Remote, Wireless, Permanent Seismic Stations: A Mountain Case

R. Stewart, H. Bland, Z. Chen, K. Hall, M. Bertram, and J. Thurston

University of Calgary

Monitoring Overview

- Specific need for monitoring
  - Changes in geology and fluids
- Design of monitoring system
  - Geographic constraints
  - Seismic requirements
  - Hardware
- Installation
- Operation

Thermal recovery concerns:

- bitumen/water into other strata
- acquifer contamination
-microseismic inducement
-major events

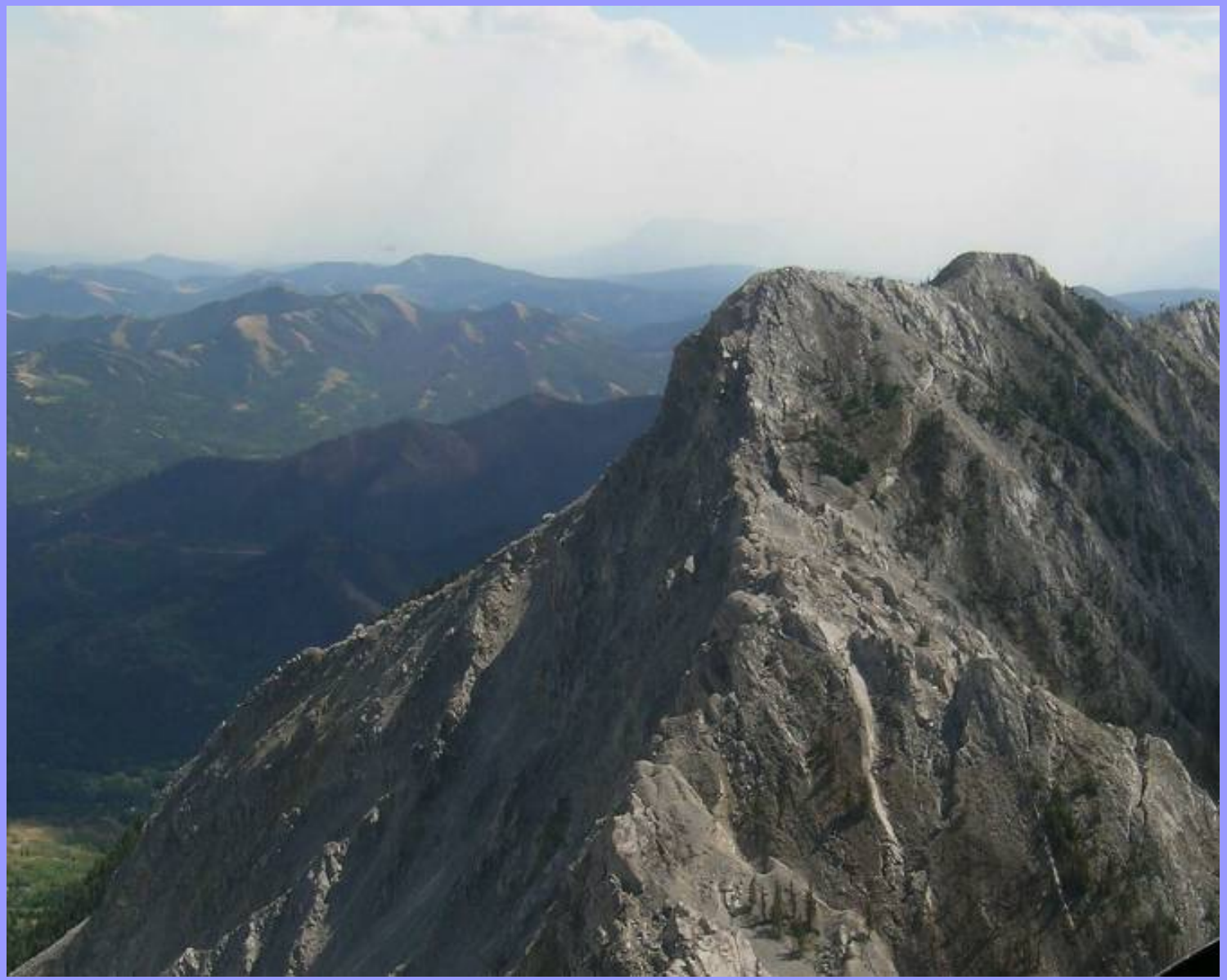
Traditional Passive Seismic Monitoring

- **“Always on”**
- **Delayed event assessment**

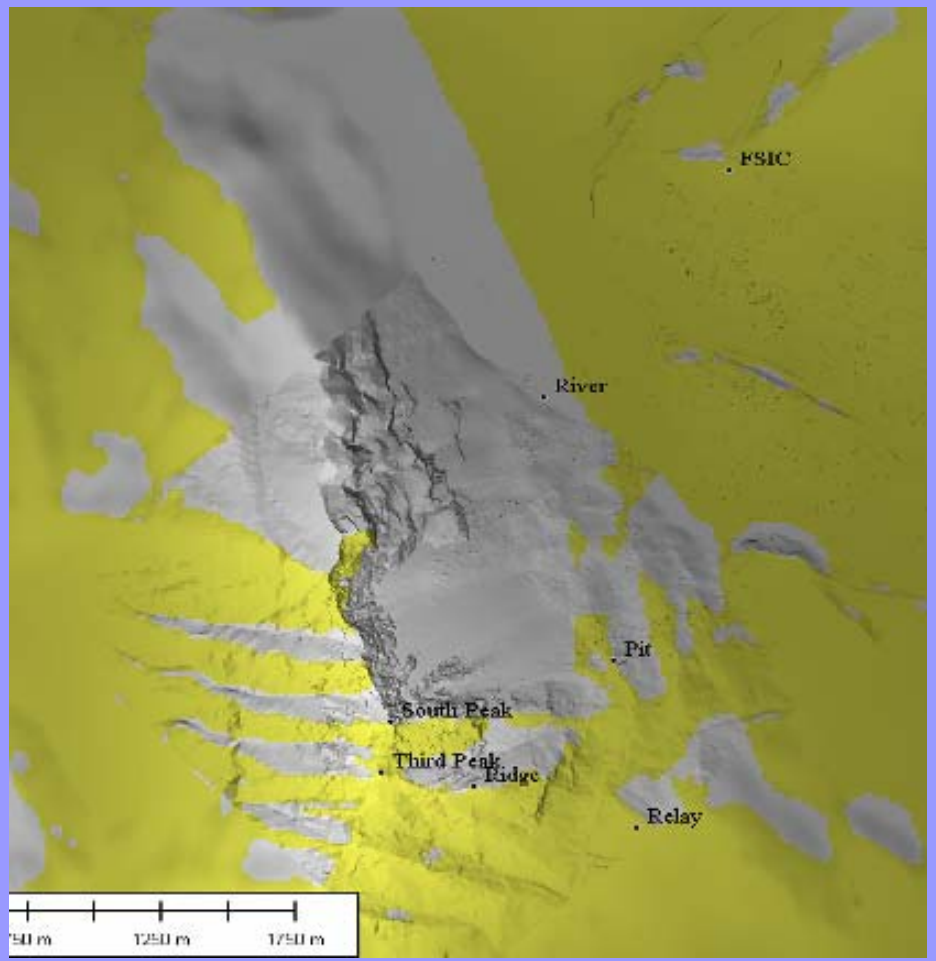
- **Road access**
- **Unconstrained power**
- **Wired/optical transmission**
- **Downhole sensors**

Frank Slide, Turtle Mtn., Alberta, Canada
North America's most fatal landslide - April 29, 1903

Fractured limestone peak, abandoned base mine workings, thrust faults

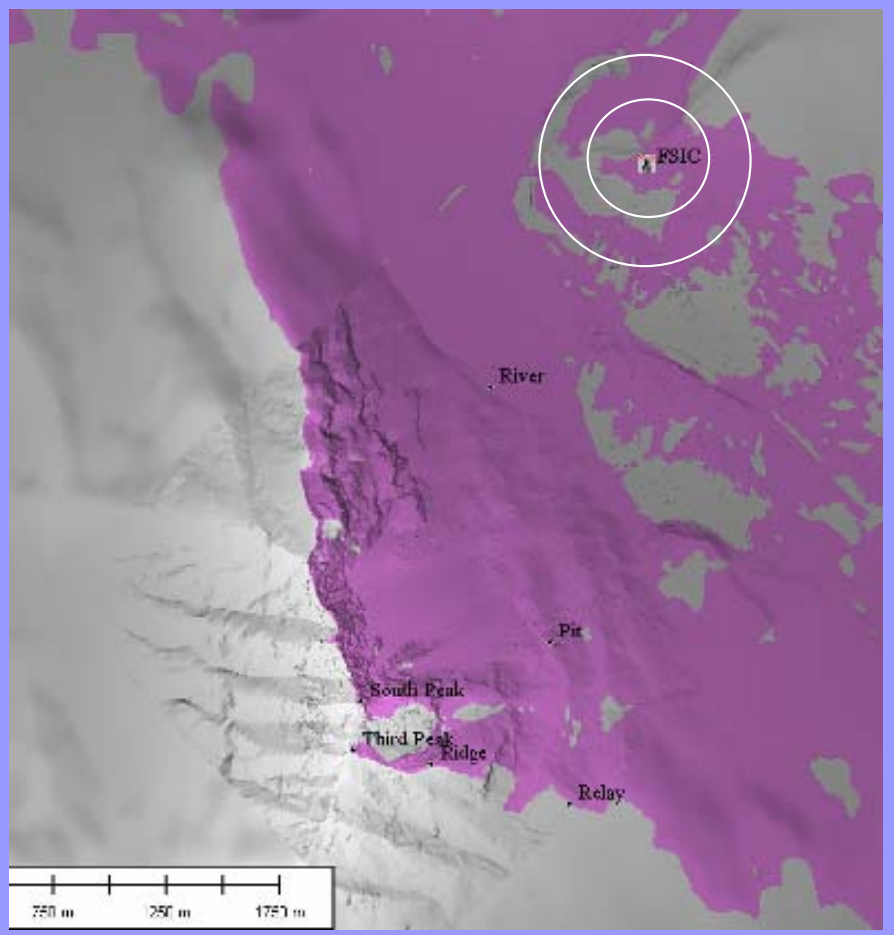


Locating the sensor stations

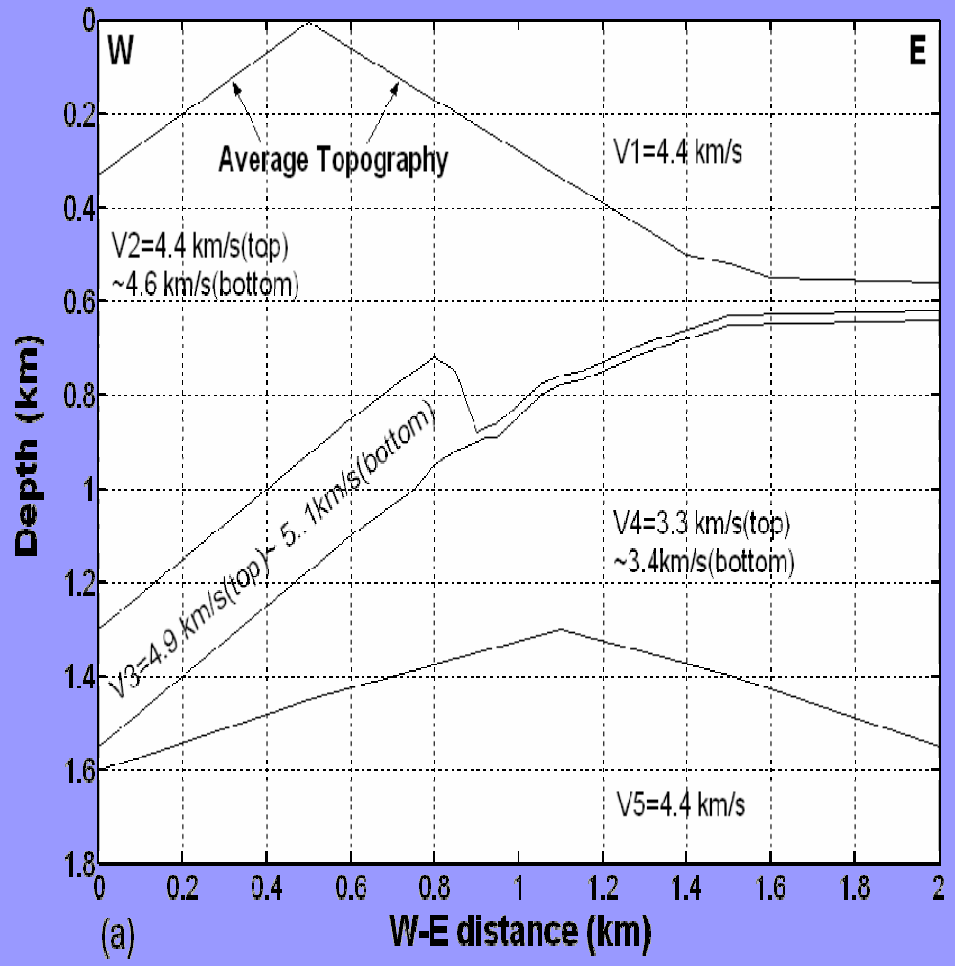


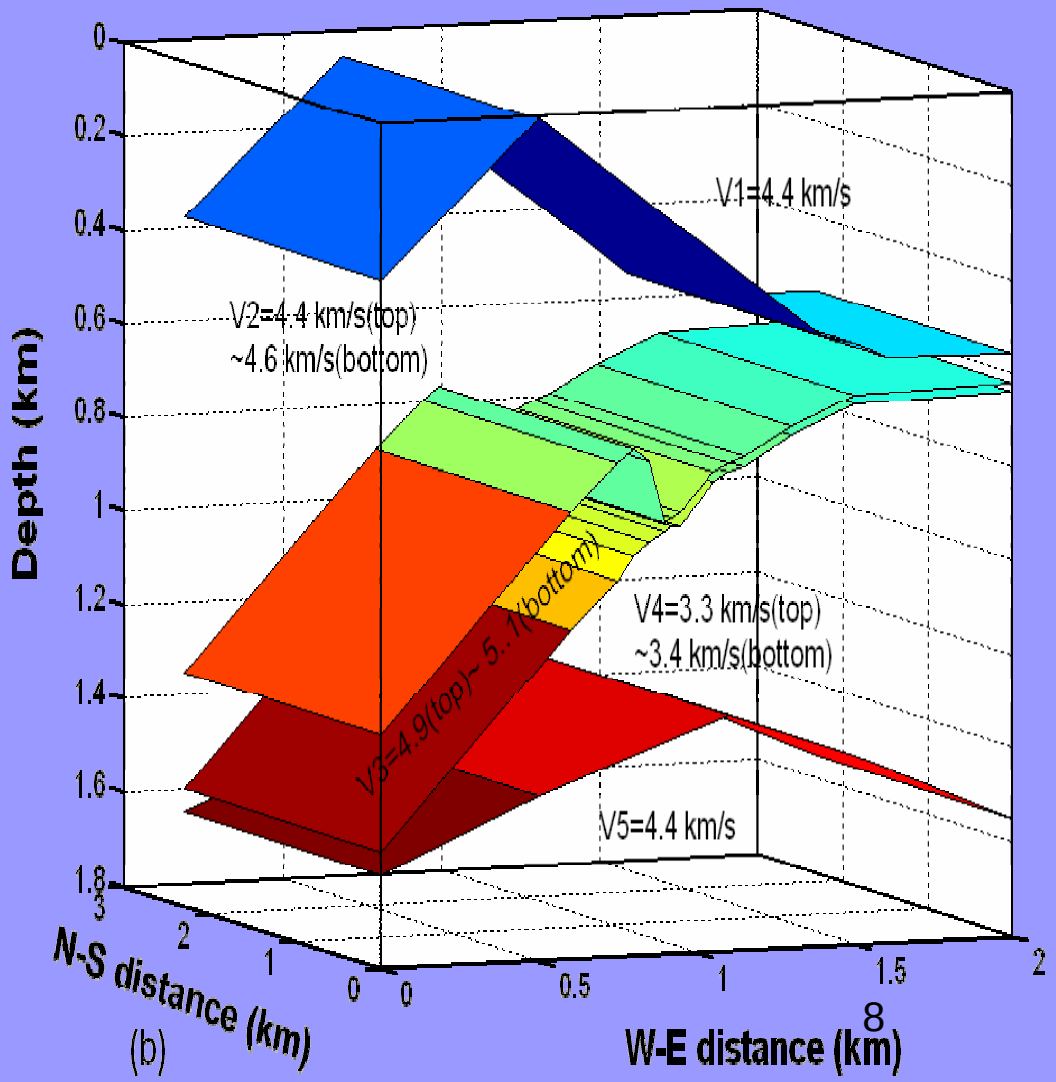
Sunlight coverage (yellow)

Radio coverage (purple)



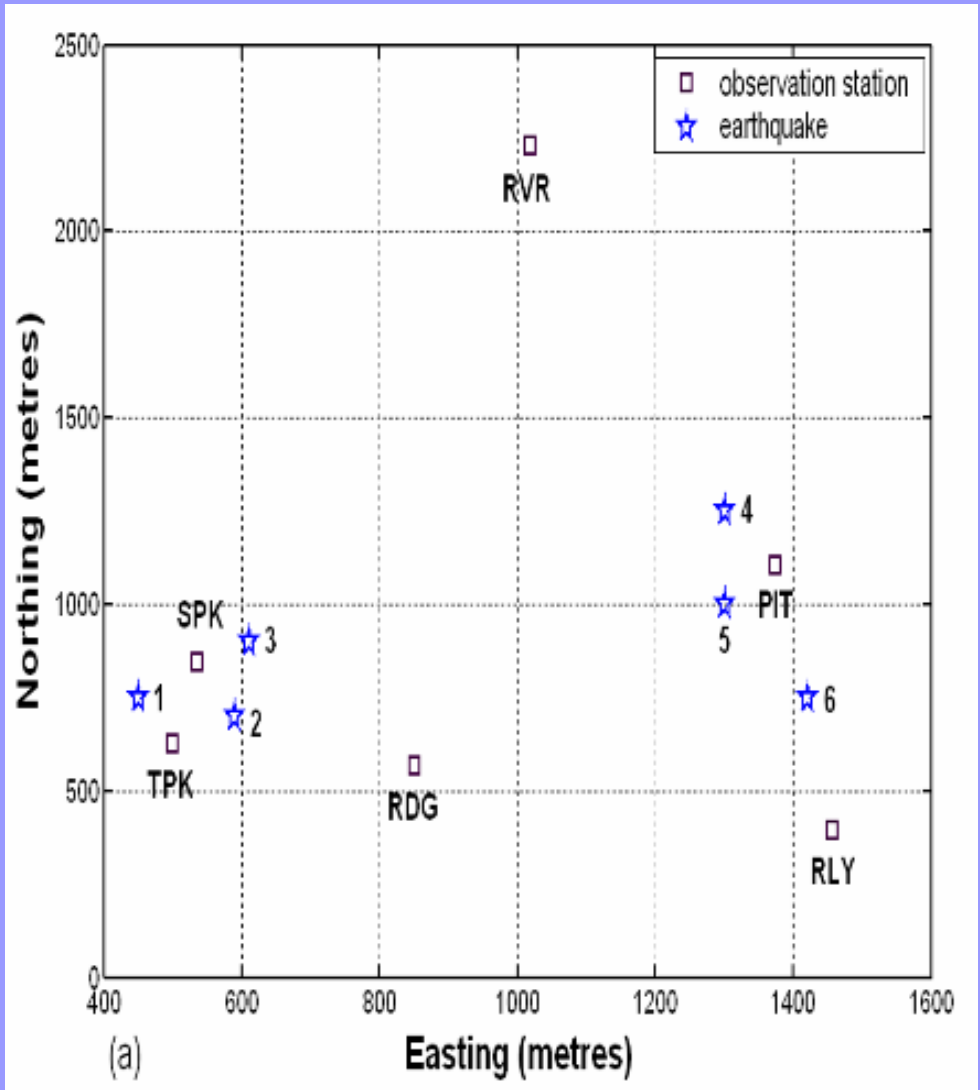
Mountain Velocity Structure

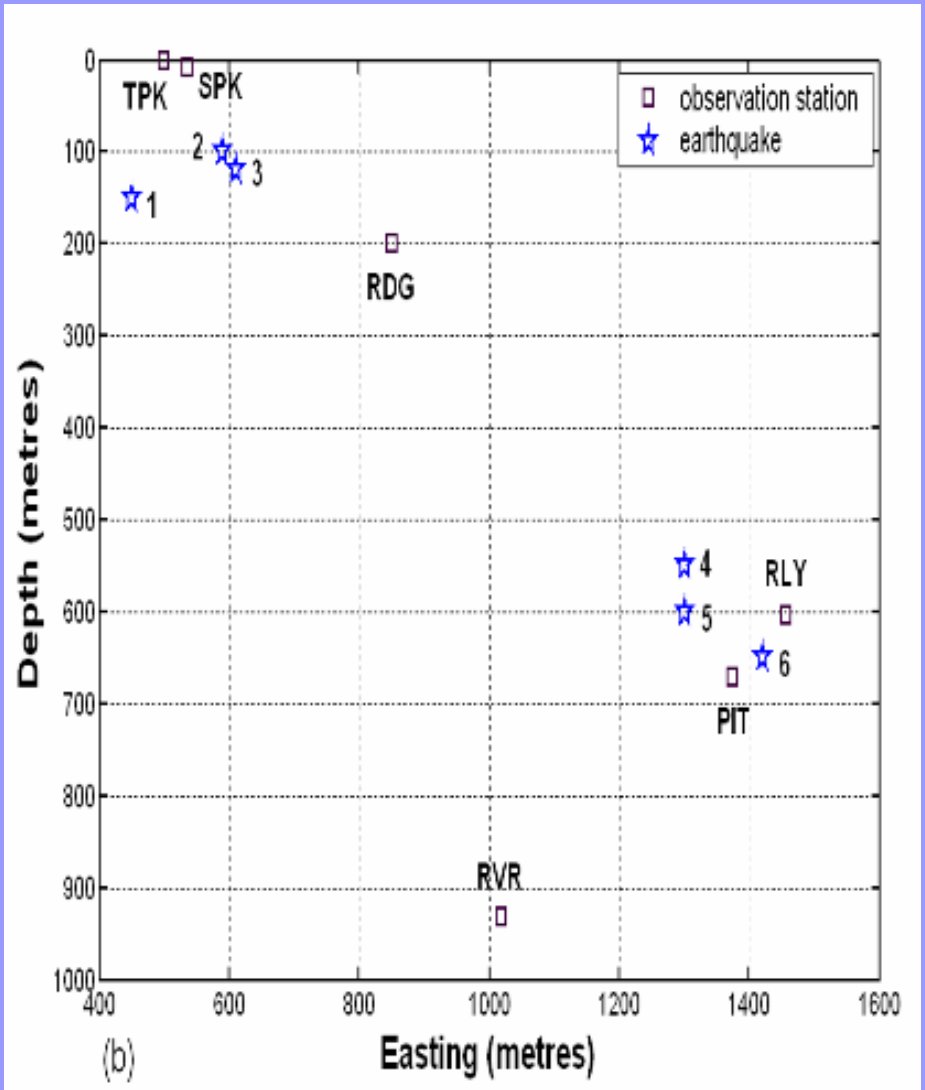




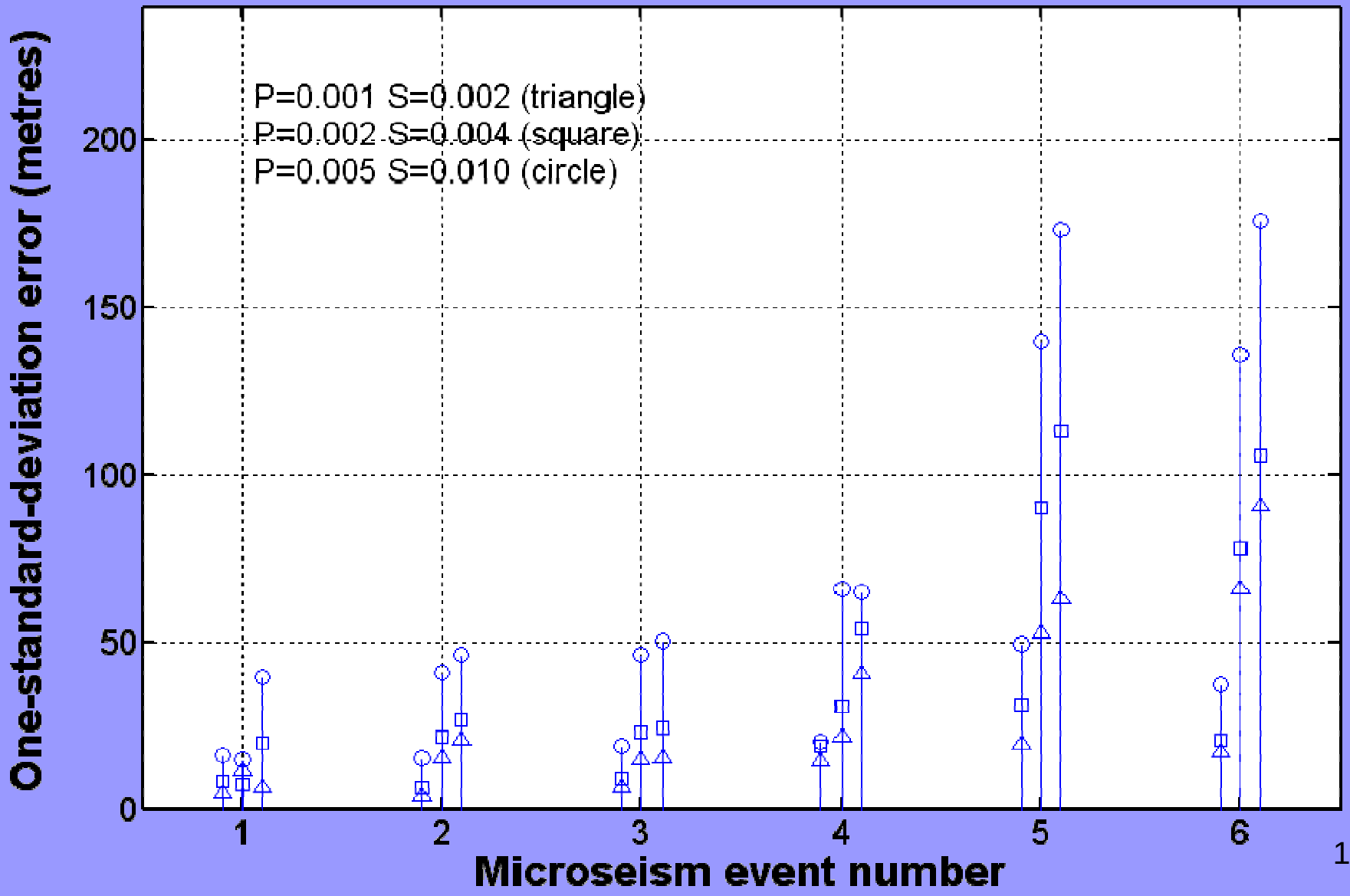
Station locations

Location of stations and microseismis

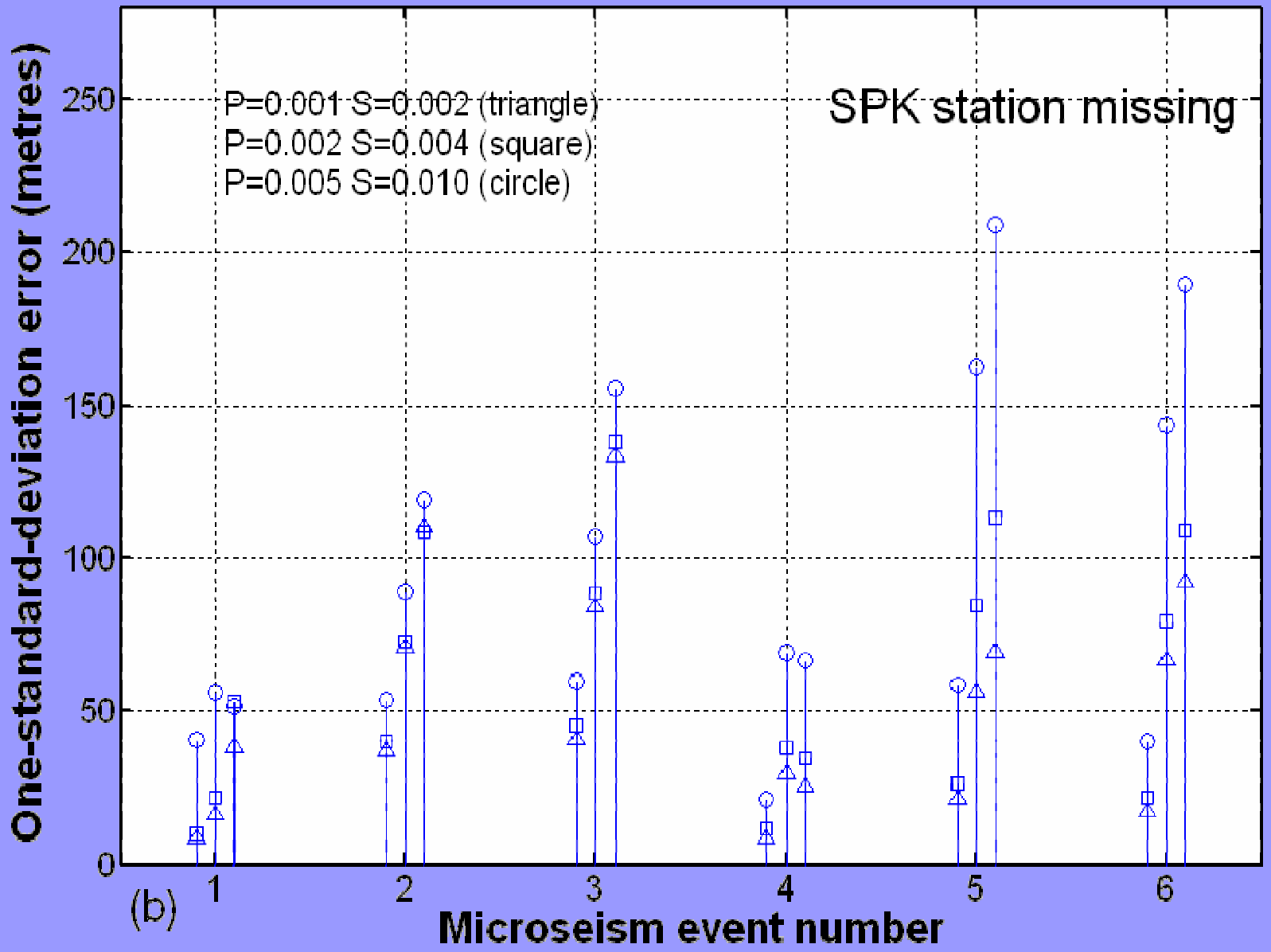




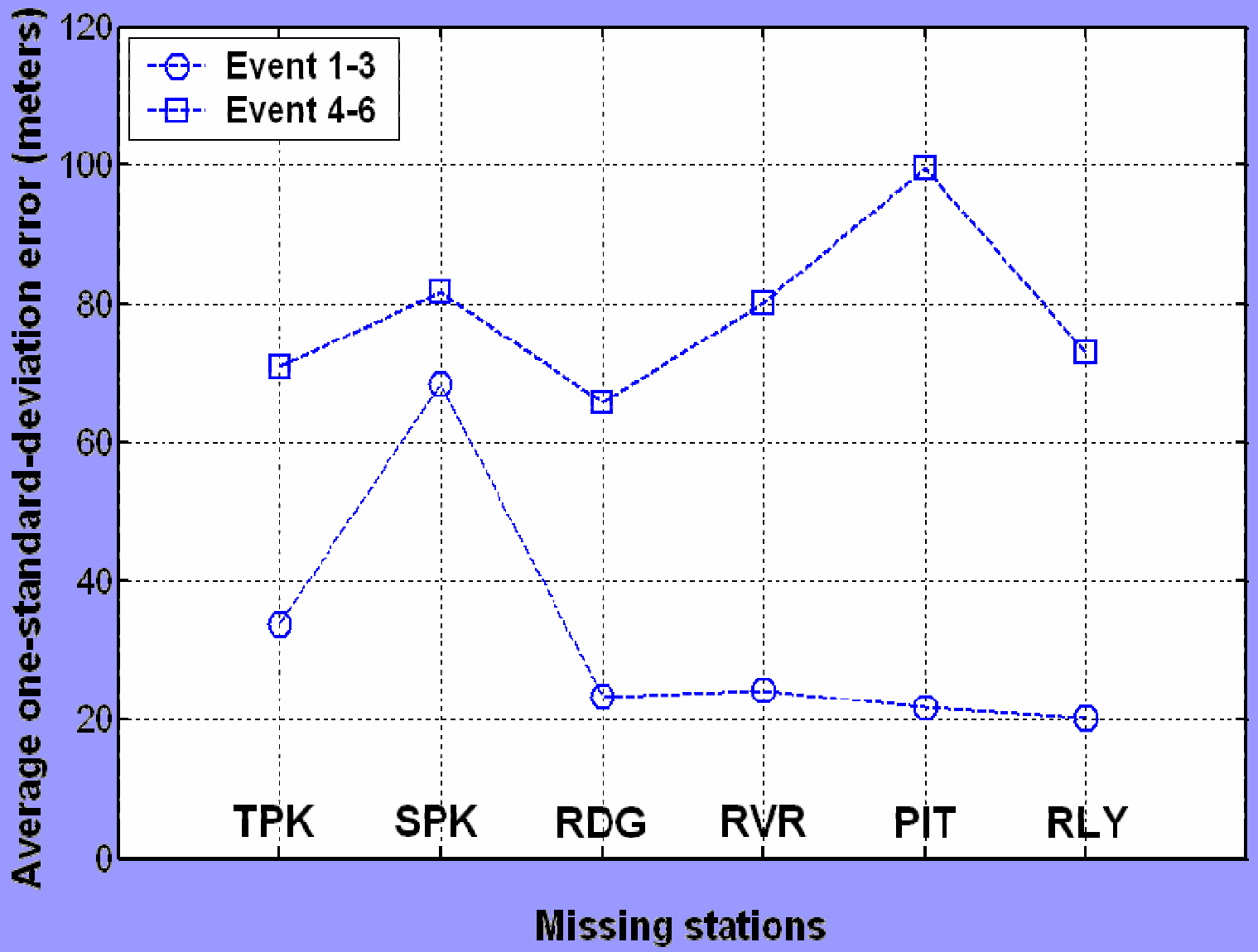
Error in hypocentre location



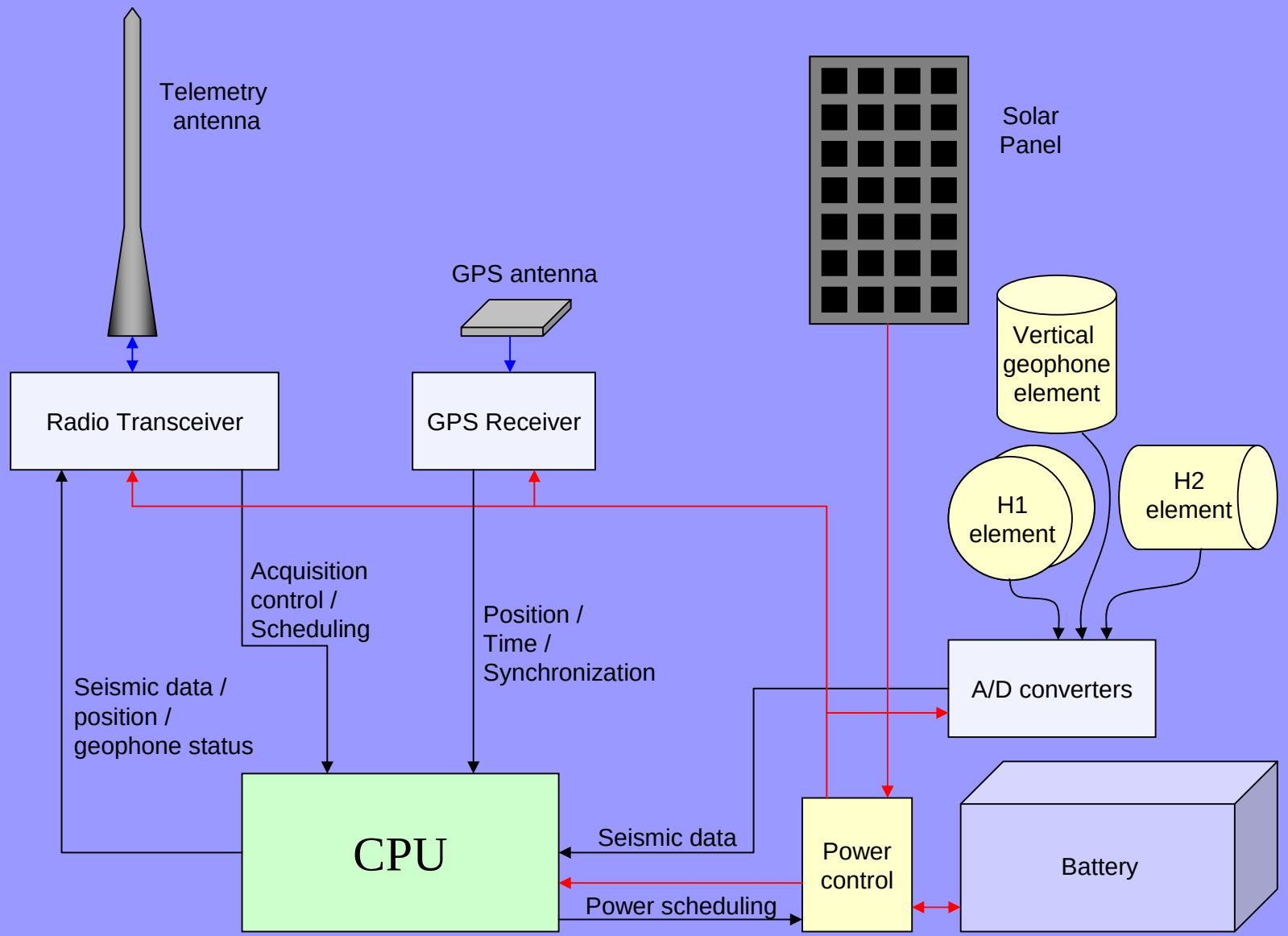
Effect of a station failure (South Peak)



Overall sensitivity to station loss



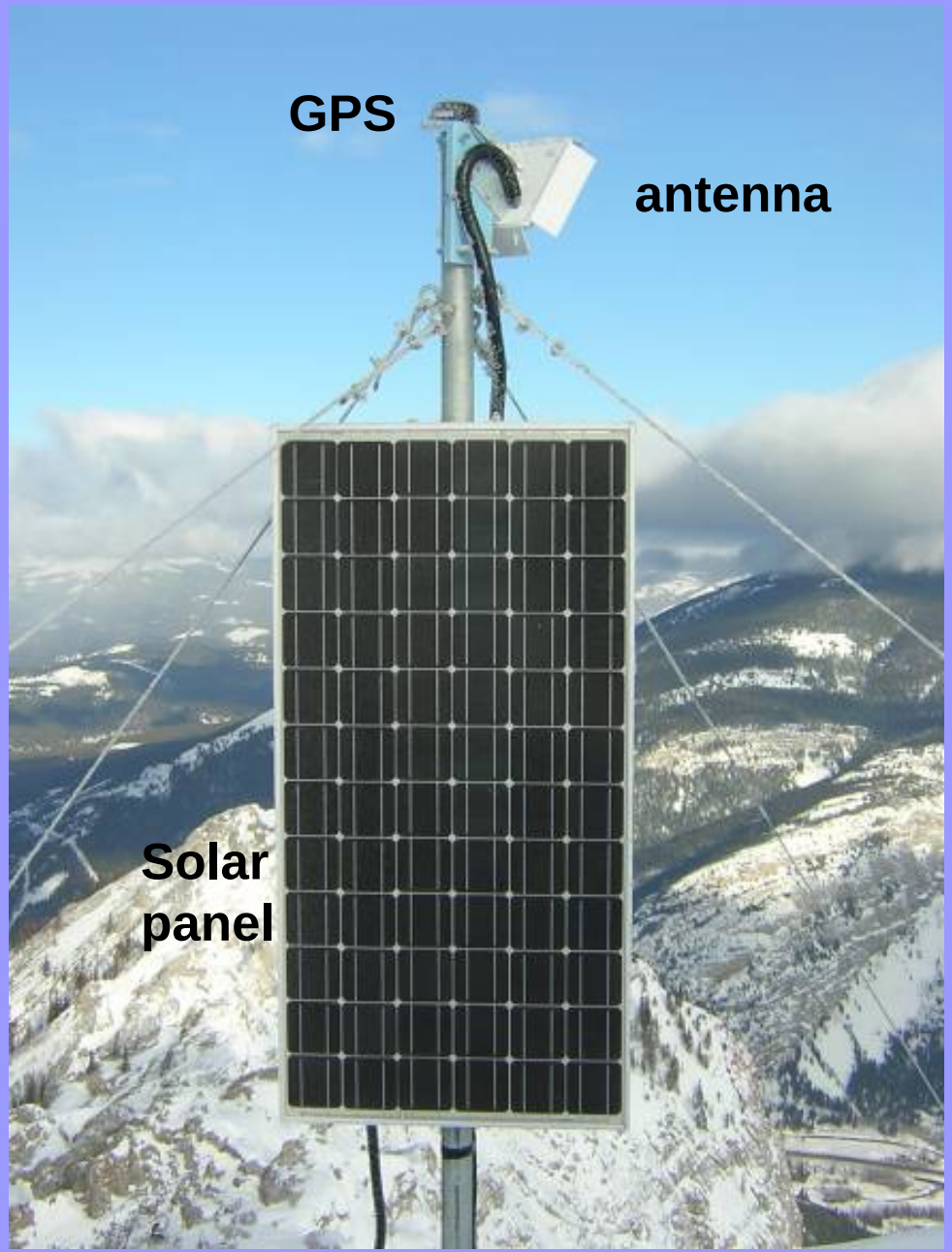
3C seismic station schematic



Helicopter access and slinging

Winter installation

Mast assembly

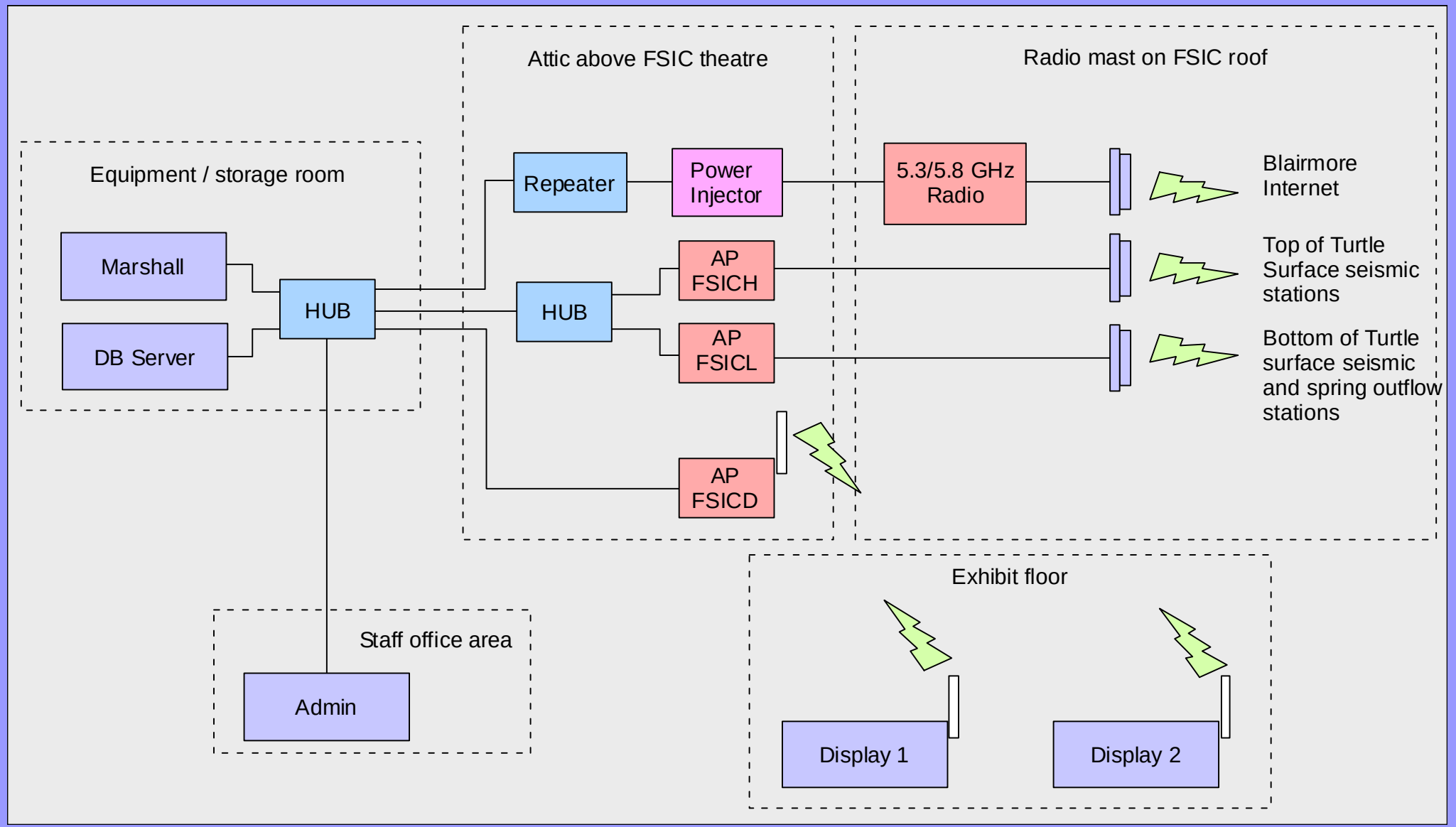


Cemented 3C geophones

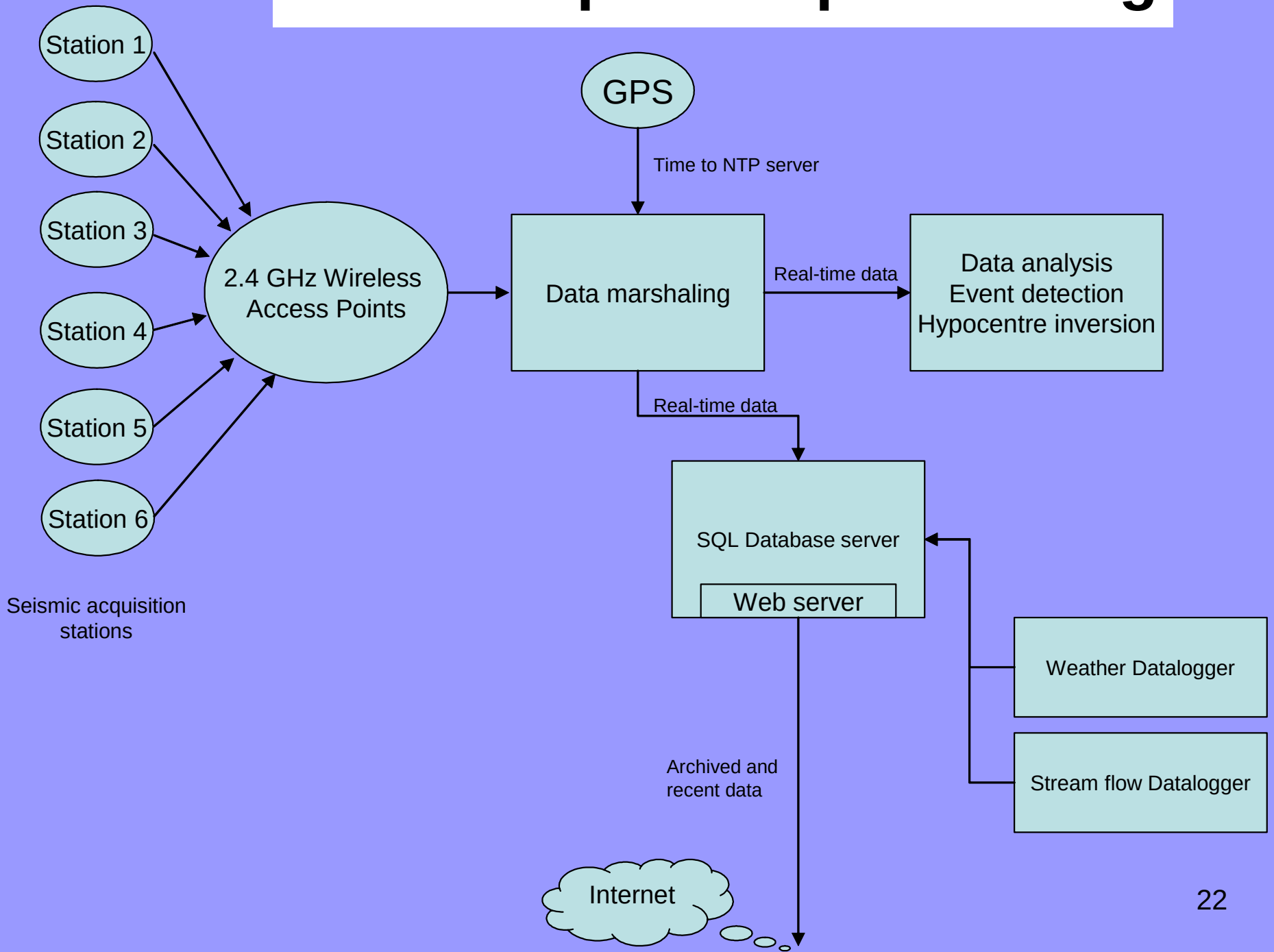
The installation ends and monitoring begins …

Receiving antennae

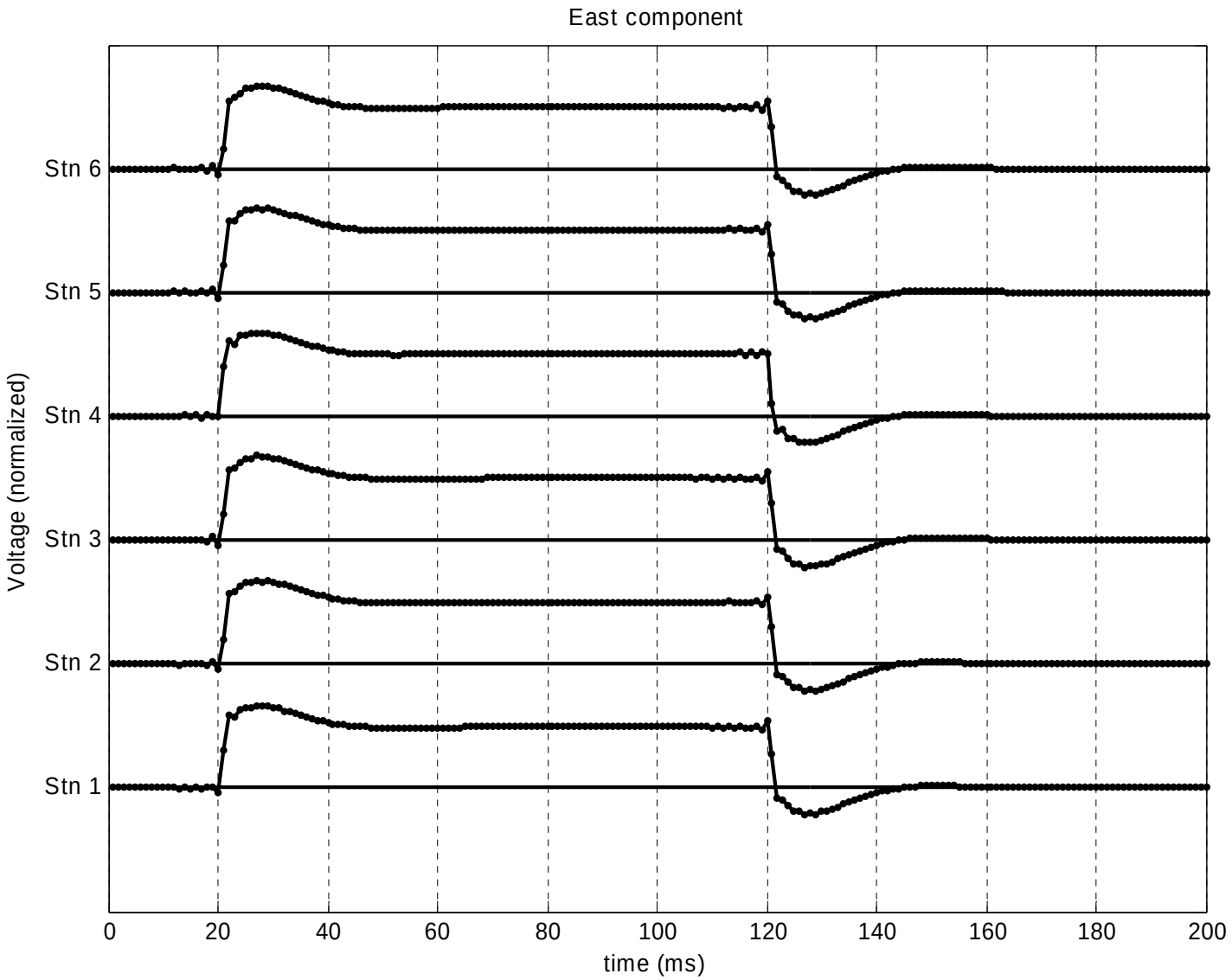
Reception & Control Centre



Data reception & processing

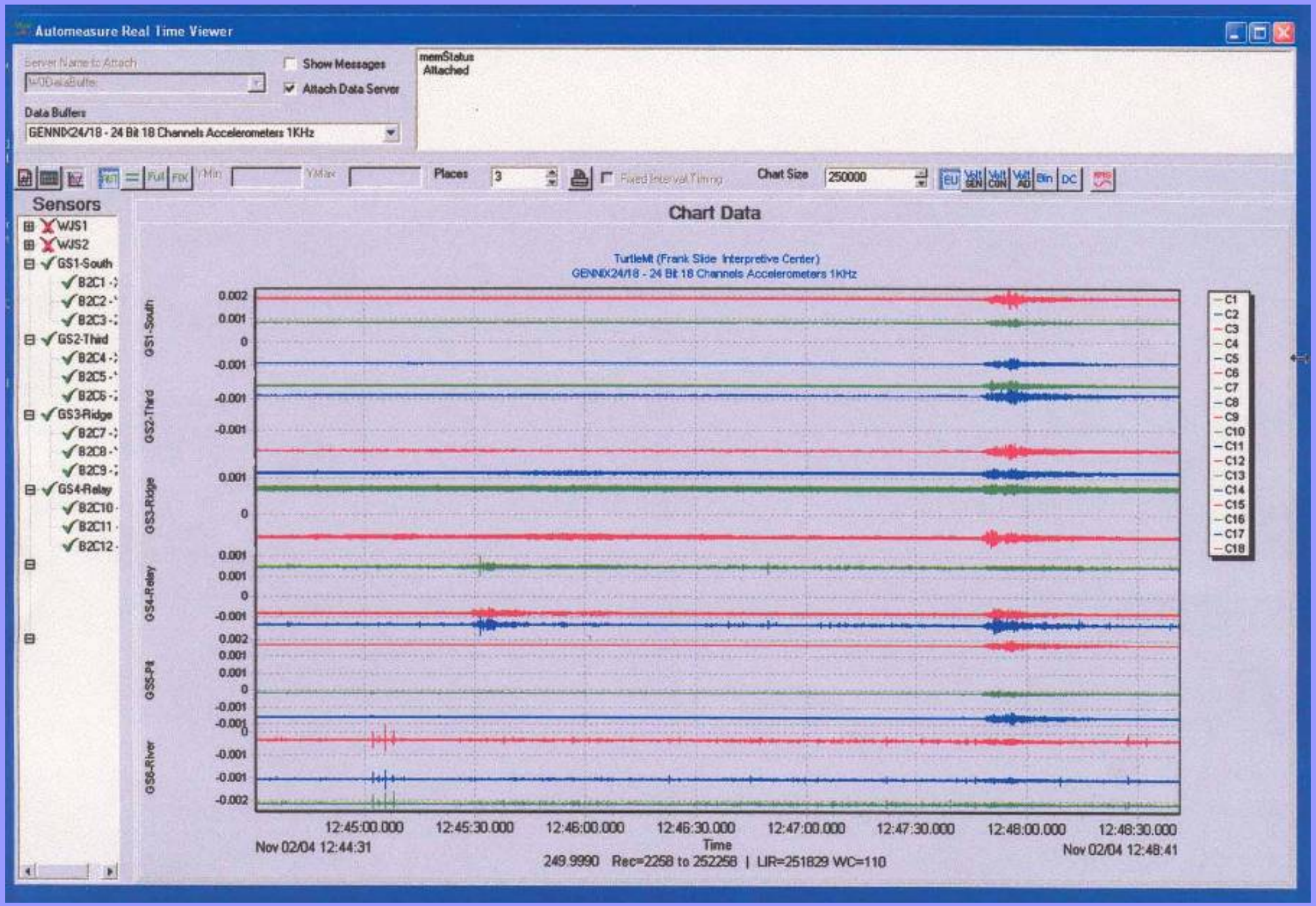


Remote geophone test



System testing and calibration

Regional seismic event detected



Summary

- Installation in remote terrain challenging
- Power & wireless are major issues
- High data transmission rates impact system
- Robust parts required
- Thorough design useful
- Web enablement helps considerably
- Scalable for other applications