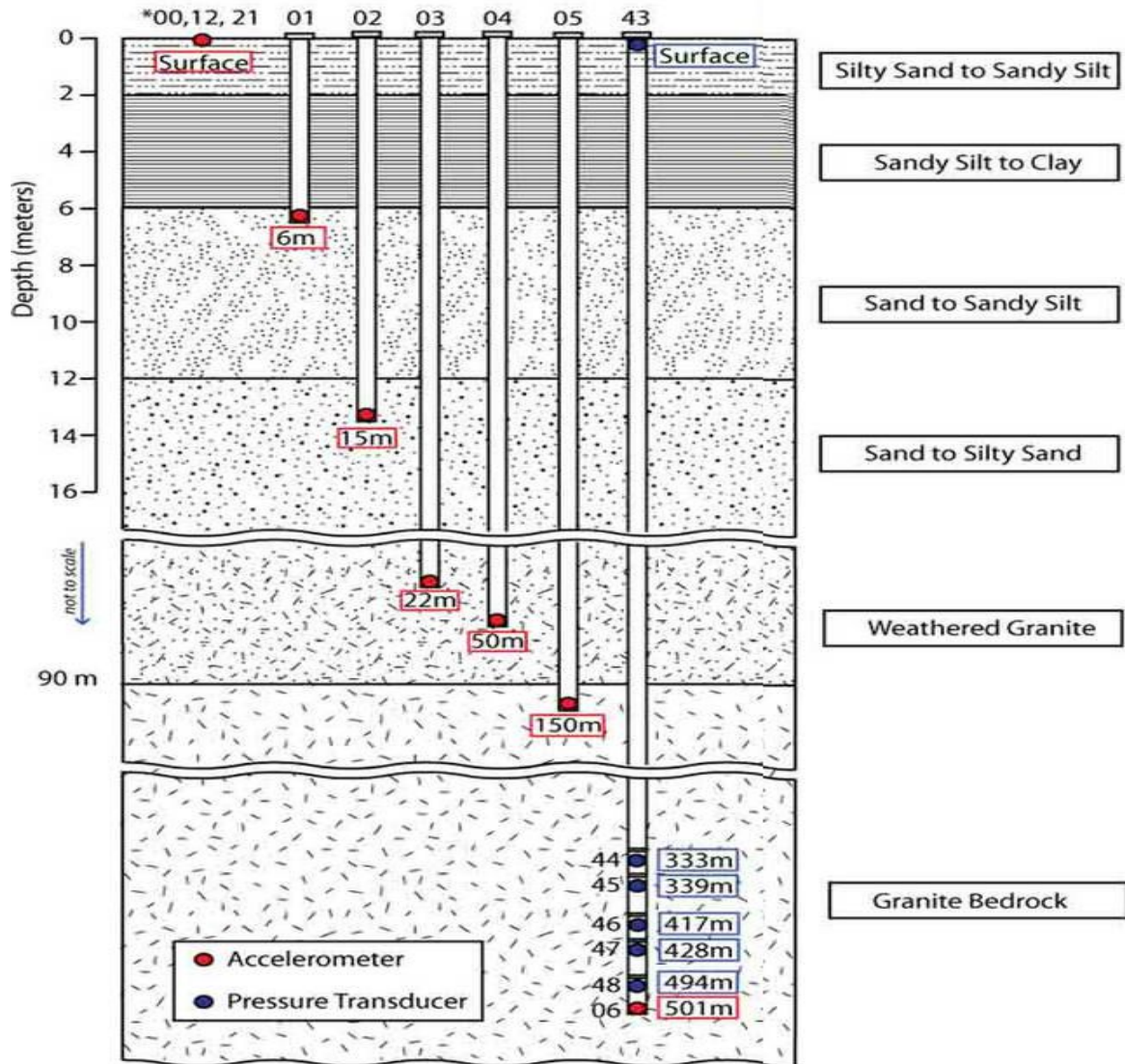


The sensors used are:

Depth	Location Code
Surface	_00
6m	_01
15m	_02
22m	_03
50m	_04
150m	_05
501m	_06

1 "N" is the SEED designation for accelerometer, however for older data sometimes a "L" was used.

The basic site cross-section looks like this:



Notes:

- 1) Diagram is conceptual only, not to scale and does not represent relative locations of wellheads etc.
- 2) Numbers indicated are the channel "Location Codes"