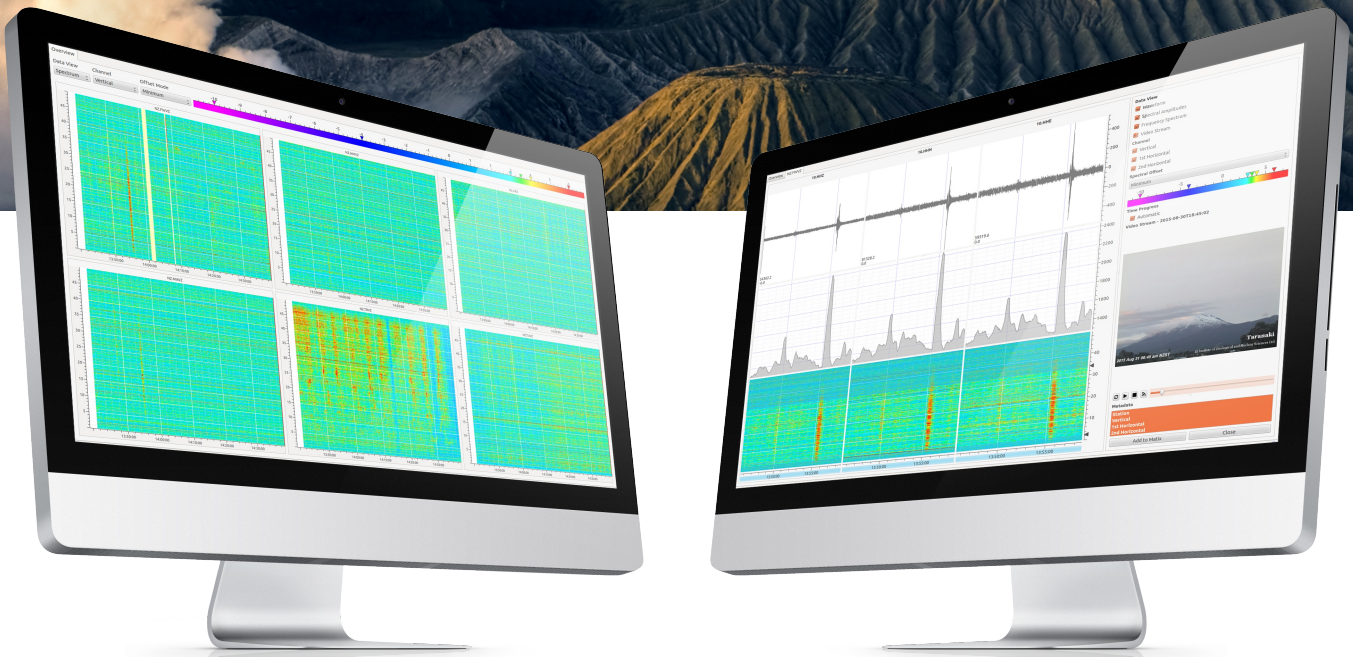


VORTEX
Volcano Monitoring

Volcano observation and monitoring



VORTEX in a nutshell

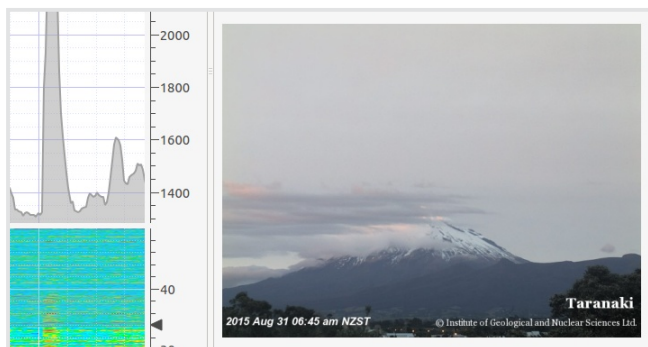
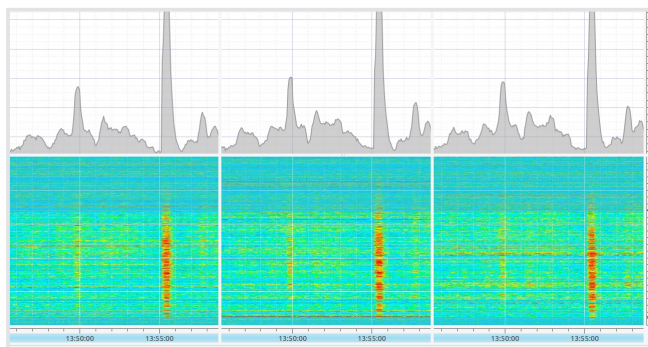
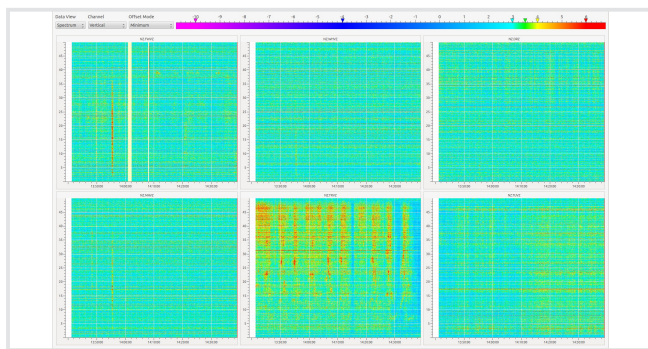
VORTEX is gempa's advanced volcano monitoring package to assess the state of a volcano by jointly observing volcano seismicity in comparison with almost any other sensor data such as temperature, pressure and video streams.

Based on SeisComP3 and in combination with gempa's CAPS and scanloc, VORTEX handles multi-type data recording, acquisition, archiving and processing. VORTEX provides sophisticated automatic and interactive data analysis and rapid assessment of the state of volcano activity.

VORTEX supports you in being prepared for the risk of volcano eruptions saving lives and essential infrastructure.

FEATURES

- **CAPS:** multi-sensor data acquisition
- **scanloc:** Local earthquake detection through cluster search
- **VORTEX RSAM:** Real-time Seismic Amplitude Measurement
- **SSAM:** Seismic Spectral Amplitude Measurement
- Duration magnitude determination (**Md**)
- Sophisticated visualization tools



Multi-sensor analysis

In combination with CAPS, VORTEX can display and analyze data from various sensors such as seismograms, temperature or pressure in almost any given format. Sensor data, here transformed by RSAM, are shown in customizable dashboards allowing simultaneous analysis and easy access to further analysis tools.

RSAM and SSAM

RSAM and SSAM allow to discriminate weak seismic signals from noise. Signals from different sources can be classified and identified based on frequency content. Such volcanic seismic sources may be indicative of phases before and during eruptions. Thus VORTEX provides operators with advanced tools to assess the state of a volcano.

Video streaming

In Vortex operators may use real-time video streams for instantaneous comparison with all the other sensor data, RSAM and SSAM. Thus any change in, e.g., seismicity can be assigned to the style of eruption, rock bursts, rainfalls, etc. The combination with video streams helps operators to react quickly and responsibly.

TECHNOLOGY

VORTEX combines analysis of seismic waveforms, RSAM, SSAM and video streams.

RSAM - Real-time Seismic-Amplitude Measurement - presents the overall signal size over periods of 10 minutes. In high-rate seismicity situations when individual earthquakes are indistinguishable or seismograms are overprinted by high-level volcanic tremor, then RSAM is an excellent way of showing transients.

SSAM - Seismic Spectral-Amplitude Measurement - shows the relative signal size in specific frequency bands. Seismic signals radiate energy at source-dependent frequencies. SSAM shows their strength at each frequency. In this way, volcanic tremor, classical earthquakes and noise can be

distinguished. SSAM therefore assists operators in signal detection and classification.

gempa's **CAPS** acquires data from co-located sensors like broadband seismometers or accelerometers, CGPS, thermometers, video cameras, etc. providing VORTEX with all available data required for detailed volcano monitoring.

scanloc, included in the volcano package, is a sophisticated auto-location module for local earthquakes. Employing advanced cluster search scanloc ensures reliable earthquake monitoring in situations with high-rate seismicity.

Optimizations to the standard SeisComP3 is added by computing the duration magnitude **Md**, commonly used for volcano monitoring.