Proper oscillations of the Earth generated by the earthquake in the Indian Ocean (Sumatra) on 26.12.2004 (sample of some preliminary results)

A.P.Venedikov, S.Nikolova, L. Dimitrova.
Geophysical Institute, Sofia.

The results here presented are obtained through the processing by our program USD of the record of a vertical seismograph of the main Bulgarian seismological station Vitosha near Sofia. One of the main purpose is to check the efficiency of our seismological instrumentation, as well as the program USD of A.Venedikov for spectral analysis of difficult data (drift, gaps and colored noise).

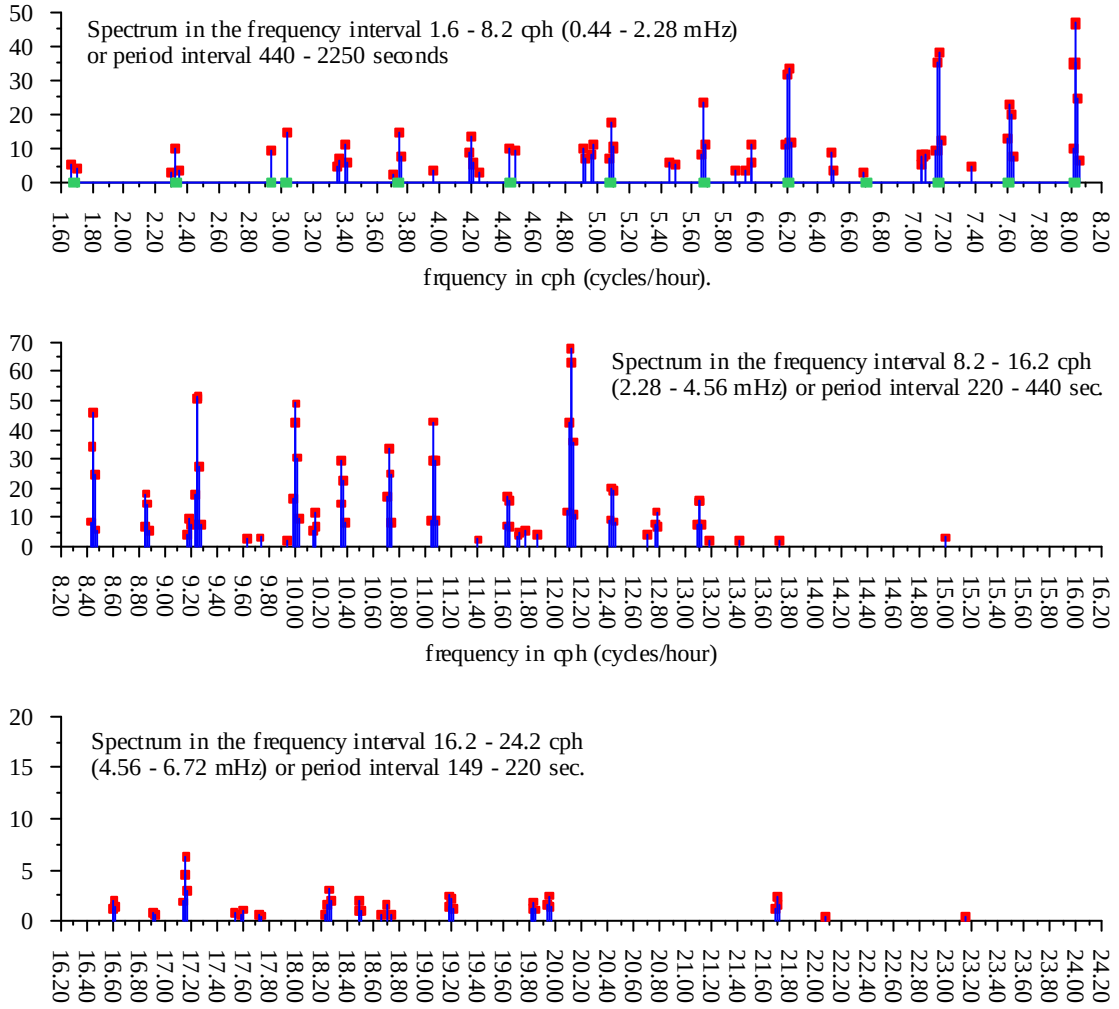

Figure 1. Spectrum, estimated by the program USD, applied on a time interval of 50 hours, starting 22 hours after the first arrival of the seismic waves. The red points and the corresponding blue lines indicate tones and overtones with statistically significant amplitudes. USD computes the corresponding phases and, as shown further by Figure 3, it can synthesize the signal, associating all tones and overtones in selected frequency interval. The green points indicate frequencies of main tones, found by Boulen, in the frequency range 1.6 till 8.2 cph.

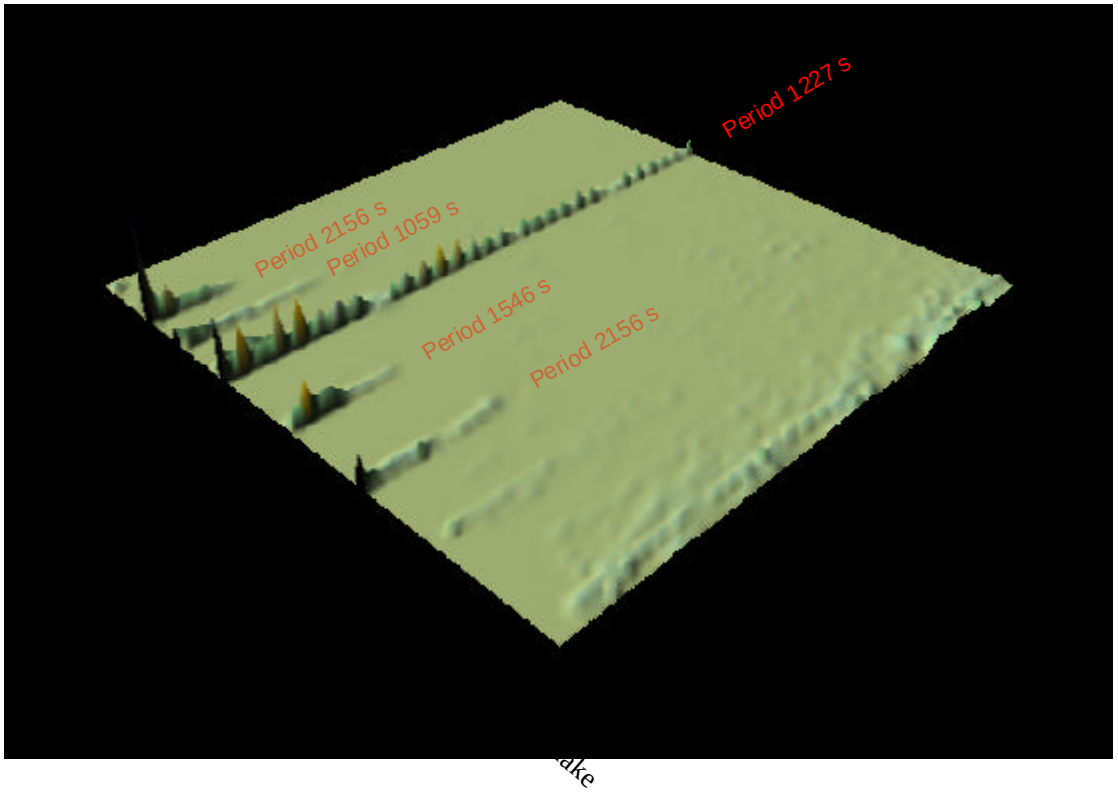

Figure 2. Study of the time variations of the spectrum of the proper oscillations in the low frequency range 0.3 ÷ 4.3 cycles/hour. This result could be obtained by USD which eliminates the drift, actually the low frequency tidal waves and can deal with gaps, due to multiple aftershocks. Most of the frequencies are totally dampened within 10 days or less. However, the tone with frequency 2.933 cycles/hour or period 1227.4 seconds is reducing its amplitude but it remains still “ringing” 35 days after the quake. The same analysis at the higher frequencies has shown almost immediate dampening of all frequencies, although, as shown by Figure 1, they have higher amplitudes.

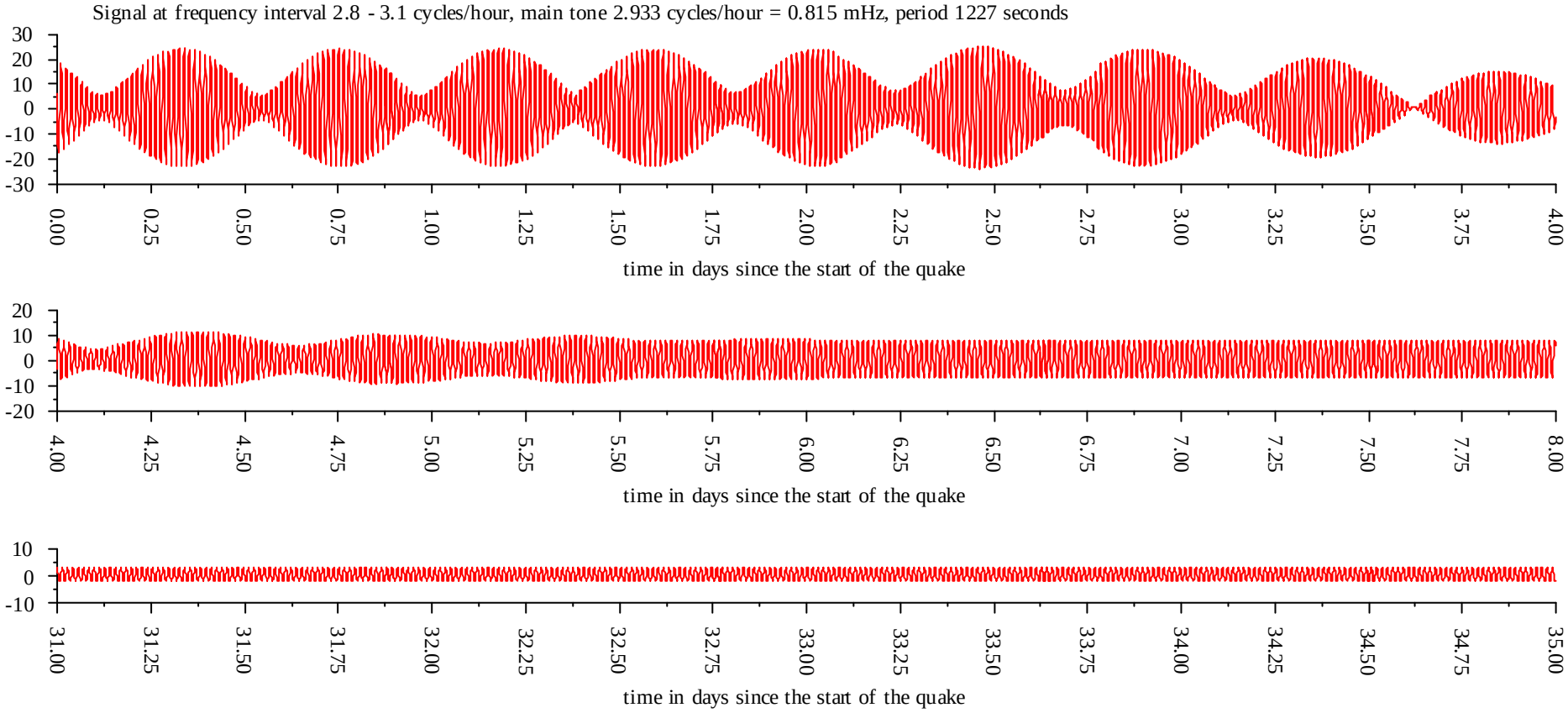

Figure 3. Synthesized signal at 2.933 cph, continuing to ring 35 days and further (see Figure 2). During the 1st 6 days or so, the main tone interferes with some overtones, due to which the signal has variable amplitude. Afterwards remains a single tone with very stable frequency 2.933 cph and slowly decreasing amplitude, but steadily persisting till 35 days and more.

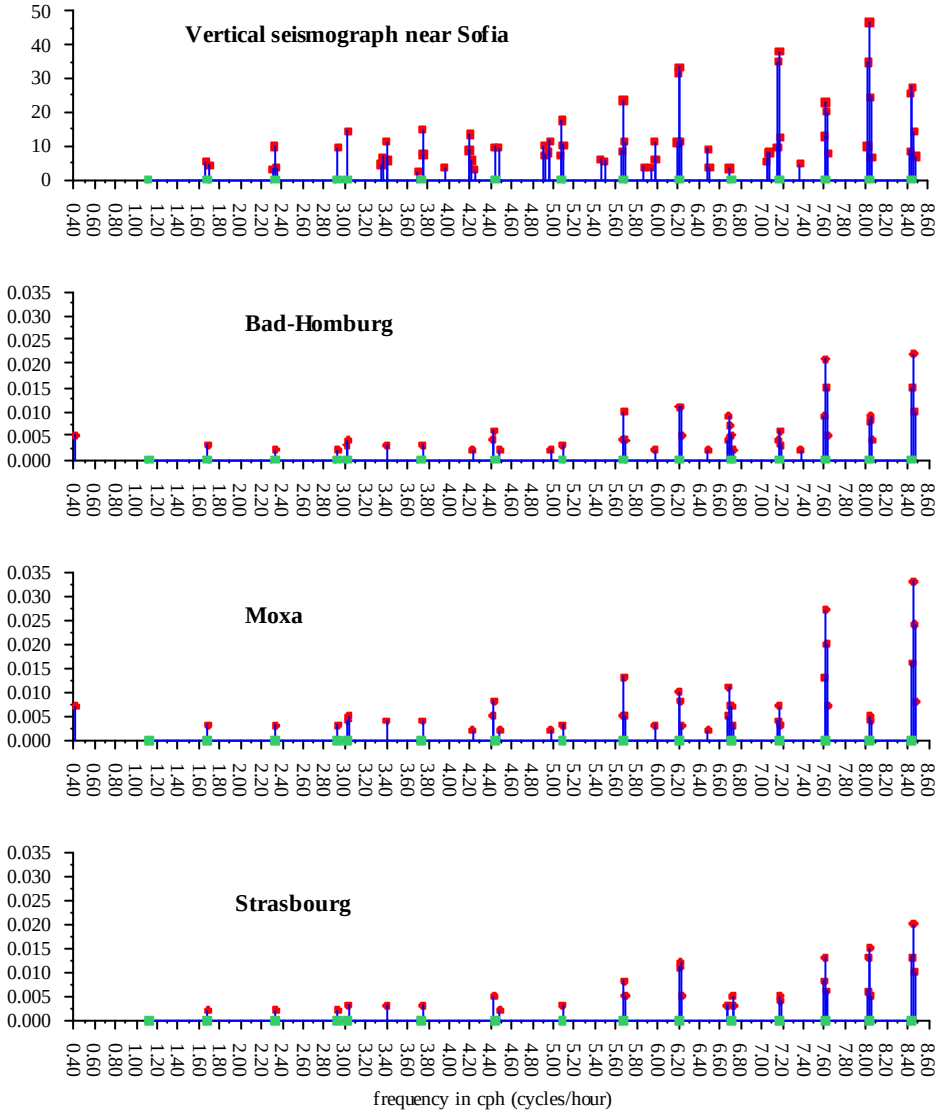

Figure 4. Spectrum at the frequency interval 0.3 ÷ 8.6 cph of 3 SG stations, compared with the spectrum of seismic data (preliminary results). Data offered by the Global Geodynamic Project (D.Crossley).