What is WNRO?

Most data loggers use the Global Positioning System (*GPS*) to set the recording time. Unlike the commonly used Gregorian calendar, *GPS* (internally) expresses date/time information using two integer numbers. The first number counts the weeks since start of the *GPS* system on January 6th, 1980. The second number gives the seconds relative to the beginning of the week.

Due to historic bandwidth limits, *GPS* Satellites transmit the week number as a 10-bit long integer only, which will become zero again every 1024 weeks. This integer overflow is called week number rollover (*WNRO*). Sooner or later, every *GPS* receiver will have a *WNRO* event. Unless corrected, the *WNRO* will cause wrong recording dates that are shifted by 1024 weeks (about 19.6 years) towards the past.

Cube Data Recorder

The GIPPtool utilities contain an algorithm that automatically detects if a *WNRO* event took place for the *GPS* receiver build into the Cube recorder. If a *WNRO* event was detected all recording dates are corrected by adding 1024 weeks to the erroneous recording time. In other words, the GIPPtools will handle *WNRO* events transparently and normally without manual intervention.

However, the implemented *WNRO* detection algorithm will fail if the *WNRO* event occurs **during** a recording. But after a restart of the Cube hardware, the automatic *WNRO* detection will be successful again.

Data recorded during a *WNRO* event must be processed in two rounds. First, all files up to the *WNRO* event are processed as usual. All files recorded after the *WNRO* event are processed in the second round, with an additional `--wnro-correction=FORCE` command line option.

Example 1. Cube data recorded during WNRO event

This example assumes a Cube with build-in *Lassen IQ* (firmware V1.16) receiver from Trimble. For this *GPS* receiver the *WNRO* event happened at midnight between Sep 13th and Sep 14th, 2025.

To convert the recorded Cube data files to miniSEED they are best sorted into two directories. All files recorded on Sep 13th and before are placed into the subdirectory `./ending_2025-09-13`. Files recorded beginning with Sep 14th go to the `./starting_2025-09-14` subdirectory.

You can then convert the files to minisEED using the following two commands:

```
cube2mseed                          --output-dir=./mseed  ./ending_2025-09-13
cube2mseed --wnro-correction=FORCE --output-dir=./mseed  ./starting_2025-09-14
```

CAUTION Only force *WNRO* correction for files actually affected! There are at least three different *GPS* receiver types that might be built into a Cube recorder.