PRELIMINARY REPORT NO. 1

Pueblo-Chixoy-Quixal Seismograph Network

Submitted to: Ing. Edgar Celada, INDE
Prepared by : Dr. Tosimatu Matumoto, UTMSI
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I. Introduction

The Pueblo-Chixoy-Quixal seismograph network began operation on Dec. 8, 1978, when the central station (Pt. 1) vertical component system was installed. Subsequently, during the period of Feb. 9-12, 1979, six remote stations and a horizontal component at the base station were installed and began recording.

All of the records which have been sent to us (covering the period Feb. 13-March 17) have been preliminarily analyzed; these results, including preliminary epicenter locations, are presented in this report, as well as a discussion of error sources and recommendations for further operation of the network.

II. Network Operation

Eight stations have been installed to date, including six vertical component remote stations (sta. 2-7) and a vertical and horizontal component at the central recording station (sta. 1Z and 1 N-S). Table 1 gives the location of the stations. Operation of the remote stations are summarized briefly as follows:

The low frequency output signal from a seismometer is amplified and converted to a variable frequency modulated signal by a voltage controlled oscillator (VCO). This audio signal then modulates a UHF transmitter which transmits the data (via a directional antenna) to the central recording station (sta. 1). Table 2 lists the VCO center frequencies and UHF carrier frequencies used for each station. To recover the seismic signal at the central recording station, the signal is demodulated twice, first by a crystal controlled UHF receiver,

and then with a discriminator tuned to the VCO frequency. The seismic signal is recorded continuously on a drum recorder, the rate of rotation of which is controlled by a precision 60 Hz signal supplied by the crystal controlled timing system.

Stations 1 N-S, 2, 4, 5, and 7 have operated satisfactorily throughout most of the period covered in this report. Stations 3 and 6 have suffered from high background seismic noise levels on occasion, attributed to wind, animal activity, and heavy vehicle traffic. Station 3 particularily has exhibited noise levels 5 to 10 times greater than the other stations. Station 7 was lost on March 27 by local bouditry.

III. Data Analysis

A preliminary analysis of the seismic data covering the period from Feb. 13 to March 16, 1979 has been accomplished. Various computer programs written specifically for the Pueblo-Chixoy-Quixal network were developed for this purpose. They are:

1)	Epicenter determination program	GUEPC1
2)	Input handler subroutine	GUIOU1
3)	Output handler subroutine	GUPRT1
4)	Output printout program	GUPRT
5)	Input card diagnostic program	GUCARD
6)	Epicenter graphic display program	GUPLT3

A crustal model had to be assumed for this preliminary analysis of epicenter location; a five layer model was used; its parameters are listed in Table 1.

An error in epicenter location can result from various sources. Among them are:

1) The velocity structure in the crust.

As mentioned above, to calculate an epicenter a crustal velocity model is required. If this model is incorrect, an error is introduced, particularily in local depth estimates.

At this point we are assuming a general crustal model which will need to be refined. The best technique for doing this is to record a large explosion for which the origin time and location are precisely known. Careful inspection of the record at each station usually will reveal the best fit model to be used. For deep structure, Matumoto et al. (1967) has developed the MAV method which employs signals from deep earthquakes observed by an array of stations.

2) The station correction

Irregularities in the crustal structure beneath individual stations and differences in elevation of the stations generally lead to errors in epicenter determination. The effect of elevation may be estimated theoretically using some assumptions, but local crustal homogeneities may only be investigated by measurement of explosion generated signals.

3) Timing resolution

Precision in identifying the arrival times of seismic waves is crucial for accurate epicenter determination. Using drum recorders with a speed of only 1 mm/sec, resolution of the arrival time of even a P wave with sharp onset is limited to 0.2 sec at best. This error in arrival time is equivalent to epicenter to certain errors on the order of kilometers.

Note that the data acquired thus far was recorded on drums and thus exhibits this limited precision timing. When the advanced recording system (memory-trigger plus tape recording system) is deployed in early May, this timing error will be reduced to the order of 0.01 sec.

4) Station distribution

The configuration of the network plays an important role in the

accuracy with which epicenter locations can be calculated. For each location parameter there is an optumim station distribution for its determination; however, these distributions are different for each parameter, and tradeoffs are necessary in order to get reassurable estimates of all parameters. For instance, of several stations are located along a circle and an event is located near the center, the epicenter (X and Y coordinates) can be accurately determined, but the depth estimate varies with the velocity in the crust. On the other hand, if the source and stations are aligned along a line the velocity structure is readily determined (knowing that the source is situated along the line and is a surface focus), but the network has virtually no power to determine the epicenter or depth.

In general, a network which is sufficiently dense, and employs stations located at a variety of azimaths and distances from the center. offers the best accuracy for epicenter location for events beneath or near the network. The error in location (and particularily in depth) increases as the distance of the source from the perimeter of the network increases.

IV. Earthquake Distribution

During the period of February 13 to March 17, 1979, 170 earthquakes were identified and analyzed. Table 3 is a list of these events, including ID number, origin time, magnitude, location (longitude, latitude), distance from the base station (X: eastward; Y: northward), depth and standard error from X, Y, and Z (depth) axes. Figures 1 (scale 1:1,000,000) and 2 (scale 1:200,000) show the distribution of epicenters determined by the Pueblo-Chixoy-Quixal network during this time period. A cross indicates an earthquake with depth shallower than 60 km and a square represents an

event with depth greater than or equal to 60 km. Figure 2 shows only the events with depth shallower than 20 km.

It must be kept in mind that the duration of the recording is only 33 days and that the timing resolution is limited to approximately 0.2 sec by the drum recording system. Therefore, this distribution may not necessarily represent a reliable delineation of the epicenters. The purpose of this report is to illustrate the capability of the network during preliminary operation, and to report on some of the trends revealed thus far in its brief operation.

Careful inspection of Table 3 indicates that the standard error within the inner cluster stations (i.e. within the triangle demarcated by stations 1, 2, and 3) is approximately 2 km, and withing the perimeter of the network is about 5 km, as predicted by the timing resolution limitations. For events occuring outside the network, a probable error of up to 20 km is not uncommon (after the improved recording system is operational, this error should be substantially reduced).

Nevertheless, we can observe some trends in the accompanying figures:

1) High activity along the San Agustin-Matagua fault system (with relatively large scatter; Figure 1)

2) Relatively close alignment of epicenters along the Cuilco-Chixoy-Polochic fault, mainly to the west of the network (event nos. 28, 48, 63, 87, 128, 129, 145, 152, 170; Figure 2).

3) Concentration of events in the proximity of the dam site (event nos. 16, 32, 77, 86, 91, 94, 160; Figure 2). All of these events are of shallow origin and most of them, if not all, may have been generated by explosions. All of the events (with the exception of event 77) occurred between 10 A.M. and 5 P.M. local time.

4) The largest located earthquake during this period occurred southwest of the dam site (event no. 137, m=4.2). The depth is estimated at 33 km, but the standard error in the depth is large, and could allow the event to have taken place within the subduction zone.

V. Recommendations

1) Most urgently needed is to keep a complete log of all explosions, including location, time, and uield. This is very important to judge the local seismicity in the proximity of the dam site. In the event of large explosions (greater than 100 kg), Dr. Matumoto should be notified at least 10 days prior to detonation. Such an explosion is very useful for the calibration of the network if the shot time of the explosion is accurately measured. Dr. Matumoto is eager to visit Guatemala for such a measurement.

2) To reduce a high noise level, the relocation of station 3 is recommended. The recommended new site is approximately 6 km southwest of the central station on Cerro San Juan.

3) Exact location of all the stations should be determined by a professional surveyor. If a laser geodimeter is available, precise measurement of distances is highly desirable as well.

4) Logging of felt earthquakes is recommended. The record should include time and description of intensity (copy of the modified Mercalli scale is enclosed).

5) The history of the old church in San Cristobal should be examined. It is said that the church was established in 1712. If this date is confirmed, it provides an important clue for making a long term maximum intensity estimate for this vicinity.

6) Station 6 should be further cleared of brush and trees within a radius

of 25 m from the geophone location to reduce wind noise. All stations not yet fenced should be fenced immediately.

7) A station log should be maintained at the central recording station for the purpose of recording all station parameters and any changes that are made (particularily gain changes) and the reasons for such changes.

GUEPC MAR. 1979

Table 1

STRUCTURE PARAMETER

VP (KM/SEC)	VS (KM/SEC)	THICKNESS(KM)
5.10	2.94	8.30
6.20	3.58	12.90
6.60	3.81	22.30
7.90	4.65	16.60
8.15	4.60	999.99

STATIONS

NO	X(KM)	Y(KM)	Z(KM)	PC(SEC)	SC(SEC)	LON(DEG)	LAT(DEG)	NAME	CODE
1	-0.000	0.000	-1.702	-0.554	-0.960	-90.49110	15.35314	CHILLEY	GU1
2	-0.000	0.000	-1.702	-0.554	-0.960	-90.49110	15.35314	CHILLEY	GU1
3	-0.000	0.000	-1.702	-0.554	-0.960	-90.49110	15.35314	CHILLEY	GU1
4	1.734	-6.525	-1.180	-0.452	-0.783	-90.47495	15.29417	SAN JUAN	GU2
5	5.756	-3.808	-1.590	-0.526	-0.912	-90.43750	15.31872	PANRUM	GU3
6	22.996	3.813	-1.650	-0.544	-0.942	-90.27692	15.38760	XUCANEB	GU4
7	-0.503	11.564	-1.960	-0.605	-1.048	-90.49579	15.45765	NAJITILA	GU5
8	-21.596	-10.757	-2.220	-0.656	-1.136	-90.69218	15.25592	CHIMAGUA	GU6
9	-0.566	-18.252	-1.020	-0.421	-0.728	-90.49637	15.18818	CHITUCAN	GU7

Table 2

Station	PA/VCO Center Frequency Hz	PA/VCO Attenuation db	UHF Carrier Frequency mHz	Azimutly from Base-Station Degree
1 Z				
1 NS				
1 EW				
2	2380	12	405.355	164
3	1700	12	404.355	123
4	2380	12	404.855	80
5	2040	12	402.855	356
6	1700	12	403.855	243
7	1360	12	402.355	179

Table 3. List of earthquakes recorded by the Pueblo-Chixoy-Quixal Seismograph Network.

February 13 - March 17, 1979

Column	Abbreviation	Description
1	NO	Identification number.
2	YR	Year
3	M D	Month and Day
4	H M	Hour and minutes, G.M.T. (to calculate local time, subtract 6 hours)
5	S	Second of the origin time, a decimal point should be assumed between 2nd and 3rd digit
6	NP	Number of P-arrival reading
7	NS	Number of S-arrival reading
8	IQ	Quality number, ranging 1 through 5, 1 being the most accurate reading
9	ITR	Number of iterations carried out during the epicenter calculations
10	MAG	Magnitude x10, magnitude is calculated based on the duration time.
11	LONG	Longitude of epicenter (in degree)
12	LAT	Latitude of epicenter (in degree)
13	X	Distance measured from the central station (eastward positive)
14	Y	Distance measured from the central station (northward positive)
15	DEPTH	Depth; if a negative depth is obtained during the iteration process, the epicenter program program automatically fix the depth at 5.0 km and X, Y are calculated.
16	DX	Standard error for X (in km)
17	DY	Standard error for Y (in km)

Table 3-Continued

18	DZ	Standard error for Z (in km)
19	S	Standard error for origin time (in sec)

NO	YR	M D	H M	S	NP	NS	IQ	ITR	MAG	LONG (DEG)	LAT (DEG)	X (KM)	Y (KM)	DEPTH (KM)	DX (KM)	DY (KM)	DZ (KM)	S
1	79	213	237	3102	5	4	2	10	3.1	-92.272	15.532	-195.0	19.8	218.8	46.7	84.3	53.8	0.57
2	79	213	238	2883	4	2	3	9	3.8	-91.257	15.014	-83.9	-37.4	43.9	29.0	32.2	58.1	0.56
3	79	213	425	5820	3	2	4	6	1.6	0.000	0.000	-209.2	-79.6	37.9	1310.0	1310.0	1310.0	16.49
4	79	213	539	1894	3	3	4	6	1.5	0.000	0.000	-100.6	-51.9	27.9	585.8	621.6	395.8	5.42
5	79	213	544	1786	4	4	4	10	3.6	-88.864	13.056	178.1	-254.0	187.5	109.1	125.0	262.3	0.67
6	79	214	118	1064	5	5	4	10	2.1	-91.409	15.281	-100.5	-7.9	166.4	44.1	58.6	29.8	0.94
7	79	214	437	3438	6	6	2	10	2.2	-92.262	14.869	-194.0	-141.9	90.4	27.4	23.6	74.5	0.29
8	79	214	553	4607	6	3	4	10	2.3	-90.233	14.890	28.2	-51.2	32.5	14.6	14.1	28.2	0.76
9	79	214	1337	536	6	4	3	10	1.8	-90.276	14.292	23.4	-117.3	139.5	74.0	63.6	63.1	1.16
10	79	214	1809	2725	5	4	4	10	2.2	-89.946	14.659	59.6	-76.7	5.0	16.9	15.3	0.0	0.90
11	79	215	932	1669	3	6	4	10	0.5	-90.140	15.348	38.4	-0.5	5.1	2.1	2.1	0.9	0.15
12	79	215	958	2029	6	7	3	6	1.5	0.000	0.000	-76.8	-51.3	22.6	50.9	69.2	71.1	2.30
13	79	215	1146	0	7	0	3	4	3.6	0.000	0.000	1310.0	1181.5	1310.0	1310.0	1310.0	1310.0	3.26
14	79	215	1529	509	6	4	4	10	3.0	-92.737	12.090	-246.0	-360.8	329.8	259.4	241.6	276.0	1.27
15	79	215	1540	3975	7	5	1	9	2.8	-91.747	14.202	-137.6	-127.2	4.4	29.1	30.1	13.2	0.69
16	79	215	1704	1245	6	4	2	10	2.5	-90.486	15.270	0.5	-9.1	5.0	1.5	1.0	0.0	0.33
17	79	215	1719	1946	5	5	3	10	0.2	-90.481	15.232	1.0	-13.4	12.3	1.7	1.4	2.9	0.19
18	79	215	1923	389	5	1	2	10	2.0	-90.388	15.246	11.2	-11.7	19.7	7.5	8.4	28.2	0.91
19	79	215	2056	2927	7	6	2	10	4.0	-91.261	13.475	-84.3	-207.6	144.2	36.2	43.5	62.2	0.54
20	79	215	2130	1896	4	1	4	10	2.1	0.000	0.000	-61.3	-281.1	88.0	344.5	256.6	993.3	2.72
21	79	215	2144	307	4	4	4	10	0.6	-90.742	15.371	-27.5	2.0	5.0	10.8	7.5	0.0	0.85
22	79	215	2237	2338	4	1	5	10	2.4	0.000	0.000	9.7	22.7	5.0	12.8	24.0	0.0	3.47
23	79	215	2341	1521	3	2	5	5	2.0	0.000	0.000	1310.0	1310.0	5.0	1310.0	1310.0	0.0	1067.38
24	79	216	19	4657	3	3	4	10	3.0	-90.922	15.101	-47.2	-27.9	64.6	10.9	8.8	10.2	0.34
25	79	216	100	4469	4	3	4	10	1.3	-90.507	15.164	-1.8	-20.9	111.5	55.9	86.2	39.3	1.43
26	79	216	310	2805	4	6	4	6	1.8	0.000	0.000	-92.4	-230.5	84.7	345.5	292.1	384.2	3.58
27	79	216	841	958	3	2	5	6	-0.1	0.000	0.000	1310.0	-665.7	5.0	1310.0	1310.0	0.0	435.17
28	79	216	856	2455	7	6	1	10	1.5	-90.662	15.364	-18.8	1.3	7.3	5.1	1.6	4.4	0.26
29	79	216	1015	3268	7	6	0	10	5.6	-90.046	14.678	48.7	-74.6	136.4	9.0	11.0	8.3	0.22
30	79	216	1040	1434	7	7	1	8	2.7	-91.050	13.236	-61.3	-234.1	48.9	117.5	144.3	381.2	1.97
31	79	216	1343	1093	6	5	1	6	2.0	-90.749	14.556	-28.2	-88.1	23.4	61.9	39.7	83.6	1.63
32	79	216	1701	3482	5	4	2	10	1.6	-90.464	15.274	2.9	-8.7	5.2	2.1	1.2	4.0	0.38
33	79	216	2157	5601	6	6	1	9	1.7	-90.926	15.006	-47.7	-38.4	6.0	4.6	5.7	73.7	0.34
34	79	216	2203	928	6	2	4	5	2.2	0.000	0.000	-143.7	5.6	15.1	394.7	542.0	727.3	9.78
35	79	216	2224	4127	5	2	4	10	3.3	-90.546	13.922	-6.0	-158.2	269.5	128.4	232.9	139.5	1.38
36	79	216	2252	5022	7	6	1	10	2.5	-90.895	15.014	-44.3	-37.5	20.4	3.6	3.9	1.9	0.27
37	79	216	2315	3897	5	1	4	5	2.5	0.000	0.000	-157.7	-38.6	45.4	687.3	728.9	439.3	13.35
38	79	217	233	1863	6	4	2	9	2.5	-90.731	13.086	-26.3	-250.7	62.0	56.6	73.6	248.5	0.88
39	79	217	601	0	7	0	1	10	2.5	0.000	0.000	1310.0	1310.0	1310.0	1310.0	1310.0	0.0	9.04
40	79	217	602	1359	4	2	3	5	3.7	0.000	0.000	-56.1	95.6	52.5	208.2	276.9	309.5	4.12
41	79	217	1058	0	4	0	4	5	1.3	0.000	0.000	1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	3.12
42	79	217	1418	1766	7	1	2	7	3.5	0.000	0.000	-123.8	-180.5	31.2	448.3	547.1	883.1	7.12
43	79	217	1719	3793	7	4	2	10	2.5	-92.371	14.456	-205.9	-99.2	5.0	73.4	128.6	0.0	1.85
44	79	217	2125	4346	5	5	4	6	1.3	0.000	0.000	-114.4	21.2	51.2	82.9	167.4	146.9	2.66
45	79	217	2136	1832	5	4	4	10	2.2	-90.142	15.253	38.2	-11.0	36.8	23.5	32.7	38.6	1.73
46	79	217	2303	2980	5	6	3	8	2.4	-91.071	12.651	-63.5	-298.8	53.0	41.3	69.0	317.8	0.55
47	79	217	2324	3535	3	1	4	10	0.3	0.000	0.000	-199.6	23.2	5.0	1310.0	1310.0	0.0	56.78
48	79	217	2328	269	7	7	2	10	1.3	-90.461	15.342	3.3	-1.2	11.6	1.4	1.4	2.3	0.35
49	79	218	110	5793	7	7	1	10	2.8	-91.531	12.911	-113.9	-270.1	56.2	78.3	109.8	398.0	1.00
50	79	218	317	4283	6	6	3	8	1.1	-90.497	14.764	-0.7	-65.1	2.6	13.8	19.2	72.4	1.12

NO	[illegible]	[illegible]	H	M	S	NF	NS	IQ	IYR	MAG	LONG (DEG)	[illegible]	X (KM)	Y (KM)	DEPTH (KM)	[illegible]	[illegible]	[illegible]	[illegible]
51	79	218	318	1427	7	7	1	10	2.7	-92.043	14.146	-169.9	-133.4	124.4	34.7	46.8	53.2	0.60
52	79	218	934	4854	7	5	3	10	2.8	0.000	0.000	66.5	-135.6	5.0	65.9	52.2	0.0	2.69
53	79	218	1012	491	7	3	1	5	4.0	0.000	0.000	-29.2	-325.4	43.0	822.5	972.7	1213.5	12.98
54	79	218	1423	0	3	5	4	3	2.7	0.000	0.000	1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	1310.00
55	79	218	1616	5243	6	4	3	7	2.1	0.000	0.000	-223.4	-188.5	86.8	355.8	523.1	490.3	4.82
56	79	218	2249	5715	5	4	3	10	2.5	-90.369	14.816	13.3	-59.3	5.0	15.9	13.5	0.0	0.90
57	79	219	201	3974	3	3	3	10	0.0	-90.499	15.244	-0.9	-12.1	14.1	3.0	2.2	6.3	0.39
58	79	219	621	4074	7	7	0	6	2.7	-91.153	13.462	-72.5	-209.1	56.2	36.6	16.7	15.0	0.65
59	79	219	813	5914	4	1	4	10	2.5	0.000	0.000	24.5	-48.6	5.0	84.1	127.5	0.0	4.43
60	79	219	907	1487	4	1	4	10	1.6	-92.181	13.921	-185.1	-158.3	85.8	41.1	38.6	114.1	0.34
61	79	219	1002	5797	4	3	4	5	0.6	-90.596	14.996	-11.6	-39.4	2.9	5.1	9.1	4.7	0.60
62	79	219	1358	2958	7	5	2	10	3.0	-90.111	14.916	41.6	-48.3	33.3	13.7	15.6	30.6	0.85
63	79	219	1625	3427	7	7	1	10	1.6	-90.363	15.369	14.0	1.8	9.8	3.3	4.3	5.3	1.04
64	79	219	1719	5715	4	0	3	10	0.2	0.000	0.000	8.6	11.2	5.0	11.4	27.5	0.0	2.98
65	79	219	1854	278	4	2	4	6	0.3	-91.176	15.686	-75.0	36.8	20.8	8.9	7.4	26.8	0.27
66	79	219	1854	2776	3	2	4	5	0.3	0.000	0.000	4.1	-16.6	3.3	86.0	29.2	25.4	2.68
67	79	219	2008	0	6	0	2	6	0.6	0.000	0.000	-36.0	1310.0	1310.0	1310.0	1310.0	1310.0	4.52
68	79	219	2008	0	6	0	3	3	2.0	0.000	0.000	1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	16.70
69	79	219	2121	981	3	5	3	5	0.9	-89.617	15.965	95.6	67.7	18.3	11.1	13.6	40.2	0.39
70	79	219	2127	4406	5	5	2	9	2.1	-89.864	15.655	68.6	33.4	6.7	8.7	9.1	61.9	0.44
71	79	220	319	4602	7	6	2	10	2.8	-93.382	16.953	-316.6	177.0	239.0	50.4	72.9	107.9	0.49
72	79	220	431	2579	7	6	1	10	2.9	-90.607	14.950	-12.7	-44.5	15.5	3.3	5.3	10.6	0.37
73	79	220	508	3443	7	7	1	10	1.8	-90.664	14.749	-19.0	-66.8	34.6	4.3	5.4	9.4	0.29
74	79	220	939	4281	7	7	0	10	4.0	-89.963	14.412	57.7	-104.0	95.2	17.6	22.2	33.3	0.53
75	79	221	533	1735	5	4	1	10	3.5	-92.218	15.121	-189.1	-25.6	113.2	9.6	13.3	17.3	0.18
76	79	221	639	4958	5	0	2	10	3.0	-90.828	14.601	-36.9	-74.3	48.9	18.3	36.9	12.9	0.12
77	79	221	858	5009	4	2	3	10	1.3	-90.470	15.272	2.3	-8.9	7.8	1.2	0.5	0.6	0.10
78	79	221	1258	2925	5	5	3	10	2.1	-90.592	15.000	-11.1	-38.9	5.0	6.6	11.2	0.0	0.95
79	79	221	1557	0	4	0	2	4	4.3	0.000	0.000	1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	4.67
80	79	221	2226	3787	3	4	4	6	2.7	0.000	0.000	-251.0	353.4	81.6	1310.0	1170.7	1310.0	8.28
81	79	222	613	3194	3	4	4	10	3.0	-92.909	18.544	-264.8	353.0	187.8	141.1	244.0	641.2	1.13
82	79	222	813	0	5	0	4	4	3.5	0.000	0.000	1310.0	27.3	1310.0	1310.0	1019.6	1310.0	4.52
83	79	222	919	0	5	0	4	4	4.6	0.000	0.000	1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	3.37
84	79	222	1450	3213	5	5	4	5	3.0	0.000	0.000	-255.7	-90.4	58.4	182.0	223.4	598.1	2.83
85	79	222	0	0	0	0	5	0	0.0	0.000	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.00
86	79	222	2224	515	5	4	3	10	0.5	-90.486	15.286	0.5	-7.4	4.4	0.8	0.3	1.7	0.10
87	79	222	2258	2919	3	0	6	10	3.0	-90.481	15.369	1.0	1.8	5.0	0.3	0.2	0.0	0.05
88	79	223	642	4750	5	1	3	5	3.0	0.000	0.000	-146.2	-47.3	16.3	190.2	137.4	332.7	2.50
89	79	223	650	1299	2	2	5	10	2.2	-88.680	14.546	198.3	-89.2	5.0	30.0	54.7	0.0	0.74
90	79	223	1438	4058	3	3	5	10	2.5	-90.223	15.032	29.3	-35.5	23.2	6.7	7.3	13.6	0.45
91	79	223	2358	4522	3	2	5	10	1.5	-90.494	15.288	-0.4	-7.2	8.7	2.2	1.3	6.5	0.16
92	79	224	844	5277	5	4	3	7	1.9	0.000	0.000	-186.7	-226.8	2.7	972.6	1202.7	1310.0	12.80
93	79	224	1154	5825	4	4	4	5	2.8	0.000	0.000	-328.0	322.6	220.9	1310.0	1310.0	1310.0	11.34
94	79	224	1620	4384	3	3	5	10	1.9	-90.482	15.310	1.0	-4.7	5.0	1.3	0.8	0.0	0.24
95	79	224	1749	356	6	3	2	10	4.2	-93.629	17.470	-343.7	234.2	186.5	59.4	86.2	193.0	0.53
96	79	225	340	2207	2	3	4	5	0.9	0.000	0.000	24.3	-70.0	8.7	516.2	119.4	686.8	4.14
97	79	225	516	5857	4	4	4	10	2.1	-91.295	12.162	-88.0	-352.9	63.8	119.0	119.9	575.7	0.86
98	79	225	1022	2566	5	1	2	10	3.7	-94.430	17.617	-431.3	250.5	234.8	102.4	90.1	237.2	0.45
99	79	225	1105	2084	5	4	2	8	2.7	0.000	0.000	-219.7	-171.8	10.7	1310.0	706.9	1310.0	7.49
100	79	225	1425	1790	4	3	3	5	2.9	0.000	0.000	-200.6	-167.0	135.5	1310.0	1153.9	1310.0	12.99

NO		D	H	M	S	NF	NS	IQ	ITR	TMG	LONG (DEG)	(D	X (KM)	Y (KM)	DEPTH (KM)	DX (KM)	DY (KM)	DZ (KM)	S
101	79	225	1709	4147	3	3	4	10	2.1	0.000	0.000		-104.4	-191.9	5.0	537.6	347.0	0.0	4.24
102	79	225	154	5081	6	1	1	5	3.5	-90.088	14.570		44.1	-86.5	24.8	11.3	12.9	26.6	0.39
103	79	225	900	3131	2	2	4	6	1.3	0.000	0.000		461.3	1310.0	5.0	1310.0	1310.0	0.0	512.40
104	79	226	1317	1485	5	5	3	6	1.3	-90.986	14.683		-54.3	-74.0	43.8	72.9	59.2	68.3	1.88
105	79	228	0	0	0	0	5	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
106	79	228	1712	0	5	0	6	4	4.8	0.000	0.000		1310.0	240.3	1310.0	1310.0	1310.0	1310.0	5.65
107	79	228	1840	4161	7	6	2	9	2.0	-91.011	14.821		-56.9	-58.8	3.5	17.2	22.0	107.0	1.04
108	79	228	2012	0	7	0	6	5	4.8	0.000	0.000		1019.9	1310.0	1310.0	1310.0	1310.0	1310.0	4.85
109	79	228	2048	883	7	7	2	6	1.3	-90.958	14.854		-51.2	-55.1	15.7	6.7	7.3	5.4	0.43
110	79	228	2137	0	7	0	6	5	5.7	-127.124	21.873		1310.0	721.2	1310.0	1310.0	1310.0	1310.0	1.60
111	79	228	2345	2813	2	2	5	10	0.9	-90.264	15.378		24.9	2.8	5.0	5.6	4.0	0.0	0.32
129 112	79	301	557	235	3	3	5	10	0.8	-90.507	14.422		-1.7	-103.0	5.0	11.7	6.3	0.0	0.36
113	79	301	734	2554	4	4	4	10	1.5	-89.335	15.046		126.5	-33.9	5.0	12.0	21.2	0.0	0.72
114	79	301	1243	2205	3	3	5	10	0.9	-89.038	15.324		159.0	-3.1	25.6	10.9	30.5	6.6	0.56
115	79	301	1335	1734	4	4	4	10	1.4	-89.159	15.022		145.8	-36.6	5.0	2.3	4.6	0.0	0.13
116	79	301	1413	1037	5	5	3	10	1.6	-91.020	14.799		-57.9	-61.2	15.8	6.0	6.0	4.4	0.30
117	79	301	1437	73	3	0	6	5	4.0	-89.397	14.781		119.7	-63.2	5.0	282.7	151.8	0.0	1.74
118	79	301	1508	5617	3	3	5	10	1.3	-91.522	13.946		-112.9	-155.6	149.8	23.3	19.3	23.7	0.24
119	79	301	1509	4077	3	3	5	10	1.6	-91.673	13.704		-129.5	-182.4	74.7	44.1	37.1	135.5	0.45
120	79	301	2124	428	6	6	3	10	2.0	-91.931	13.872		-157.7	-163.8	115.2	22.8	29.2	40.5	3.27
121	79	302	240	669	5	5	4	10	1.1	-90.958	14.838		-51.2	-56.9	18.8	3.7	3.5	2.3	0.19
122	79	302	312	5884	6	6	4	10	1.3	-89.544	16.004		103.7	72.0	33.3	8.5	11.3	2.6	0.33
123	79	302	500	3802	3	3	5	6	0.9	-90.539	14.729		-5.3	-69.0	17.6	52.3	34.7	25.5	1.93
124	79	302	632	3485	5	5	3	7	1.4	-89.674	15.521		89.4	18.7	11.8	2.9	4.5	57.5	0.17
125	79	302	845	5675	4	0	4	10	2.1	-90.387	15.198		11.4	-17.1	21.9	0.0	0.0	0.1	0.00
126	79	302	1213	3780	3	3	5	7	1.3	-92.560	14.366		-226.6	-109.1	63.1	65.2	53.6	216.8	0.63
127	79	302	1230	0	6	0	6	5	4.0	0.000	-8.603		1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	1.05
128	79	302	1408	3404	5	5	5	10	0.9	-90.829	15.414		-37.0	6.8	17.1	10.0	8.7	18.2	0.77
129	79	310	1650	1781	5	5	3	10	0.0	-90.614	15.354		-13.5	0.2	11.1	1.4	1.4	5.3	0.24
130	79	311	357	5214	6	5	3	7	1.9	0.000	0.000		-148.0	-232.7	61.0	327.8	380.6	557.4	4.34
131	79	311	446	4507	5	5	3	10	1.4	-91.632	13.602		-125.0	-193.6	76.5	16.1	21.5	60.7	0.27
132	79	311	651	0	5	0	3	8	2.8	-83.434	4.417		772.6	-1209.5	597.9	1310.0	1310.0	1310.0	1.34
133	79	311	739	0	4	4	4	4	2.5	0.000	0.000		1027.8	472.1	1310.0	1310.0	1310.0	1310.0	864.40
134	79	311	845	5184	4	2	4	10	2.8	-93.155	15.966		-291.7	67.8	350.0	42.5	40.6	42.9	0.24
135	79	311	922	0	3	0	5	6	0.8	0.000	0.000		1310.0	1310.0	5.0	1310.0	1310.0	0.0	16.20
136	79	311	1214	958	4	4	4	10	2.7	-93.421	17.131		-320.9	196.7	240.0	46.4	42.9	83.4	0.29
137	79	311	1219	3972	5	0	3	10	4.2	-90.332	15.225		17.3	-14.2	33.4	28.7	32.9	102.9	1.54
138	79	311	1540	2370	6	6	3	10	0.2	-90.377	15.320		12.5	-3.6	4.9	0.7	0.8	2.8	0.20
139	79	312	241	1296	5	1	6	10	2.9	-94.321	16.105		-419.4	83.3	5.0	30.0	107.2	0.0	0.70
140	79	312	830	1728	6	6	2	10	2.4	-91.928	14.102		-157.3	-138.3	76.0	34.2	45.7	89.6	0.65
141	79	312	906	843	3	3	5	10	0.5	-90.427	14.944		6.9	-45.2	5.0	10.6	13.4	0.0	0.82
142	79	312	913	43	6	6	2	7	1.9	0.000	0.000		212.4	-12.8	41.8	119.5	385.5	139.9	5.78
143	79	312	1444	2300	5	4	3	10	2.5	-91.258	16.863		-84.0	167.1	219.7	35.3	44.6	44.5	0.48
144	79	312	1535	0	5	0	3	7	3.9	0.000	0.000		903.6	1310.0	1310.0	1310.0	1310.0	1310.0	3.39
145	79	312	1711	4070	7	7	2	10	0.8	-90.619	15.358		-14.1	0.6	14.5	1.3	1.5	2.9	0.23
146	79	312	2320	280	3	3	5	10	1.3	-90.256	15.459		25.6	11.8	5.0	7.8	8.1	0.0	0.64
147	79	312	2321	3226	5	4	3	5	2.6	0.000	0.000		1310.0	1310.0	5.0	1310.0	1310.0	0.0	518.17
148	79	313	634	2333	4	4	4	10	2.7	-91.831	14.220		-146.8	-125.3	5.0	14.9	17.4	0.0	0.34
149	79	313	1449	8	7	0	2	7	3.9	-85.913	7.757		501.2	-840.1	472.0	1310.0	1310.0	1310.0	0.67
150	79	313	1530	651	7	5	1	7	2.5	-90.830	13.122		-37.2	-246.7	87.2	132.7	154.0	272.2	1.99

NO		IPD	H	M	S	NF	NS	IQ	IR	MAG	LONG (DEG)		X (KM)	Y (KM)	DEPTH (KM)	D (KM)	D (KM)	D (KM)	S
151	79	313	2034	1515	8	4	1	10	3.2	-90.753	13.203		-28.7	-237.7	38.0	61.1	491.8	650.5	0.31
152	79	314	49	5390	8	6	1	10	1.1	-90.587	13.353		-10.5	0.0	12.2	1.0	1.1	2.5	0.21
153	79	314	835	3353	7	6	1	10	2.5	-91.916	13.796		-156.0	-172.0	115.7	22.2	28.8	44.4	0.39
154	79	314	943	2824	7	0	2	7	2.9	-88.487	10.856		219.4	-497.3	246.1	1310.0	1310.0	1310.0	1.31
155	79	314	1109	0	4	0	6	10	5.7	0.000	0.000		1310.0	1310.0	772.7	1310.0	1310.0	0.0	22.51
156	79	314	1215	3691	5	2	3	10	2.5	-91.608	13.507		-122.4	-204.1	5.0	155.0	109.0	0.0	1.21
157	79	314	1239	0	3	0	5	5	2.0	0.000	0.000		1310.0	771.5	5.0	1310.0	1310.0	0.0	19.54
158	79	314	1538	0	4	0	6	3	4.6	0.000	0.000		1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	10.28
159	79	314	1825	863	7	7	1	10	1.4	-89.429	15.079		116.2	-30.3	14.6	5.4	10.5	5.1	0.43
160	79	314	2124	5443	4	2	4	5	0.5	-90.484	15.271		0.7	-9.0	1.6	4.8	2.7	8.6	0.71
161	79	315	134	1227	4	1	6	10	3.3	-92.886	17.732		-262.3	263.2	200.0	63.1	56.2	127.9	0.34
162	79	315	346	36	8	2	1	7	3.9	-88.787	13.539		186.6	-200.5	87.0	70.8	95.1	213.2	0.96
163	79	315	703	0	4	0	4	3	2.7	0.000	0.000		1310.0	1310.0	1310.0	1310.0	1310.0	1310.0	11.81
164	79	315	754	108	7	5	1	10	3.6	-87.338	14.477		345.1	-96.9	5.0	47.7	152.7	0.0	1.58
165	79	315	1143	5750	4	1	4	10	1.5	-91.673	14.113		-129.4	-137.1	5.0	55.6	51.8	0.0	0.08
166	79	315	1828	5870	7	7	1	10	1.2	-90.312	14.578		19.6	-85.7	5.0	10.0	8.1	0.0	0.70
167	79	316	650	4743	5	3	3	10	3.0	-93.700	17.277		-351.4	212.8	5.0	20.6	33.6	0.0	0.30
168	79	316	930	4636	5	0	3	7	1.7	0.000	0.000		-333.7	-97.7	119.2	1310.0	1310.0	1310.0	7.46
169	79	316	1204	4215	2	1	5	5	-0.3	0.000	0.000		52.0	-184.7	5.0	1310.0	1310.0	0.0	33.23
170	79	316	1233	4794	6	6	3	10	-0.4	-90.607	15.370		-12.8	1.9	5.0	1.4	1.5	0.0	0.34
171	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
172	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
173	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
174	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
175	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
176	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
177	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
178	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
179	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
180	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
181	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
182	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
183	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
184	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
185	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
186	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
187	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
188	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
189	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
190	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
191	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
192	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
193	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
194	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
195	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
196	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
197	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
198	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
199	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00
200	0	0	0	0	0	0	0	0	0.0	0.000	0.000		0.0	0.0	0.0	0.0	0.0	0.0	0.00