



“Hvussu stutt- og langtíðar 4D GNSS tíðarrøðir kunnu avdúka deformatiúnir av heingibrúgvum”

Short and Long Term 4D GNSS Time Series of long span suspension bridges

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Overview

- Use of GNSS to measure the movements
- 7 Bridges, only some case studies here
- Large and small suspension bridges, one viaduct, one cable stayed bridge
- New tests on the Severn Suspension Bridge, antennas on cables and towers

GNSS

- Global Navigation Satellite System
- GPS is one type
- GLONASS, BeiDou, Galileo and local systems
- Around 120 + satellites
- Geodetic GNSS receivers allow mm precision



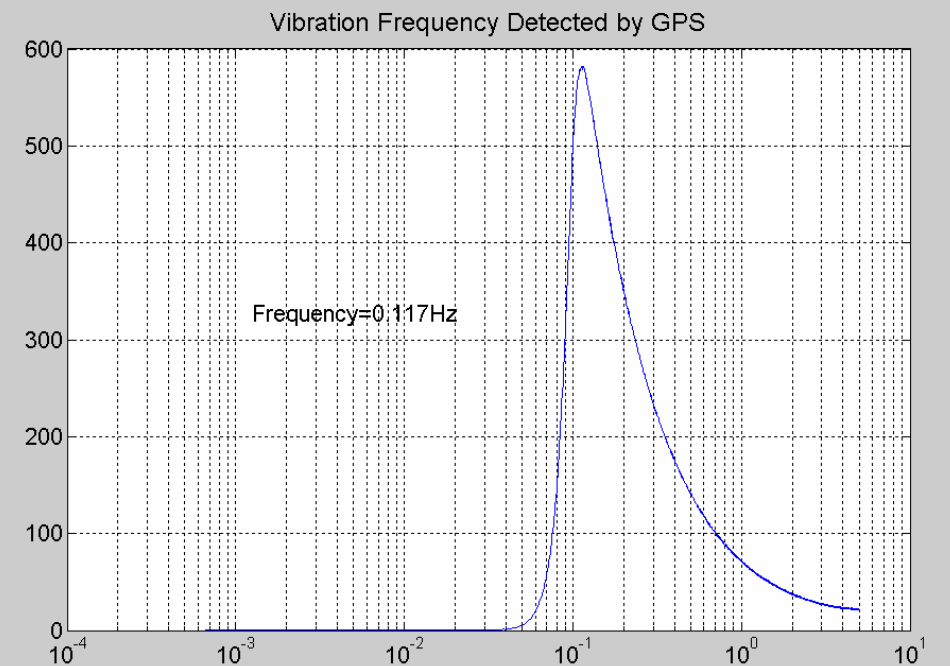
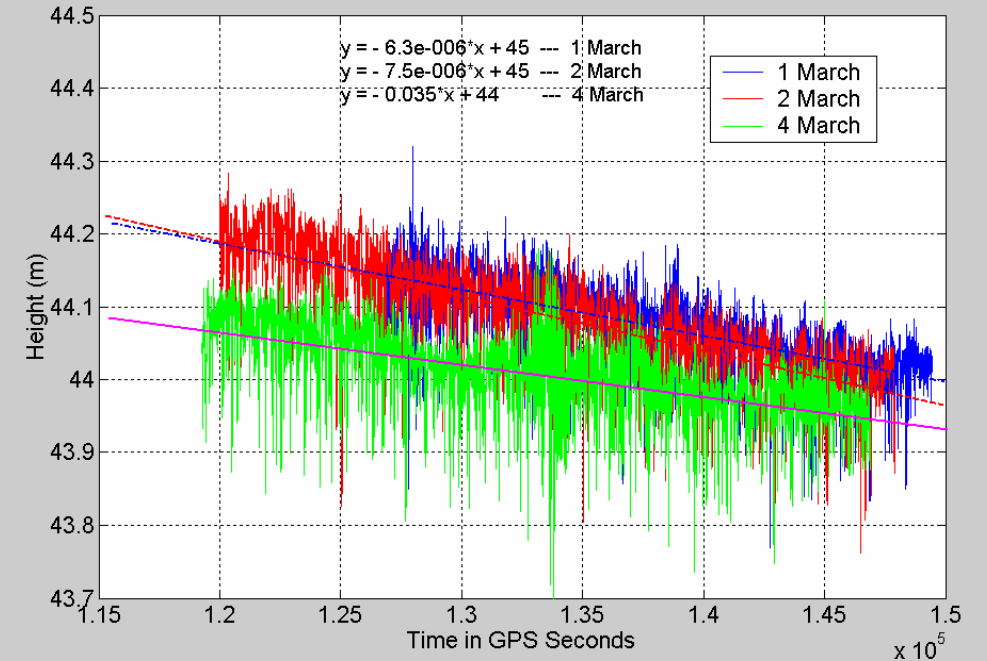
Humber Bridge, UK

- Large suspension bridge
- Movements of up to 4m
- First research started in 1996
- 1.2km between towers

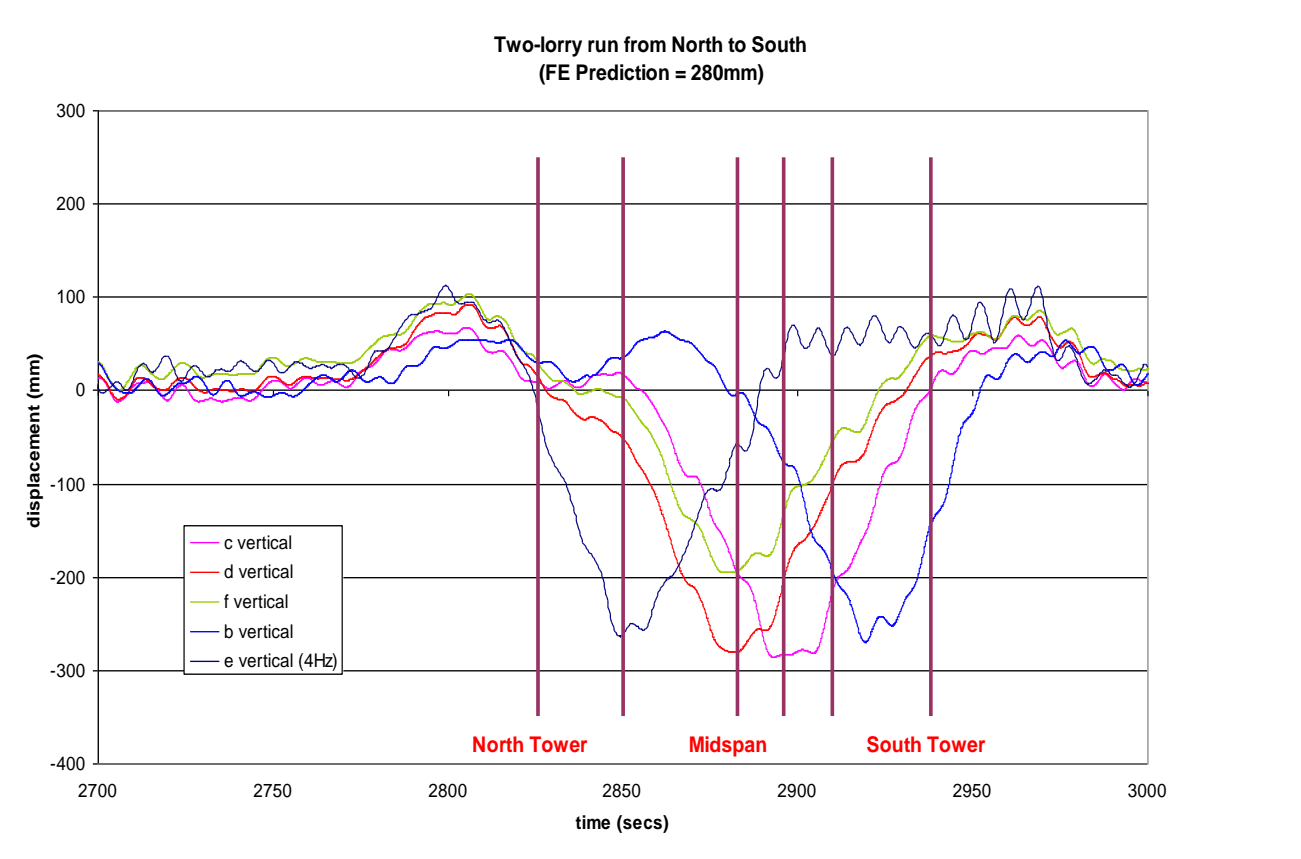


Results

- Various types of movements
- Three consecutive days
- Frequency analysis can be made of the time series

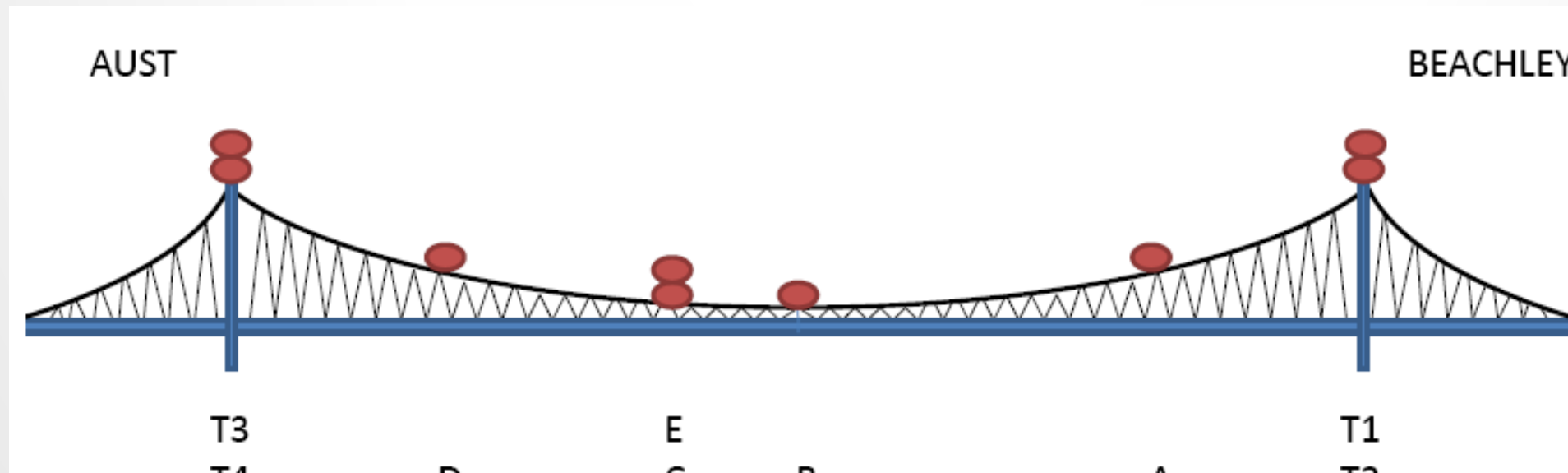


Forth Road Bridge, UK



Severn Suspension Bridge, UK

- 9 GNSS receivers
- 2 reference stations
- Synchronised movements
- Tests in 2010 and 2015

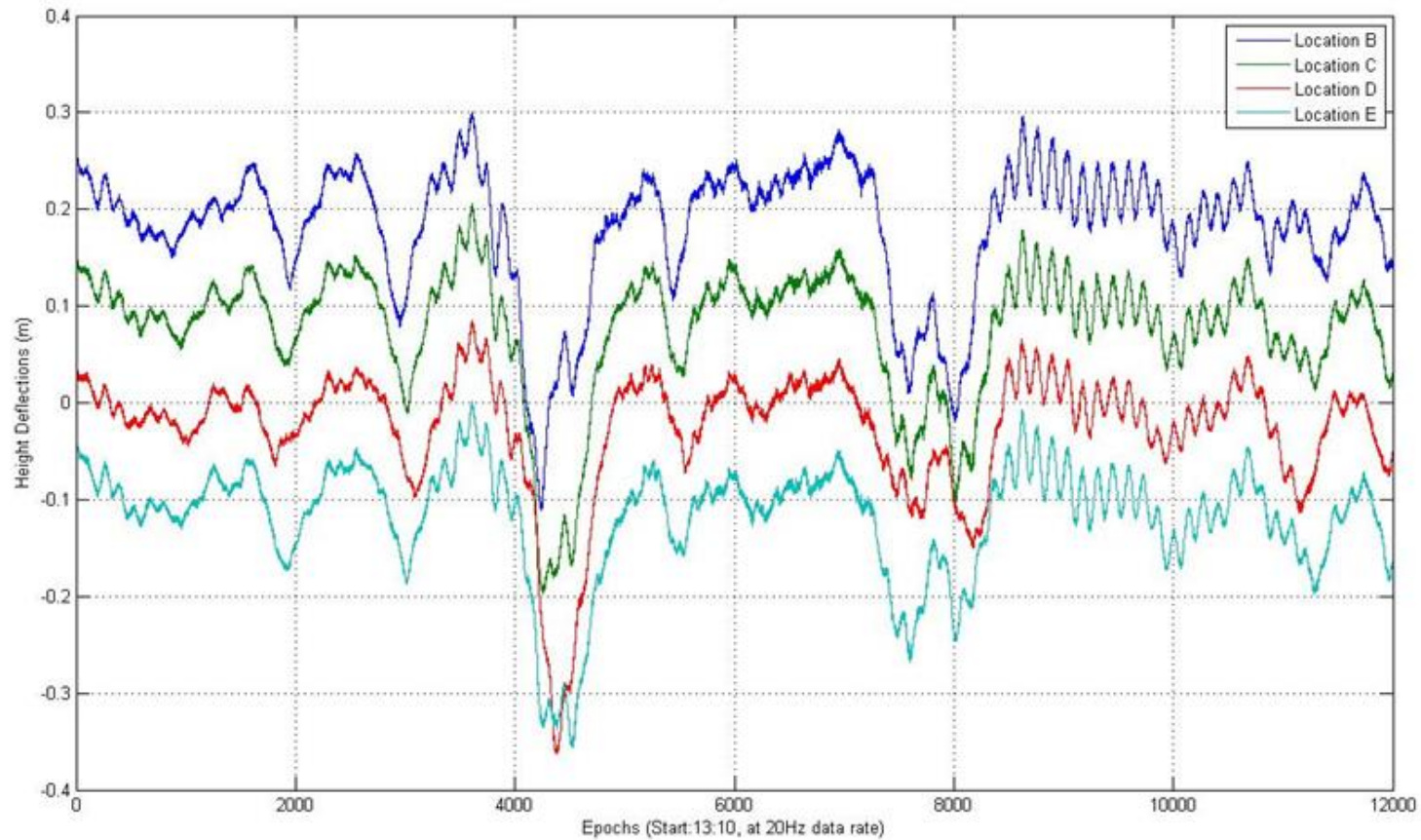
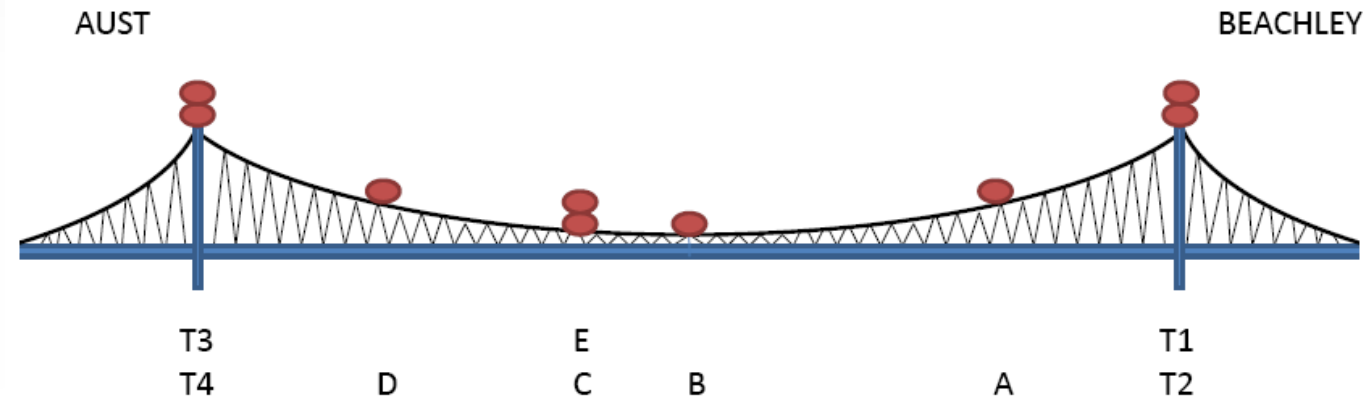


- Antenna locations, tower and cable



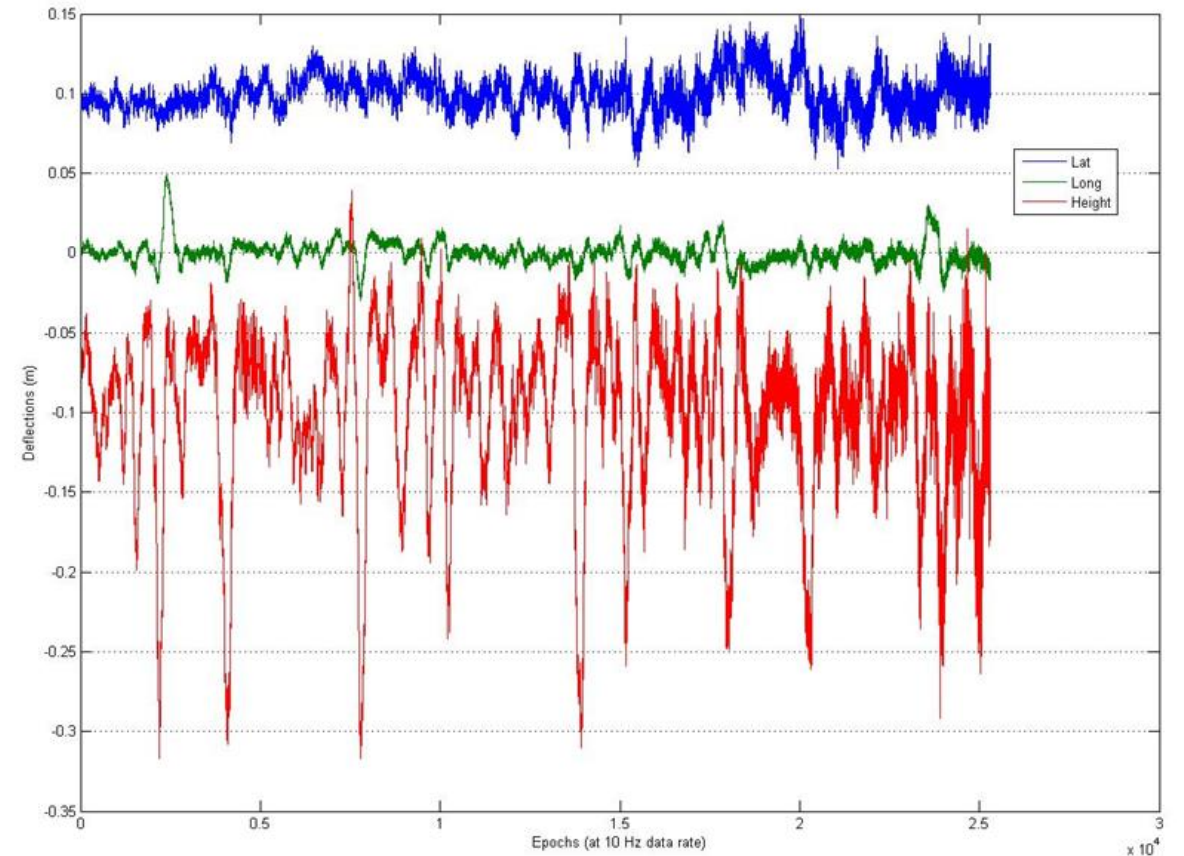
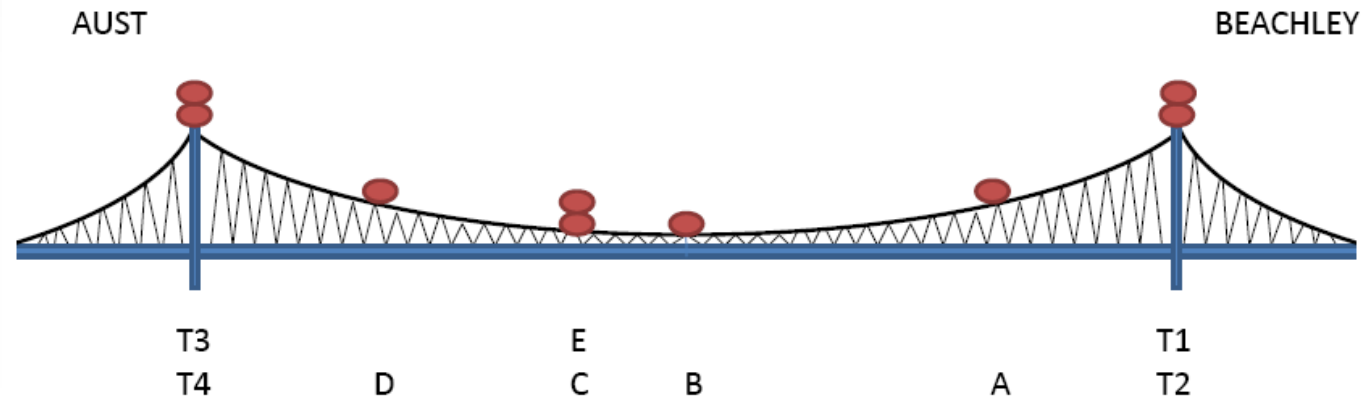
Results

- Height 4 locations 10 mins



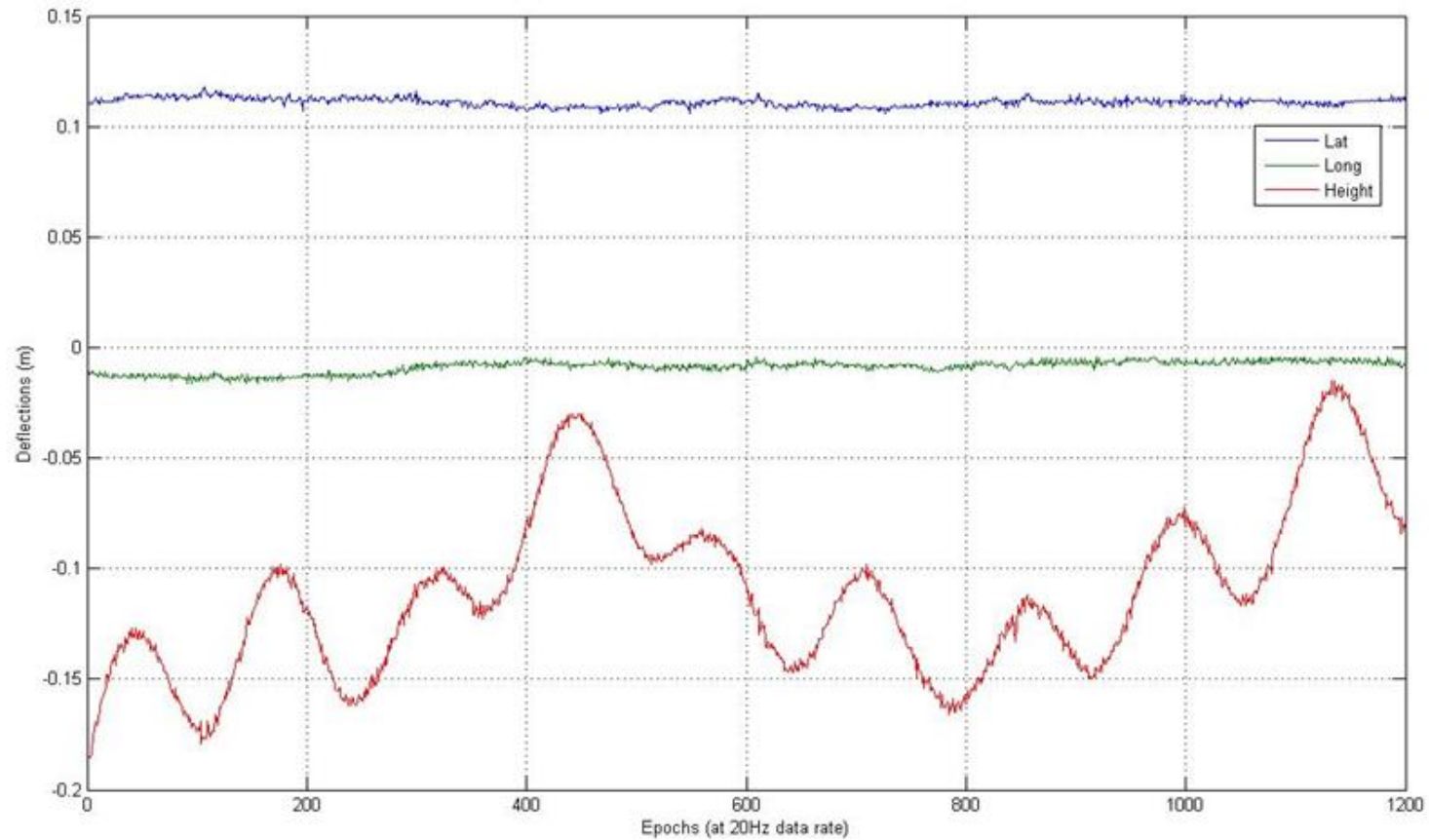
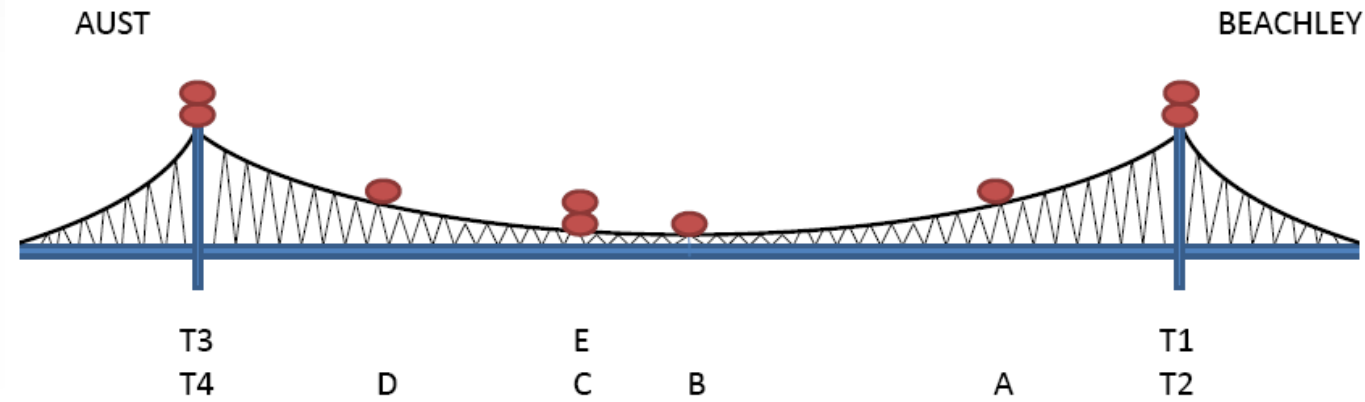
Results

- Movements location A, 40 min period



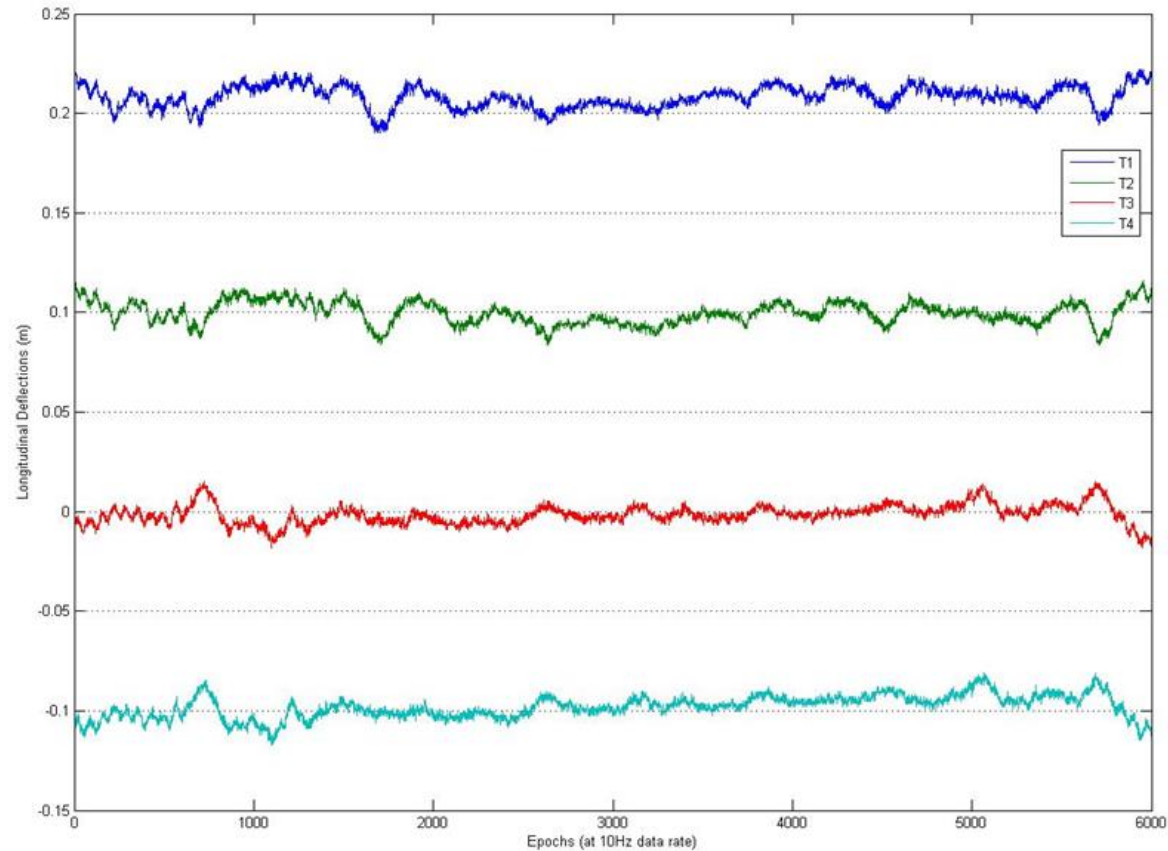
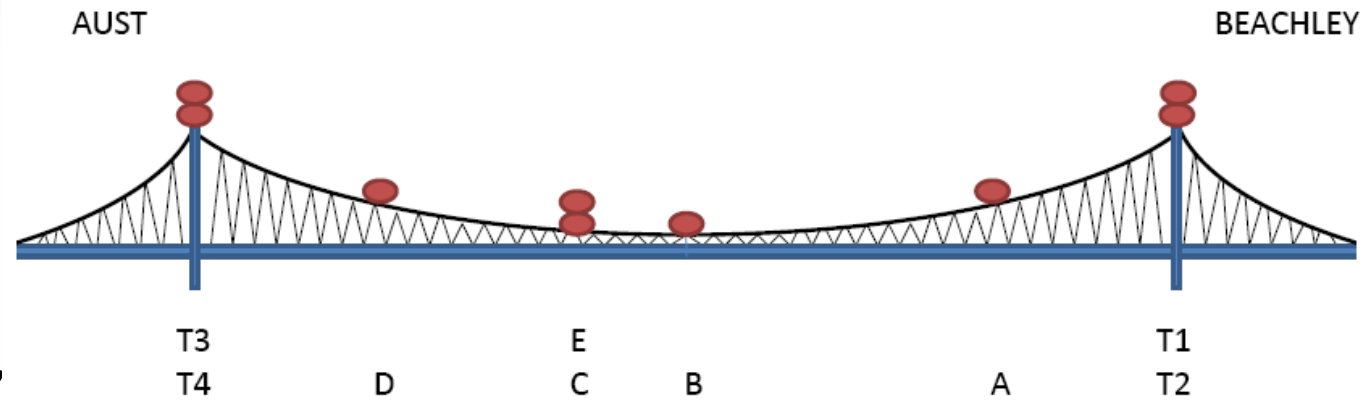
Results

- Location B 1 min



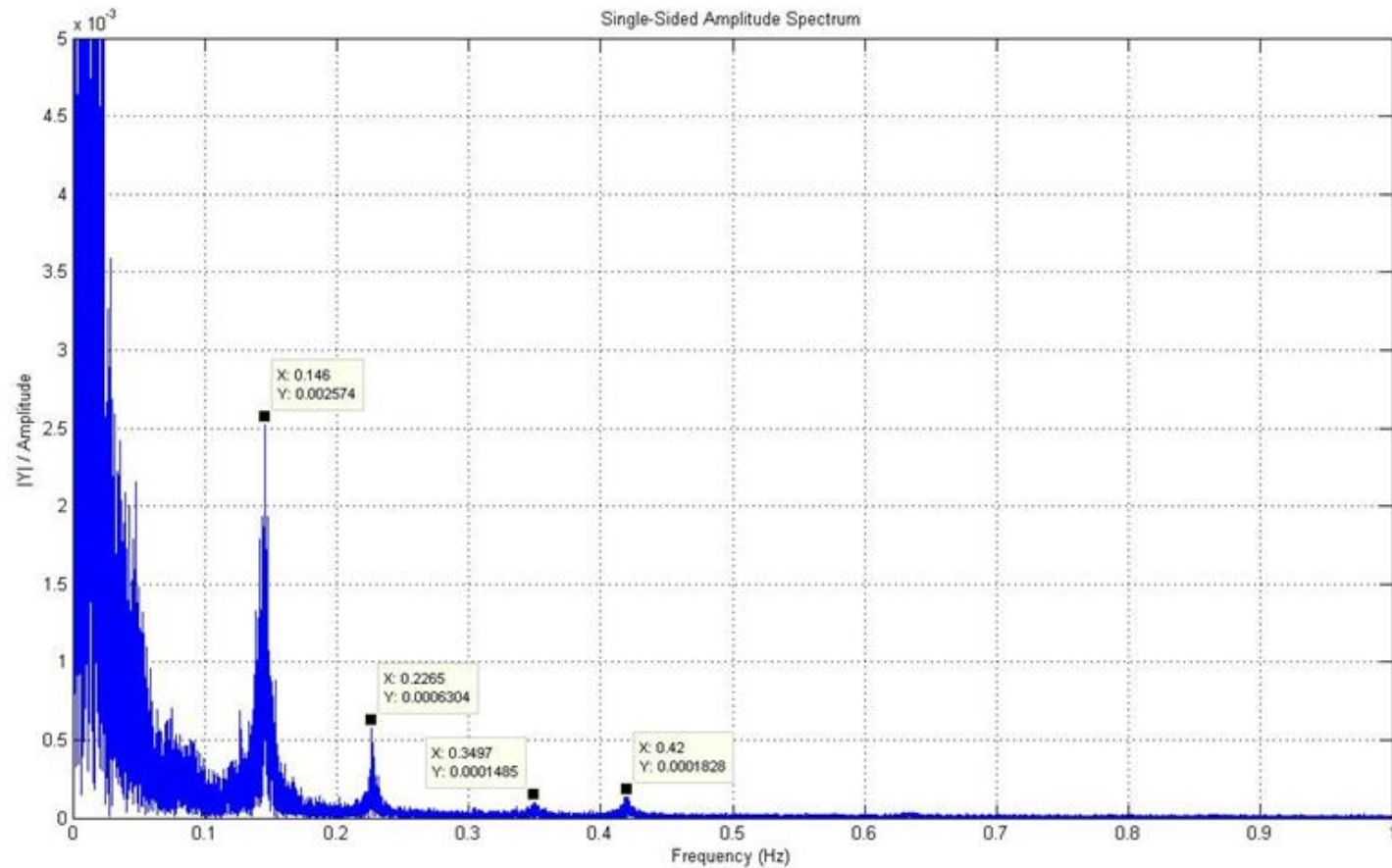
Results

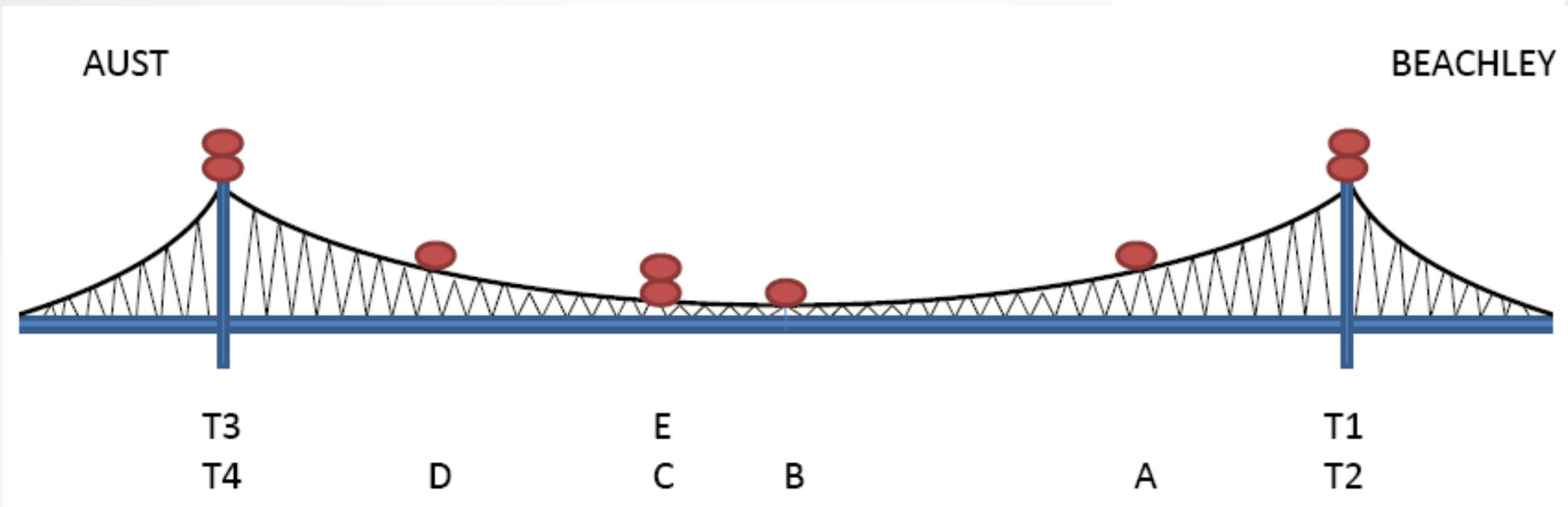
- Tower Longitudinal movements, 10 mins



Results

- Location B spectral analysis





vertical

longitudinal

| Position | A | B | C | D | E | T1 | T2 | T3 | T4 |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Freq | 0.0595 | | | | | | | | |
| Hz | 0.1453 | 0.146 | 0.1448 | 0.1457 | 0.1457 | 0.1457 | 0.1455 | 0.1461 | 0.1457 |
| | 0.1862 | | 0.1847 | 0.1847 | | | | | |
| | | 0.2265 | 0.2264 | | 0.2264 | | | | |

Conclusions

- Valuable monitoring tool and technique
- Forth and Severn suffer wire breaks
- Long term monitoring
- Combination of data with Finite Element Models for Structural Health Monitoring
- Similar thinking led to the Granskingarráðioð funded project for ship monitoring



Vísinda) *vøka*