

NOTES ABOUT TIMING INCONSISTENCIES WITHIN THE “C” NETWORK DATA

In August of 2013, we observed an issue with the way data is stored in miniSEED format at the IRIS DMC for some station data arriving with the C network code, and this briefly summarizes the issue.

There is one fundamental problem, which is that the sample rate in the data is not dealt with correctly when there is no Blockette 100 carried within the miniSEED record headers. A cumulative timing error is noted when requesting relatively long and continuous time series, vs requesting short windows of time series.

What was observed is explained in this example:

Station C.NICH:

Data were requested using two different time windows using IRIS webservice, one short, (7 minutes) and one long (2 days) and the result was that a timing offset is accumulated in the longer timeseries:

Step 1: From short window, using this syntax:

<http://services.iris.edu/irisws/timeseries/1/query?net=C&sta=NICH&cha=SHZ&start=2010-04-10T15:44:04&end=2010-04-10T15:44:07&output=ascii2&loc=->

```
TIMESERIES C_NICH__SHZ_M, 150 samples, 49.998 sps,  
2010-04-10T15:44:04.000900, TSPAIR, INTEGER, COUNTS
```

2010-04-10T15:44:05.000900	-80
2010-04-10T15:44:05.020900	-43
2010-04-10T15:44:05.040900	-49
2010-04-10T15:44:05.060900	-143
2010-04-10T15:44:05.080900	-133
2010-04-10T15:44:05.100900	-43
2010-04-10T15:44:05.120900	-30
2010-04-10T15:44:05.140900	-85
2010-04-10T15:44:05.160900	-101
2010-04-10T15:44:05.180900	-30
2010-04-10T15:44:05.200900	-12
2010-04-10T15:44:05.220900	-111
2010-04-10T15:44:05.240900	-133
2010-04-10T15:44:05.260900	-76
2010-04-10T15:44:05.280900	4
2010-04-10T15:44:05.300900	0
2010-04-10T15:44:05.320900	-218
2010-04-10T15:44:05.340900	-171
2010-04-10T15:44:05.360900	47
2010-04-10T15:44:05.380900	-21
2010-04-10T15:44:05.400900	-116
2010-04-10T15:44:05.420900	-35
2010-04-10T15:44:05.440900	-76
2010-04-10T15:44:05.460900	-136
2010-04-10T15:44:05.480900	-33
2010-04-10T15:44:05.500900	-48
2010-04-10T15:44:05.520900	-199
2010-04-10T15:44:05.540900	-81
2010-04-10T15:44:05.560900	97
2010-04-10T15:44:05.580900	-25
2010-04-10T15:44:05.600900	-202
2010-04-10T15:44:05.620900	-144
2010-04-10T15:44:05.640900	64
2010-04-10T15:44:05.660900	-1
2010-04-10T15:44:05.680900	-235
2010-04-10T15:44:05.700900	-109

Step 2: FROM LONG WINDOW:

<http://services.iris.edu/irisws/timeseries/1/query?net=C&sta=NICH&cha=SHZ&start=2010-04-09T15:44:04&end=2010-04-10T15:44:07&output=ascii2&loc=->

TIMESERIES C_NICH__SHZ_M, 4320117 samples, 49.998 sps,
2010-04-09T15:44:04.014000, TSPAIR, INTEGER, COUNTS

2010-04-10T15:44:04.654000	0
2010-04-10T15:44:04.674000	-218
2010-04-10T15:44:04.694000	-171
2010-04-10T15:44:04.714000	47
2010-04-10T15:44:04.734000	-21
2010-04-10T15:44:04.754000	-116
2010-04-10T15:44:04.774000	-35
2010-04-10T15:44:04.794000	-76
2010-04-10T15:44:04.814000	-136
2010-04-10T15:44:04.834000	-33
2010-04-10T15:44:04.854000	-48
2010-04-10T15:44:04.874000	-199
2010-04-10T15:44:04.894000	-81
2010-04-10T15:44:04.914000	97
2010-04-10T15:44:04.934000	-25
2010-04-10T15:44:04.954000	-202
2010-04-10T15:44:04.974000	-144
2010-04-10T15:44:04.994000	64
2010-04-10T15:44:05.014000	-1
2010-04-10T15:44:05.034000	-235
2010-04-10T15:44:05.054000	-109
2010-04-10T15:44:05.074000	50
2010-04-10T15:44:05.094000	-87
2010-04-10T15:44:05.114000	-164
2010-04-10T15:44:05.134000	-66
2010-04-10T15:44:05.154000	-33
2010-04-10T15:44:05.174000	-35
2010-04-10T15:44:05.194000	0
2010-04-10T15:44:05.214000	-139
2010-04-10T15:44:05.234000	-200
2010-04-10T15:44:05.254000	8
2010-04-10T15:44:05.274000	28
2010-04-10T15:44:05.294000	-158
2010-04-10T15:44:05.314000	-133
2010-04-10T15:44:05.334000	22
2010-04-10T15:44:05.354000	-34
2010-04-10T15:44:05.374000	-142

When zeroing in, first from small request, these values are returned:

```
2010-04-10T15:44:05.320900 -218
2010-04-10T15:44:05.340900 -171
2010-04-10T15:44:05.360900 47
2010-04-10T15:44:05.380900 -21
2010-04-10T15:44:05.400900 -116
2010-04-10T15:44:05.420900 -35
2010-04-10T15:44:05.440900 -76
```

from the longer request, these values are returned:

```
2010-04-10T15:44:04.654000 0
2010-04-10T15:44:04.674000 -218
2010-04-10T15:44:04.694000 -171
2010-04-10T15:44:04.714000 47
2010-04-10T15:44:04.734000 -21
2010-04-10T15:44:04.754000 -116
2010-04-10T15:44:04.774000 -35
2010-04-10T15:44:04.794000 -76
2010-04-10T15:44:04.814000 -136
2010-04-10T15:44:04.834000 -33
2010-04-10T15:44:04.854000 -48
2010-04-10T15:44:04.874000 -199
2010-04-10T15:44:04.894000 -81
2010-04-10T15:44:04.914000 97
2010-04-10T15:44:04.934000 -25
2010-04-10T15:44:04.954000 -202
2010-04-10T15:44:04.974000 -144
2010-04-10T15:44:04.994000 64
2010-04-10T15:44:05.014000 -1
2010-04-10T15:44:05.034000 -235
2010-04-10T15:44:05.054000 -109
.....
```

You can see that the data are repeated but shifted in time

The sample with a value of -218 has a time stamp of

2010-04-10T15:44:05.320900 in the short request
but

2010-04-10T15:44:04.674000 in the long request

In conclusion:

49.99804688 samples/second versus the rate derived from the 2-day segment of
49.9996256 samples/second. Over the 2 days of 4,343,967 samples that rate

difference adds up to the time differences that one sees. The timing in the miniSEED records is most likely correct, so small segments of data extracted from the archive (e.g. 7 minutes) are mostly correct, but when reconstructing the time series (from the many small segments of miniSEED) for very long segments the error adds up.

The limited resolution of the "nominal sample rate" in the miniSEED is not able to represent the proper sample rate, and these miniSEED records do not include a Blockette 100, which can be used to store a higher resolution sample rate. Fixing the data would be a non-trivial project.

During the reconstruction of the time series one could optionally recalculate the sample rate. This has been added to the IRIS utility called `miniseed2sac`.