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HIGH RESOLUTION IMAGING OF THE SUBDUCTED SLAB IN THE CASCADIA CONVERGENCE ZONE USING TELESEISMIC P WAVE CONVERSIONS RECORDED WITH A DENSE ARRAY OF SEISMOMETERS

Submitted By

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PASSCAL Data Report 96-004

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96-004

Experiment Name: Cascadia, 1993-94

Project Title: High Resolution Imaging of the Subducted Slab in the Cascadia Convergence Zone Using Teleseismic P Wave Conversions Recorded with a Dense Array of Seismometers

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Funding Agency: NSF

Start Date: March 23, 1993 End Date: April 13, 1994

Array Coordinates: 44.42N, 235.51W - 239.70W

Experiment Design and Goals

>From April 1993 until April 1994 we operated a large, dense linear array of broadband seismometers across the Cascadia subduction zone in western Oregon. The array extended 300 km from the Pacific coast, across the Coast Range, Willamette Valley, and Cascades Mountains, into the Ochoco Mountains in the back arc (Fig. 1). Altogether 69 sites were occupied with as many as 44 stations operating simultaneously at a given time. Station spacing was 4 km along the western 240 km and 8 km along the remaining eastern part. The primary goal of the experiment was to obtain a high-resolution image of the crustal and upper-mantle structure beneath the arc using converted phases from teleseismic body waves and to demonstrate that interpretation of converted phase profiles can be approached in a manner similar to profiles in reflection/refraction studies.

Principal Accomplishments

The dipping Moho of the subducted Juan de Fuca (JdF) lithosphere can be clearly recognized in the raw receiver-function profile. From the coast, at a 30 km depth, the JdF Moho, deepens eastward at a steady 11° angle, increasing to 19° under the Willamette Valley, and reaching a depth of 80 km underneath the Cascades. The subhorizontal Moho of the overriding North American plate is also clearly recognized.

Waveform inversion of this data set provides some of the most detailed information to date on the structure of the lithosphere beneath a volcanic arc and the overlying mantle wedge. There is a clear evidence for a low-velocity zone sandwiched between the JdF Moho and the upper crust of the overriding plate beneath the Coast Range, and interpreted as the subducted Juan de Fuca crust. This crust seems to undergo velocity-increasing eclogite transformation near the slab bend. Above the subducted plate we observe an eastward thickening wedge of low-velocity serpentinized continental mantle, caused by dehydration of the subducting Juan de Fuca plate. Under the Cascade volcanoes, partial melting probably also contributes to localized, extremely low values of seismic wave speeds. In the upper crust of the Coast Range, and extending into the Old Cascades, waveform inversion indicates the presence of a thick body of mafic material. This material

is characterized by a high Poisson ratio and has been imaged previously by refraction experiments. East of the Cascade volcanoes, the structure is much simpler.

The SKS split times are shown to increase from about 1.0 s at the coast to about 2.2 s (among the largest values world-wide) under the Cascade volcanoes. The overall direction of fast polarization beneath the forearc and the arc is consistent with the direction of motion of the Juan de Fuca plate. We estimate the maximum depth of anisotropic material beneath the array to be 30-40 km in the Coast Range and about 130 km under the volcanoes. Combined with the receiver function profiles, we hypothesize that the one-second difference in SKS-splitting between the coast and the volcanoes is mainly caused by the presence of highly anisotropic wedge of serpentinite. Under the volcanoes, fluid-filled cracks may also contribute significantly to anisotropy.

References

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The data base in the STA_ERR directory contains suspected errors associated with instrument magnification and polarity. Timing drifts while the GPS or Omega is unlocked have not been corrected. The error data base contains corrections due to 10 s Omega miscues. **Moreover, on 1993/06/30 (Julian day 181) 23:59:59 there was a leap second, which we did not correct by reprogramming the Refteks.** This affects only stations with recorders equipped with Omega; the affected stations have -1.0 s correction in the error data base. An example is shown in Table 5.

Recording Parameters

All sensors were broadband, either Streckeisen STS-2 or Guralp CMG-3ESP. Recorders were 16-bit Refteks, recording two continuous data streams with sampling rates of 20 and 1 sps. The timing was provided by either by Omega or GPS.

Recorded Data

Data are organized into array day-tapes, tapes with data from the entire array for one or several days. These are tar files whose structure is shown in Table 1.

Ancillary Information

There is a tar tape containing ancillary information. There are four directories DT_LOGS, STA_DB, STA_ERR, and STA_LOC, which are described below.

DT_LOGS: Day-Tape Content

The content of each day-tape can be found in the DT log file (an example is shown in Table 2).

STA_DB: Station Names

All stations names start with the letter A followed by a number. Originally, the station numbers contained two-digits increasing from number 01 at the coast. As the array was rearranged with time, some stations fell between previously occupied sites, say A30 and A31, and in that case the new station name was given a 3 digit number, say A305. Hence, if all two digit station numbers are converted to 3 digit numbers by appending a zero, the station numbers increase with distance from the coast. The data base used to convert the Reftek numbers to the station names is given in directory STA_DB. The file names in the data base contain the Julian day and time. Always the latest file before the start of the recording is used to match the Reftek number with the correct station name. An example is shown in Table 3.

STA_LOC: Station Locations

The station locations were determined by the GPS. The coordinates are given in Table 4. A few stations were relocated by a small distance because of site problems. In those situations, the station name remained unchanged. Precise station locations appropriate for a given date can be found in the directory STA_LOC. Again, the file names of the data base contain the Julian day and time, and the latest file before the start of the recording is used to find the station location.

STA_ERR: Problems and Errors

In general the deployment was very successful. After an initial shakedown, the there were no serious problems. Some sites, primarily those on exposed hard rock, show elevated low-frequency noise on the horizontal components during the daylight hours. We believe this noise is caused by tilting of the exposed rock surface in response to temperature fluctuations.

Table 1. Format of the Array Day-Tapes

These are SEGY files created by ref2segy, then renamed, reorganized and tared.

ERRS/A05.179-194.err	*All pertinent error files created by ref2sey are stored in ERRS.*
ERRS/A04.179-193.err	*Station name and JD-span indicated.*
ERRS/A06.179-194.err	
ERRS/A41.178-192.err	
LOGS/A04.179-193.log	*All pertinent logfiles created by ref2sey are stored in LOGS.*
LOGS/A06.179-194.log	*Station name and JD-span indicated.*
LOGS/A05.179-194.log	
LOGS/A41.178-192.log	
LOGS/A42.178-192.log	
R185.01/	*Stream 01, 20 sps, JD 185 / Hour / STAT.HR.MIN.SEC.COMP*
R185.01/00/	
R185.01/00/A04.00.08.17.N	
R185.01/00/A04.00.08.17.E	
R185.01/00/A04.00.28.21.Z	
R185.01/00/A04.00.28.21.N	
R185.01/00/A04.00.28.21.E	
R185.01/00/A04.00.48.24.Z	
R185.01/00/A04.00.48.24.N	
R185.01/00/A04.00.48.24.E	
R185.01/00/A05.00.16.55.Z	
R185.01/00/A05.00.16.55.N	
R185.01/00/A05.00.16.55.E	
R185.01/00/A05.00.36.58.Z	
R185.01/00/A05.00.36.58.N	
R185.01/00/A05.00.36.58.E	
R185.01/00/A05.00.57.02.Z	
R185.01/00/A05.00.57.02.N	
R185.01/00/A05.00.57.02.E	
R185.01/00/A06.00.15.49.Z	
R185.01/00/A06.00.15.49.N	
R185.01/00/A06.00.15.49.E	
R185.01/00/A06.00.35.53.Z	
R185.01/00/A06.00.35.53.N	
R185.01/00/A06.00.35.53.E	
R185.01/00/A06.00.55.56.Z	
R185.01/00/A06.00.55.56.N	
R185.01/00/A06.00.55.56.E	
R185.01/00/A41.00.11.37.N	
R185.01/00/A04.00.08.17.Z	
R185.01/00/A41.00.11.37.E	
R185.01/00/A41.00.31.40.Z	
R185.01/00/A41.00.31.40.N	
R185.01/00/A41.00.31.40.E	
R185.01/00/A41.00.51.44.Z	
R185.01/00/A41.00.51.44.N	
R185.01/00/A41.00.51.44.E	
R185.01/00/A42.00.19.36.Z	
R185.01/00/A42.00.19.36.N	
R185.01/00/A42.00.19.36.E	

R185.01/00/A42.00.39.40.Z
R185.01/00/A42.00.39.40.N
R185.01/00/A42.00.39.40.E
R185.01/00/A42.00.59.43.Z
R185.01/00/A42.00.59.43.N
R185.01/00/A42.00.59.43.E
R185.01/00/A41.00.11.37.Z
R185.01/01/
R185.01/01/A04.01.08.28.N
R185.01/01/A04.01.08.28.E
R185.01/01/A04.01.28.31.Z
R185.01/01/A04.01.28.31.N
R185.01/01/A04.01.28.31.E
R185.01/01/A04.01.48.35.Z
R185.01/01/A04.01.48.35.N
R185.01/01/A04.01.48.35.E
R185.01/01/A05.01.17.05.Z
R185.01/01/A05.01.17.05.N
R185.01/01/A05.01.17.05.E
R185.01/01/A05.01.37.09.Z
R185.01/01/A05.01.37.09.N
R185.01/01/A05.01.37.09.E
R185.01/01/A05.01.57.12.Z
R185.01/01/A05.01.57.12.N
R185.01/01/A05.01.57.12.E
R185.01/01/A06.01.16.00.Z
R185.01/01/A06.01.16.00.N
R185.01/01/A06.01.16.00.E
R185.01/01/A06.01.36.03.Z
R185.01/01/A06.01.36.03.N
R185.01/01/A06.01.36.03.E
R185.01/01/A06.01.56.07.Z
R185.01/01/A06.01.56.07.N
R185.01/01/A06.01.56.07.E
R185.01/01/A41.01.11.47.N
R185.01/01/A04.01.08.28.Z
R185.01/01/A41.01.11.47.E
R185.01/01/A41.01.31.51.Z
R185.01/01/A41.01.31.51.N
R185.01/01/A41.01.31.51.E
R185.01/01/A41.01.51.54.Z
R185.01/01/A41.01.51.54.N
R185.01/01/A41.01.51.54.E
R185.01/01/A42.01.19.47.Z
R185.01/01/A42.01.19.47.N
R185.01/01/A42.01.19.47.E
R185.01/01/A42.01.39.50.Z
R185.01/01/A42.01.39.50.N
R185.01/01/A42.01.39.50.E
R185.01/01/A42.01.59.54.Z
R185.01/01/A42.01.59.54.N
R185.01/01/A42.01.59.54.E
R185.01/01/A41.01.11.47.Z
R185.01/02/

R185.01/02/A04.02.08.38.N
R185.01/02/A04.02.08.38.E
R185.01/02/A04.02.28.42.Z

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R185.02/ *Stream 02, 1sps, JD 185 / STAT.HR.MIN.SEC.COMP*
R185.02/A04.05.17.11.N
R185.02/A04.05.17.11.E
R185.02/A05.05.46.00.Z
R185.02/A05.05.46.00.N
R185.02/A05.05.46.00.E
R185.02/A04.05.17.11.Z
R185.02/A04.11.19.37.N
R185.02/A04.11.19.37.E
R185.02/A05.11.48.26.Z
R185.02/A05.11.48.26.N
R185.02/A05.11.48.26.E
R185.02/A04.11.19.37.Z
R185.02/A04.17.22.03.N
R185.02/A04.17.22.03.E
R185.02/A05.17.50.52.Z
R185.02/A05.17.50.52.N
R185.02/A05.17.50.52.E
R185.02/A04.17.22.03.Z
R185.02/A04.23.24.29.N
R185.02/A04.23.24.29.E
R185.02/A05.23.53.18.Z
R185.02/A05.23.53.18.N
R185.02/A05.23.53.18.E
R185.02/A04.23.24.29.Z
R185.02/A06.00.42.40.N
R185.02/A06.00.42.40.E
R185.02/A06.00.42.40.Z
R185.02/A06.06.45.06.N
R185.02/A06.06.45.06.E
R185.02/A06.06.45.06.Z
R185.02/A06.12.47.32.N
R185.02/A06.12.47.32.E
R185.02/A06.12.47.32.Z
R185.02/A06.18.49.58.N
R185.02/A06.18.49.58.E
R185.02/A06.18.49.58.Z
R185.02/A41.04.30.35.N
R185.02/A41.04.30.35.E
R185.02/A41.04.30.35.Z
R185.02/A41.10.33.01.N
R185.02/A41.10.33.01.E
R185.02/A41.10.33.01.Z
R185.02/A41.16.35.27.N
R185.02/A41.16.35.27.E

R185.02/A41.16.35.27.Z
R185.02/A41.22.37.53.N
R185.02/A41.22.37.53.E
R185.02/A41.22.37.53.Z
R185.02/A42.05.34.36.N
R185.02/A42.05.34.36.E
R185.02/A42.05.34.36.Z
R185.02/A42.11.37.02.N
R185.02/A42.11.37.02.E
R185.02/A42.11.37.02.Z
R185.02/A42.17.39.28.N
R185.02/A42.17.39.28.E
R185.02/A42.17.39.28.Z
R185.02/A42.23.41.54.N
R185.02/A42.23.41.54.E
R185.02/A42.23.41.54.Z
ERRS/A03.179-193.err
ERRS/A02.179-193.err
ERRS/A01.179-193.err
ERRS/A40.178-191.err
ERRS/A28.180-194.err
ERRS/A15.181-195.err
ERRS/A19.181-195.err
LOGS/A01.179-193.log
LOGS/A03.179-193.log
LOGS/A02.179-193.log
LOGS/A40.178-191.log
LOGS/A28.180-194.log
LOGS/A19.181-195.log
LOGS/A15.181-195.log
R185.01/
R185.01/00/
R185.01/00/A01.00.10.01.N
R185.01/00/A01.00.10.01.E
R185.01/00/A01.00.30.04.Z
R185.01/00/A01.00.30.04.N

Table 2. Example of the Day-Tape Content File (DT_logs)

```
logs/DT_logs/DT.93/DT177.93


                Experiment: CASCADIA93

********

                Tape: DT177.93
Stream 01: A01, A02, A03, A04, A05, A06, A07, A08, A10, A11, A12,
           A14, A15, A16, A17, A18, A19, A21, A22, A23, A24, A25, A26,
           A27, A28, A30, A31, A32, A33, A34, A35, A38, A39, A40, A41,
           A42, A43,
         Mbytes:    369.0981
Stream 02: A01, A02, A03, A04, A05, A06, A07, A08, A10, A11, A12,
           A14, A15, A16, A17, A18, A19, A21, A22, A23, A24, A25, A26,
           A27, A28, A30, A31, A32, A33, A34, A35, A38, A39, A40, A41,
           A42, A43,
         Mbytes:     18.2900
Stream 03: A18, A23, A33,
         Mbytes:      0.2168
Stream 04: A18, A23, A33, A35,
         Mbytes:      0.1348
                Total Mbytes:    387.7397
```

Recorded streams, stations, and Mbytes of data for day-tape DT177.93 are listed. Note, streams 03 and 04 never contain any useful data.

Table 3. Example of Station Data Base File (STA_DB)

This file should not be of much use.
The main purpose of this file was to link the RefTek # (last field) to the Station Name (first field).
The type and serial serial number of the sensor are also listed.

```
STA_DB/DB.93/127.00.00.db

A01:0:0:0:ESP/3110:+1:+2:+3:475
A02:0:0:0:STS2/69209:+1:+2:+3:358
A02:0:0:0:STS2/69209:+4:+5:+6:358
A03:0:0:0:ESP/?:+1:+2:+3:551
A04:0:0:0:ESP/3109:+1:+2:+3:480
A05:0:0:0:STS2/69204:+1:+2:+3:476
A05:0:0:0:STS2/69204:+4:+5:+6:476
A06:0:0:0:ESP/3105:+1:+2:+3:367
A07:0:0:0:ESP/3142:+1:+2:+3:371
A08:0:0:0:ESP/?:+1:+2:+3:369
A09:0:0:0:STS2/99154:+1:+2:+3:479
A09:0:0:0:STS2/99154:+4:+5:+6:479
A10:0:0:0:ESP/3151:+1:+2:+3:345
A11:0:0:0:ESP/3102:+1:+2:+3:362
A12:0:0:0:ESP/3102:+1:+2:+3:378
A13:0:0:0:ESP/3107:+1:+2:+3:363
A14:0:0:0:STS2/19108:+1:+2:+3:418
A14:0:0:0:STS2/19108:+4:+5:+6:418
A15:0:0:0:ESP/3104:+1:+2:+3:387
A16:0:0:0:NONE:+0:+0:+0:000
A17:0:0:0:ESP/3108:+1:+2:+3:242
A18:0:0:0:STS2/69202:+1:+2:+3:231
A18:0:0:0:STS2/69202:+4:+5:+6:231
A19:0:0:0:NONE:+0:+0:+0:000
A20:0:0:0:ESP/398:+1:+2:+3:361
A21:0:0:0:ESP/3111:+1:+2:+3:477
A22:0:0:0:ESP/3148:+1:+2:+3:149
A23:0:0:0:STS2/19109:+1:+2:+3:488
A23:0:0:0:STS2/19109:+4:+5:+6:488
A24:0:0:0:ESP/3046:+1:+2:+3:342
A25:0:0:0:ESP/3106:+1:+2:+3:474
A26:0:0:0:STS2/9216:+1:+2:+3:484
A26:0:0:0:STS2/9216:+4:+5:+6:484
A27:0:0:0:ESP/3150:+1:+2:+3:153
A28:0:0:0:ESP/3144:+1:+2:+3:553
A29:0:0:0:STS2/?:+1:+2:+3:356
A29:0:0:0:STS2/?:+4:+5:+6:356
A30:0:0:0:ESP/3145:+1:+2:+3:114
A31:0:0:0:STS2/69211:+1:+2:+3:198
A31:0:0:0:STS2/69211:+4:+5:+6:198
A32:0:0:0:ESP/3147:+1:+2:+3:380
A33:0:0:0:STS2/96214:+1:+2:+3:381
A33:0:0:0:STS2/96214:+4:+5:+6:381
A34:0:0:0:NONE:+0:+0:+0:000
A35:0:0:0:STS2/69206:+1:+2:+3:486
A35:0:0:0:STS2/69206:+4:+5:+6:486
A36:0:0:0:NONE:+0:+0:+0:000
A37:0:0:0:STS2/?:+1:+2:+3:370
A37:0:0:0:STS2/?:+4:+5:+6:370
A38:0:0:0:ESP/3155:+1:+2:+3:384
```

A39:0:0:0:NONE:+0:+0:+0:000
A40:0:0:0:ESP/3152:+1:+2:+3:482
A41:0:0:0:STS2/69203:+1:+2:+3:478
A41:0:0:0:STS2/69203:+4:+5:+6:478
A42:0:0:0:ESP/3153:+1:+2:+3:099
A43:0:0:0:NONE:+0:+0:+0:000

Table 4. Station Locations

These station locations apply after 93/296 03:11.

logs/STA_LOC/93.296.03.11.loc.db

A01	44.42875	-124.04945	54
A02	44.42006	-124.00247	42
A03	44.42325	-123.94747	437
A04	44.42908	-123.88795	554
A05	44.42703	-123.85184	594
A06	44.42694	-123.80517	493
A07	44.42467	-123.74531	347
A08	44.42120	-123.70103	789
A09	44.42617	-123.65691	886
A10	44.41481	-123.59467	393
A11	44.42117	-123.53944	140
A12	44.41956	-123.49839	649
A13	44.43044	-123.45111	411
A14	44.42556	-123.40005	216
A15	44.42853	-123.34077	163
A16	44.43111	-123.29220	76
A17	44.43364	-123.24133	76
A18	44.43069	-123.18456	85
A19	44.42639	-123.14208	82
A20	44.42433	-123.09306	85
A21	44.41969	-123.03789	100
A22	44.42542	-122.98422	112
A23	44.42711	-122.94422	252
A24	44.42239	-122.89783	548
A25	44.42450	-122.84444	291
A26	44.41983	-122.80078	100
A27	44.42689	-122.73339	292
A275	44.42706	-122.68742	417
A28	44.42583	-122.64167	350
A285	44.42606	-122.59514	365
A29	44.42664	-122.54875	536
A295	44.42286	-122.49986	633
A30	44.42450	-122.43436	582
A305	44.43053	-122.38989	603
A31	44.42717	-122.33820	990
A315	44.43378	-122.29220	1176
A32	44.42922	-122.24111	798
A325	44.42445	-122.18642	1152
A33	44.41830	-122.13969	1274
A335	44.40814	-122.08830	1284
A34	44.42497	-122.04508	1234
A345	44.42175	-121.99644	1051
A35	44.42592	-121.95917	1164
A355	44.42083	-121.90314	1511
A36	44.41739	-121.85211	1466
A365	44.41947	-121.79816	1319
A37	44.42817	-121.74308	1179

A375	44.41753	-121.68864	984
A38	44.41678	-121.61655	1169
A385	44.41567	-121.57933	1112
A39	44.41505	-121.53772	1127
A395	44.40972	-121.49017	999
A40	44.41453	-121.43884	899
A405	44.41486	-121.37786	865
A41	44.41575	-121.34111	880
A415	44.41664	-121.28481	835
A42	44.41261	-121.23061	807
A425	44.41139	-121.18242	612
A43	44.41180	-121.12952	975
A435	44.41764	-121.08014	1100
A44	44.41311	-121.03220	960
A445	44.41919	-120.97977	1112
A455	44.41945	-120.89861	1021
A465	44.41253	-120.78345	1182
A475	44.42244	-120.66914	1207
A485	44.41597	-120.60052	1234
A495	44.41153	-120.47547	1289
A505	44.42411	-120.36958	1365
A515	44.42517	-120.29842	1548

Table 5. Example of the Error Data Base (STA_ERR)

```
logs/STA_ERR/93.181.23.59.err.db

A01:+1.00:+1.00:+1.00:+00.0:-01.000
A02:+1.00:+1.00:+1.00:+00.0:-01.000
A03:+1.00:+1.00:+1.00:+00.0:-01.000
A04:+1.00:+1.00:+1.00:+00.0:+00.000
A05:+1.00:+1.00:+1.00:+00.0:-01.000
A06:+1.00:+1.00:+1.00:+00.0:-01.000
A07:+1.00:+1.00:+1.00:+00.0:-01.000
A08:+1.00:+1.00:+1.00:+00.0:-01.000
A09:+1.00:+1.00:+1.00:+00.0:-01.000
A10:+1.00:+1.00:+1.00:+00.0:-01.000
A11:+1.00:+1.00:+1.00:+00.0:+00.000
A12:+1.00:+1.00:+1.00:+00.0:-01.000
A13:+1.00:+1.00:+1.00:+00.0:-01.000
A14:+1.00:+1.00:+1.00:+00.0:+00.000
A15:+1.00:+1.00:+1.00:+00.0:-01.000
A16:+1.00:+0.50:+0.50:+00.0:-01.000
A17:+1.00:+1.00:+1.00:+00.0:+00.000
A18:+1.00:+1.00:+1.00:+00.0:-01.000
A19:+1.00:-1.00:-1.00:+00.0:-01.000
A20:+1.00:+1.00:+1.00:+00.0:-01.000
A21:+1.00:+1.00:+1.00:+00.0:-01.000
A22:+1.00:+1.00:+1.00:+00.0:-01.000
A23:+1.00:+1.00:+1.00:+00.0:-01.000
A24:+1.00:+1.00:+1.00:+00.0:-01.000
A25:+1.00:+1.00:+1.00:+00.0:+00.000
A26:+1.00:+1.00:+1.00:+00.0:-01.000
A27:+1.00:+1.00:+1.00:+00.0:-01.000
A275:+1.00:+1.00:+1.00:+00.0:-01.000
A28:+1.00:+1.00:+1.00:+00.0:-01.000
A285:+1.00:+1.00:+1.00:+00.0:-01.000
A29:+1.00:+1.00:+1.00:+00.0:-01.000
A295:+1.00:+1.00:+1.00:+00.0:-01.000
A30:+1.00:+1.00:+1.00:+00.0:-01.000
A305:+1.00:+1.00:+1.00:+00.0:-01.000
A31:+1.00:+1.00:+1.00:+00.0:-01.000
A315:+1.00:+1.00:+1.00:+00.0:+00.000
A32:+1.00:+1.00:+1.00:+00.0:+00.000
A325:+1.00:+1.00:+1.00:+00.0:-01.000
A33:+1.00:+1.00:+1.00:+00.0:-01.000
A335:+1.00:+1.00:+1.00:+00.0:-01.000
A34:+1.00:+1.00:+1.00:+00.0:-01.000
A345:+1.00:+1.00:+1.00:+00.0:-01.000
A35:+1.00:+1.00:+1.00:+00.0:-01.000
A355:+1.00:+1.00:+1.00:+00.0:-01.000
A36:+1.00:+1.00:+1.00:+00.0:-01.000
A365:+1.00:+1.00:+1.00:+00.0:-01.000
A37:+1.00:+1.00:+1.00:+00.0:-01.000
A375:+1.00:+1.00:+1.00:+00.0:-01.000
A38:+1.00:+1.00:+1.00:+00.0:-01.000
```

```
A385:+1.00:+1.00:+1.00:+00.0:-01.000
A39:+1.00:+1.00:+1.00:-10.0:-01.000
A395:+1.00:+1.00:+1.00:+00.0:-01.000
A40:+1.00:+1.00:+1.00:+00.0:-01.000
A405:+1.00:+1.00:+1.00:+00.0:-01.000
A41:+1.00:+1.00:+1.00:+00.0:-01.000
A415:+1.00:+1.00:+1.00:+00.0:-01.000
A42:+1.00:+1.00:+1.00:+00.0:-01.000
A425:+1.00:+1.00:+1.00:+00.0:-01.000
A43:+1.00:+1.00:+1.00:+00.0:-01.000
A435:+1.00:+1.00:+1.00:+10.0:-01.000
A44:+1.00:+1.00:+1.00:+00.0:-01.000
A445:+1.00:+1.00:+1.00:+00.0:-01.000
A455:+1.00:+1.00:+1.00:+00.0:-01.000
A465:+1.00:+1.00:+1.00:+00.0:-01.000
A475:+1.00:+1.00:+1.00:+00.0:-01.000
A485:+1.00:+1.00:+1.00:+00.0:-01.000
A495:+1.00:+1.00:+1.00:+00.0:-01.000
A505:+1.00:+1.00:+1.00:+00.0:-01.000
A515:+1.00:+1.00:+1.00:+00.0:-01.000


Station error file format:

Sta_name : Gain_err_Z : Gain_err_N : Gain_err_E : Orient_err : Time_err

where

Gain_err_Z -- gain correction for Z component
Gain_err_N -- gain correction for N component
Gain_err_E -- gain correction for E component
              Note: polarity reversal is represented by -1.00.

Orient_err -- is the correction for orientation in degrees from the true
              North, e.g., +10.0 means 10 deg off the true North to the
              East.

Time_err   -- is the time correction (in seconds).
              + add correction to the header,
              - subtract the correction from the header start time.
```