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Time-lapse Microtremor Data recorded on an Oil and Gas Field in Voitsdorf, Austria

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The results of two passive microtremor surveys on an oil and gas field in Voitsdorf (Austria) are compared. The time lag between the surveys was 16 months. Two physically separated hydrocarbon deposits were considered; one of them is produced since more than 40 years and the other one was just recently discovered. The first survey consists of six short measurement profiles (approx. 2km length each) across the recently discovered deposit. The second survey consists of six long profiles (approx. 9km length each) across both hydrocarbon deposits. For each profile the seismic wave field was recorded synchronously at several different locations and for at least 12 hours. Data interpretation is based on a comprehensive data-set and on a correlation analysis of four different spectral attributes. These attributes quantify characteristic features of the wave field's Fourier spectra in the low-frequency range ($<$ 10Hz). One attribute quantifies the spectral energy (i.e. integral), another attribute quantifies maxima in V/H spectral ratios, and two attributes describe frequency shifts of peaks within the spectra of vertical and horizontal wave field components. Due to temporal variations of the signals, a special processing method has been developed, which combines the long-term measurements (several hours of continuous records) of multiple profiles. This procedure considerably enhances the consistency of the results for each spectral attribute. The results show that the integrated approach using several attributes significantly increases the probability to detect the hydrocarbon reservoir locations without any a priori information. Also, the two reservoirs show different signal characteristics, which may be due to the different production status. A numerical study of two-dimensional seismic wave propagation is applied to explain some of

the basic characteristic patterns observed in the frequency shift spectral attributes. The results of the numerical study indicate that the frequency shift attribute may contain information on the depth of hydrocarbon reservoirs, provided that the reservoir acts as a (secondary) source of low-frequency waves.