Geophysical Research Abstracts,
Vol. 11, EGU2009-4430, 2009
EGU General Assembly 2009

Improvements to Seismic Monitoring of the European Arctic Using Three-Component Array Processing at SPITS

S. J. Gibbons, J. Schweitzer, F. Ringdal, T. Kværna, and S. Mykkeltveit
NORSAR, Seismology, Kjeller, Norway (steven@norsar.no, +47 63818719)

The European Arctic, which includes the former Soviet nuclear test sites on Novaya Zemlya, is an important region in the context of CTBT monitoring. Novaya Zemlya is characterized by very low natural seismicity and only a very small number of seismic events have been observed since the last known nuclear test on October 24, 1990. The detectability of seismic events on Novaya Zemlya as well as in many other parts of the European Arctic is primarily determined by the two small-aperture IMS arrays ARCES (on the far north of the Norwegian mainland) and SPITS (on the island of Spitsbergen). In August 2004, the SPITS array was upgraded with the replacement of the short-period seismometers with broadband instruments and an increase in the sampling rate from 40 Hz to 80 Hz. The most important feature of the upgrade for the detection and location of small magnitude seismic events however was the deployment of three-component instruments at 6 of the 9 sites on the array. The detection and correct classification of secondary phases are of paramount importance for events observed by only a small number of stations at regional distances. In the absence of the Lg phases typically observed for many continental propagation paths, the deployment of multiple three-component stations was deemed a necessary undertaking to exploit the higher amplitudes of the Sn phases likely to be observed on the horizontal seismograms.
With reference to four events on and around Novaya Zemlya in 2006 and 2007, we demonstrate the improved signal-to-noise ratio of the Sn phases on beams of rotated horizontal components. Performing f-k analysis on the horizontal components, or on combinations of vertical and horizontal components, provides improved direction estimates and phase classifications for low SNR signals. We demonstrate secondary phases which are incorrectly classified when f-k analysis is limited to the vertical components but which provide good estimates when waveforms from both vertical and horizontal components are available.