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Application of long-base laser interferometer for monitoring crustal deformations in a wide frequency band: the Northern Caucasus case study

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The long-base wide-band laser interferometer with a measurable armlength of 75m, situated in Baksan valley (the North Caucasus, Russia), is used for monitoring crustal deformations over a wide frequency range. The optical scheme of the interferometer, installed in an underground tunnel, is the two passes (N=2) Michelson-type interferometer. The long-term monitoring strains of the Earth is provided in several channels: from very low frequencies up to 1.6 kHz. Unique geodynamical features of the region, the proximity of the Elbrus volcanic edifice and existing long-term high-quality observed time series of deformations allow to study a wide class of geophysical phenomenae. Some of them are listen below.

For the frequencies of order of 10^{-6} Hz the existence of the deformations having a global character is proved at a statistically significant level. The existence of mutual relations between global deformation fields, global seismic processes and global geodynamics of the Earth (variations of the speed of rotation) is shown. The new method for a control of the state of magmatic structures of the Elbrus volcano was developed. The method is based on revealing resonant modes, exited by the magmatic resonant structures upon incidence of a broadband teleseismic signals. Revealed resonant modes are related to the shallow magmatic chamber of the Elbrus volcano with the characteristic size of about 9 km and setting down on the depth of 1-7 km. The effect of modulation of high-frequency seismic noise by the low-frequency termo-elastic deformations, caused by the "running" shadow of the Moon on a surface of the Earth during a full solar eclipse 29.03.2006, is found. This work is supported by the Russian Foundation for Basic Research under Grant No 07-05-00786.