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VII.6 Event Detectability of Seismograph Stations in Fennoscandia

Based on six years of ISC data (1964-69) the operational event detection capabilities have been analyzed for those stations in Fennoscandia that reported regularly to the ISC during this time period (Pirhonen et al, 1976). It has been demonstrated that the incremental P-wave detection probability of a station as a function of ISC m_b can be very accurately modelled by a cumulative Gaussian distribution function. This has been found to hold true when analyzing large as well as small regions. By maximum likelihood estimation based on the Gaussian model (Ringdal, 1975) we have established that operational detection thresholds, both at the 50 and 90 per cent levels, exhibit large variations between individual Nordic stations. For the entire teleseismic region, the 50 per cent thresholds range from m_b=4.5 to 5.5; the best stations being located in Finland. This is consistent with the expected increase in seismic noise level with decreasing distance from the North Atlantic Ocean. Fig. VII.6.1 shows the 50 per cent thresholds of all stations in the teleseismic range, while Fig. VII.6.2 shows the estimated detection curves.

Studies of the noise power spectra of four Fennoscandian stations over a one-year period show as a common feature a very sharp fall-off with increasing frequency in the band of interest for P-wave detection. From 1 to 2 Hz the decrease in average noise power is 15-20 dB, while the standard deviation at each frequency in this band is much lower, typically 4-6 dB.

An attempt to predict relative detectability thresholds based on noise level and station magnitude corrections was only partly successful. The results were generally consistent with previous estimates, but with occasional deviations of several tenths of an m_b unit. The simple method of estimating

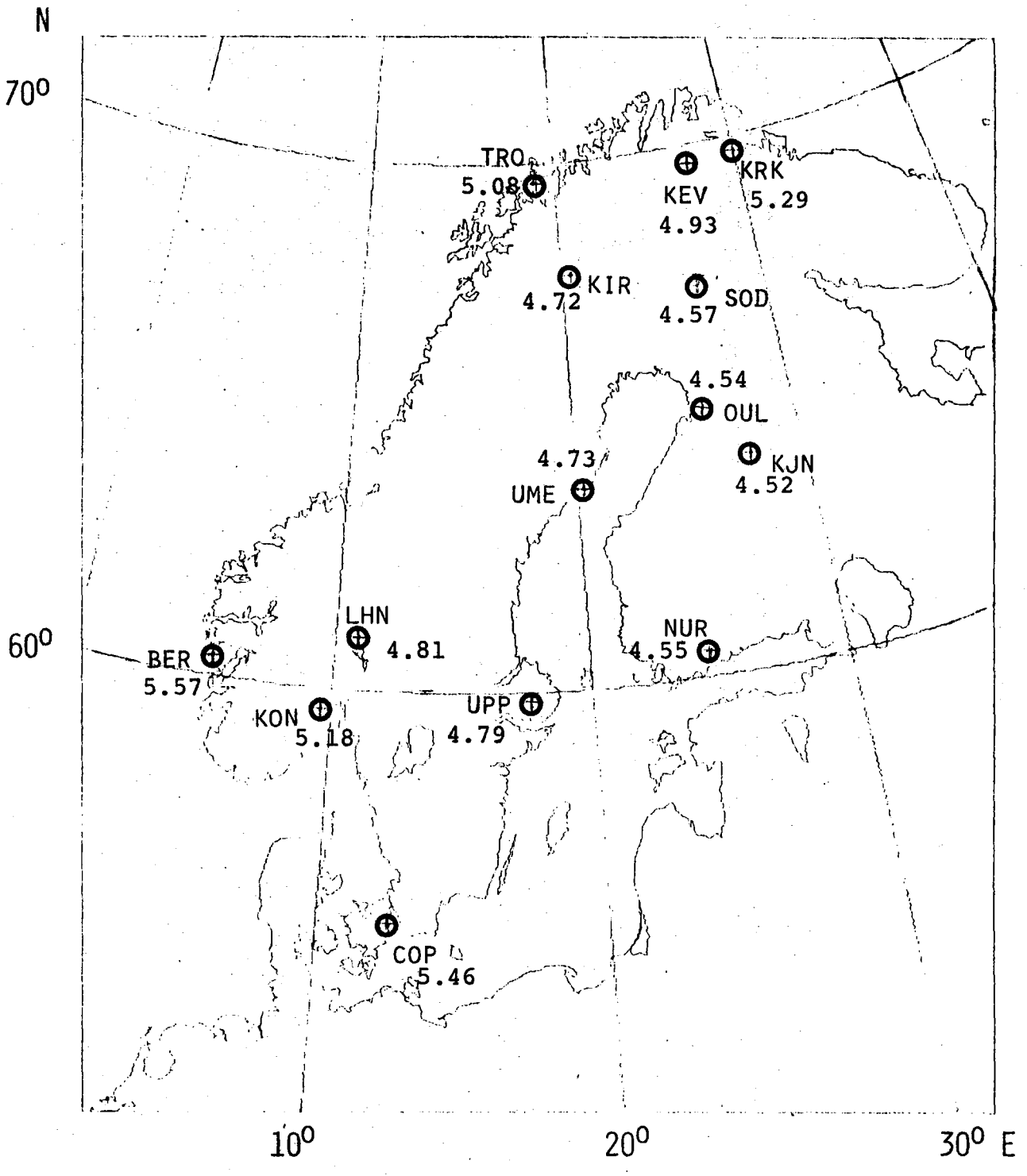

Fig.VII.6.1 Seismograph stations in Fennoscandia used in this study and their estimated 50 per cent operational detection thresholds in the teleseismic range.

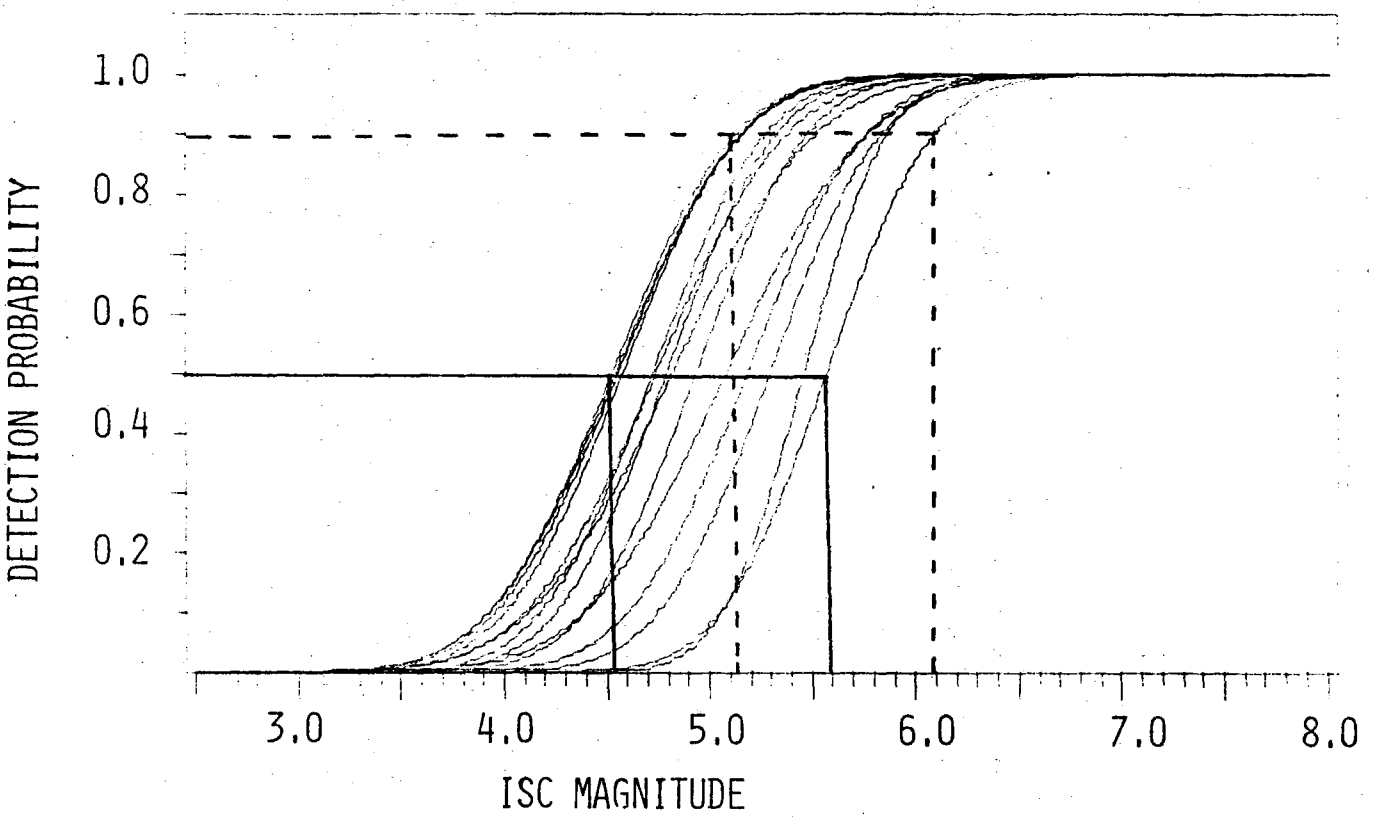

Fig. VII.6.2 Maximum likelihood detectability curves of all stations in the teleseismic range (30-90 degrees from Umeå).

station detecting capability by counting the number of reported events was found to give a good first order estimate of relative 50 per cent thresholds between stations.

For each station, there are significant regional variations in detection thresholds that cannot be attributed to differences in epicentral distances. Of particular interest is the observation that the 50 per cent threshold on the average is 0.4 m_b units higher for Western North America than for the Japan-Kuriles-Kamchatka arc, although the epicentral distances are similar for these two regions. This points to a considerably stronger attenuation of high frequencies in the mantle for the paths corresponding to the former region.

An indirect argument was used to compare the performance of the Fennoscandian stations to the average ISC station for one selected region (Japan-Kuriles-Kamchatka). It appears that the Fennoscandian stations are generally better than average for this region, with a mean improvement in 50 per cent thresholds of about 0.4 m_b units. A more complete evaluation of the relative standings of individual stations in the world-wide network would require a much more extensive study, but could possibly be obtained using the general techniques described previously in this paper.

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