

VORTEX
Volcano Monitoring



Volcano observation and monitoring

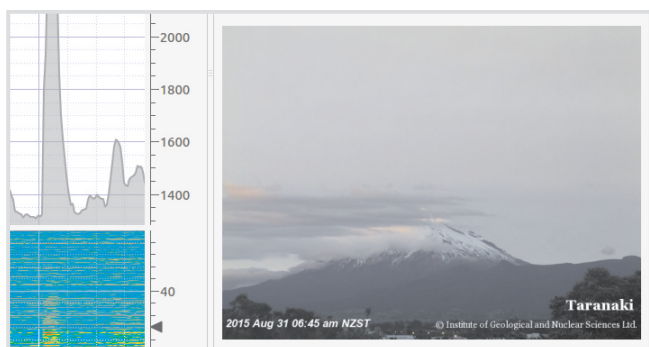
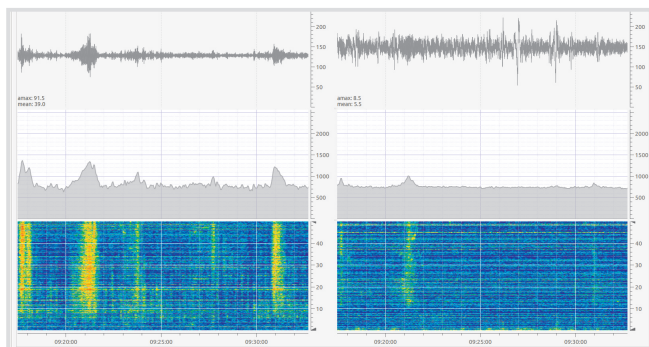
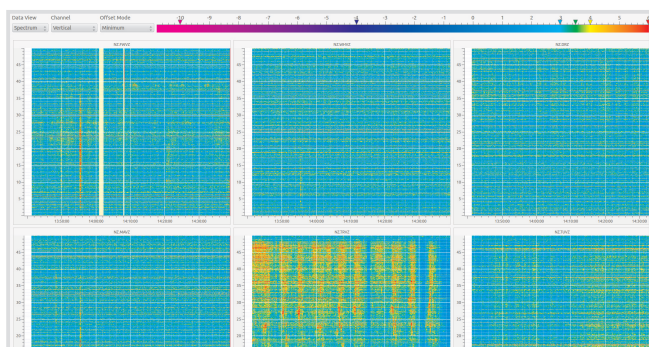


VORTEX in a nutshell

gempa offers a suite of modules for volcano monitoring. The central element is VORTEX, a module to assess the condition of volcanoes based on multi sensor data as seismic, infrasound, video etc. into a common volcano monitoring system. In combination with gempa's Common Acquisition Protocol Server (CAPS) also other sensor data as temprature or gas measurements can be acquired and integrated . VORTEX visualizes the data in form of real-time seismic amplitudes (RSAM) and seismic spectral amplitudes (SSAM) in addition to the standard the time series plots. VORTEX is based on the SeisComP framework and can be fully integrated into the SeisComP system. Useful additions for such system are the microseismic detector scanloc and the crosscorrelation module ccloc.

FEATURES

- Multi-sensor data integration
- Visualization of video, seismic and infrasound data, air pressure, etc.
- RSAM: Real-time Seismic Amplitude Measurement
- SSAM: Seismic Spectral Amplitude Measurement
- Multiplot dashboard and sensor selection on maps
- Based on the SeisComP framework



Multi-sensor analysis

In combination with CAPS, VORTEX can display and analyze data from various sensors such as seismograms, temperature or infrasound in almost any given format. Sensor data, here transformed into 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 and infrasound 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. Zooming and filtering can be applied to each stream/sensor.

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 and infrasound waves including 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,

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.

ccloc a crosscorrelation module applies pattern matching to volcanic signals.

Md duration magnitude is integrated in SeisComP.