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7.9 Correlation between temperature and number of detections

When operating an automatic detector such as the STA/LTA detector in effect at the regional arrays in northern Europe, the number of false detections as a function of STA/LTA threshold, frequency and slowness is an important consideration. As discussed in Section 7.6, the f-k analysis is an effective tool at these arrays to separate such false alarms from real seismic detections, by using the calculated phase velocity. In addition, the estimated azimuths and signal frequency can be used to obtain some indications about the origins of these noise detections.

A number of sources contribute to such detections. Some are of cultural origin, others are environmentally determined. In some cases there are significant noise detection effects only during certain times of the year, or during certain environmental conditions.

Luosto and Saastamoinen (1964) have demonstrated a clear correlation between large temperature variations and ice-shocks in a lake. Ice-shocks were observed during the freezing period in early winter, and then a strong correlation between number of ice-shocks and temperature decline was found in March/April. During this latter spring period, the temperature goes above the freezing point during the day, and falls to 10-20 degrees Celsius below freezing point during the night.

In a study of NORESS noise detections, Kværna (1990) found a strong correlation between the water flow in the nearby river Glomma and the number of low-velocity phase detections. Fyen (1990) showed that the noise level is also strongly correlated with the water flow. The noise at certain frequencies is furthermore very strongly affected by various sources of industrial activity.

Many of such noise 'events' are very strong. For the ARCESS array, they are often located within, or very close to the array.

Figs. 7.9.1 and 7.9.2 show the number of detections and termperature at ARCESS and NORESS, respectively, each for a two-week period. We notice a clear correlation between temperature and detection rate. During nighttime, the detection rate is considerably higher than during daytime.

In Fig. 7.9.3, we report a longer period for ARCESS, and we see a very typical increase in the number of detections during the first freezing night in the autumn, but thereafter the connection between freezing temperature and number of detections is not as clear during the mid-winter. However, when the spring comes, we again see a clear correlation between large temperature variations and peaks in the number of detections.

Although these examples are clear enough, we find other periods when the number of detections increases dramatically, without any obvious correlation with temperature changes. One other potential source of such increase in the number of detections is the increase of waterflow in the nearby rivers (Kværna, 1990).

Fig. 7.9.4 illustrates the intensity of these events. The STA/LTA detector classifies this correctly as an "event", but the subsequent fk-analysis classifies it as a "false alarm", which is also correct with respect to what we are looking for.

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References

Luosto, U. and P. Saastamoinen (1964): , Observations about ice-shocks on lake Saaksjarvi, Geophysica, Vol. 9, No.1, University of Helsinki.

Kværna, T. (1990): Sources of short-term fluctuations in the seismic noise level at NORESS, PEPI, 63, 269-276.

Fyen, J. (1990): Diurnal and seasonal variations in the microseismic noise level observed at the NORESS array, *Phys. Earth Planet. Int.*, 63, 252-268.

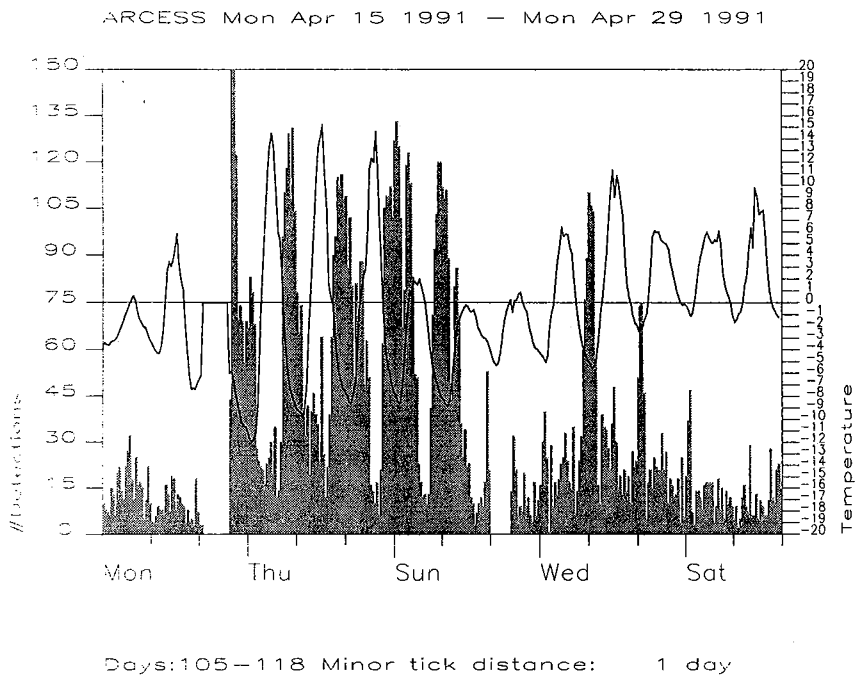

Fig. 7.9.1. Number of detections (shaded) and temperature for ARCESS during the period April 15 through April 28, 1991.

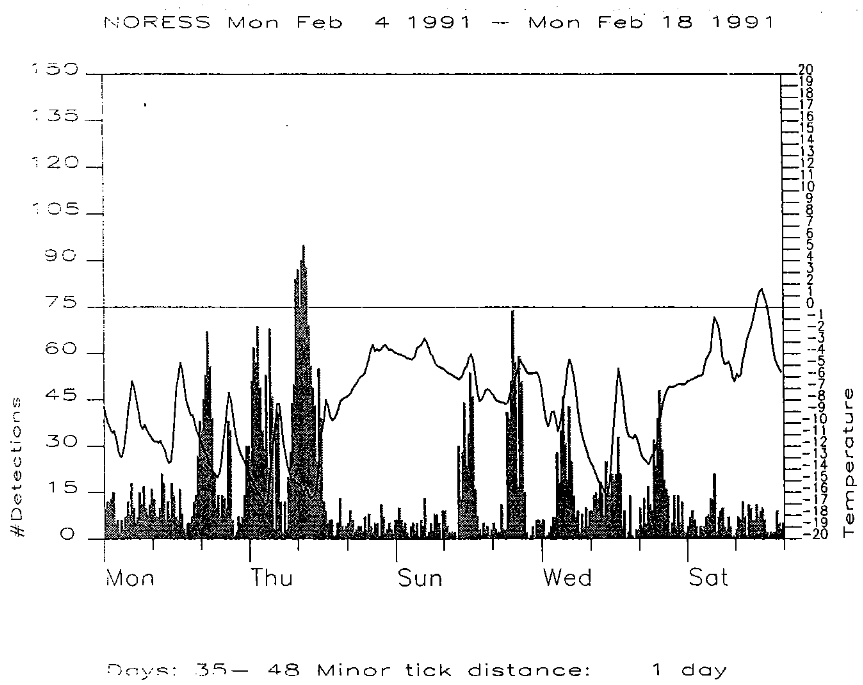

Fig. 7.9.2. Number of detections (shaded) and temperature for NORESS during the period February 4 through February 17, 1992)

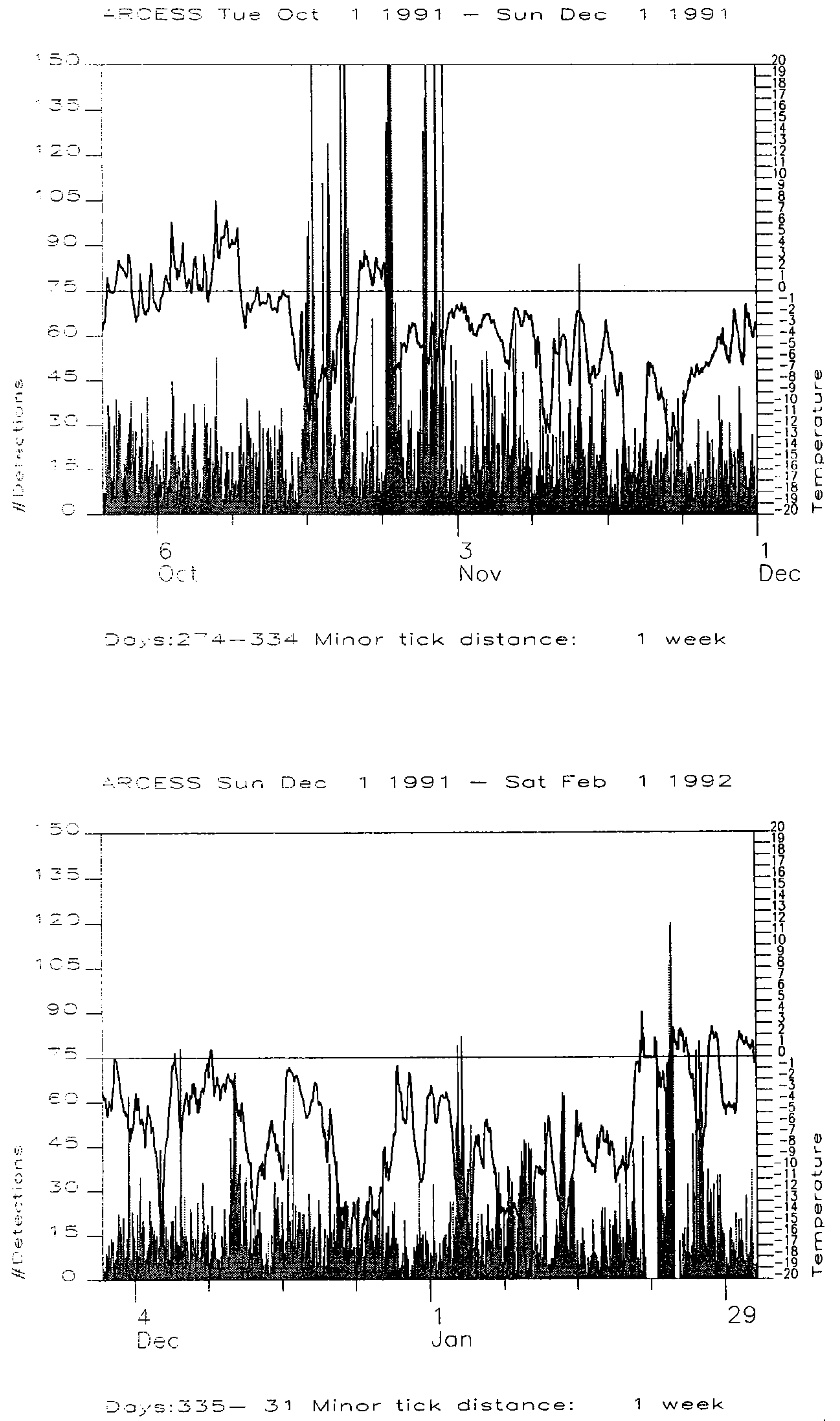

Fig. 7.9.3. Number of detections and temperature (bold line) for ARCESS during the period October 1 to December 1, 1991 (upper) and December 1, 1991, to February 1, 1992 (lower)..

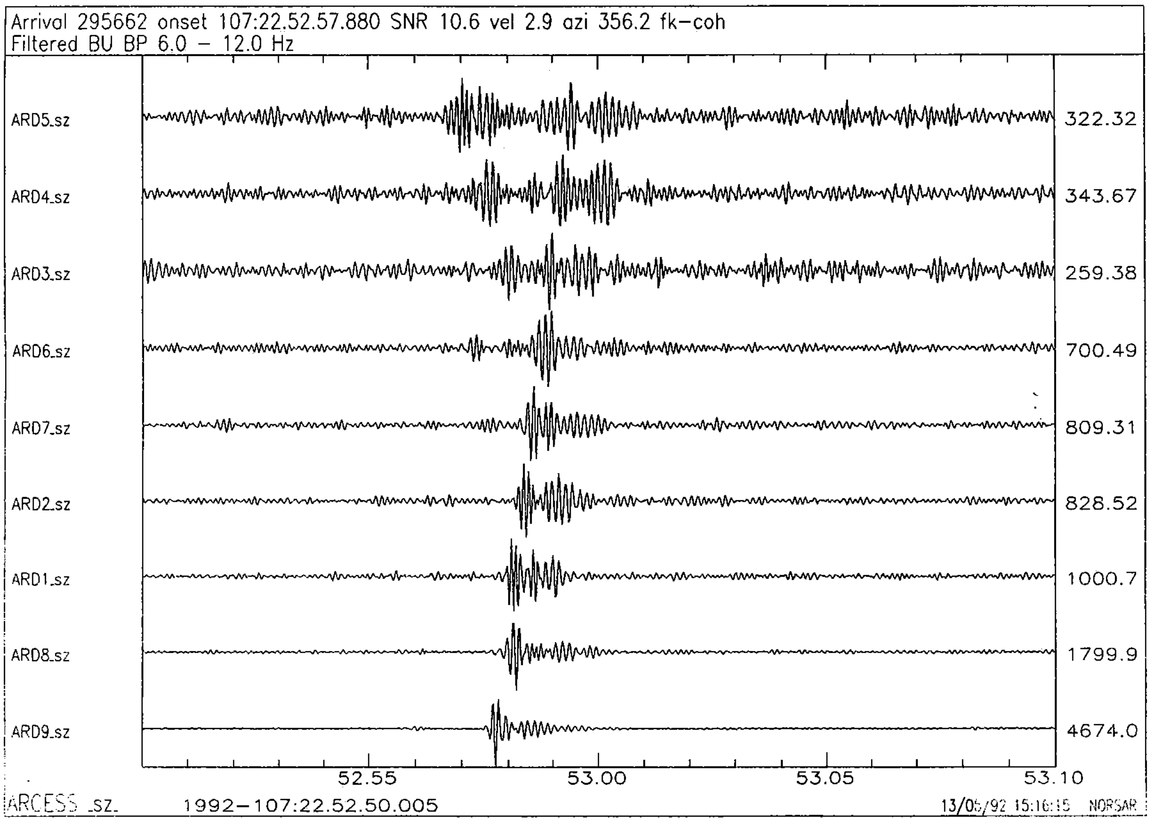

Fig. 7.9.4. Example of a "false alarm". This event originated very close to the array, and is interpreted as an "ice-shock". The fk-analysis classified this event as "noise", by reporting apparent velocity 2.9.