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Stratigraphy of earthquake precursors according to the laser strainmeters data

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Summary of the laser-interferometric methods application for geophysical studies of earthquake precursors over past 30 years is presented. The laser interferometers developed in the IRE RAS on the original optical schemes were used and the experience of their application in seismology was accumulated. Measuring instrument basis of different experimental prototypes varies from L=2 m up to L=800 m, strain resolution dL/L=10(-11)-10(-12), analysed frequencies range from quasistatic and ultra-long period 10(-5)-10(-4) Hz up to seismic and acoustic 10(3) Hz oscillations of the earth surface. At our present activity this technique is used for the development of early detection of precursors of earthquakes and other dangerous natural processes. The phenomena foregoing and accompanying seismic events for the regional M=4 and remote M=7-8 earthquakes are discussed. We have distinguished the next performances of the precursors recorded by laser strainmeters: wide band deformations of the earth surface (anomalous variation of a mean diurnal velocity of tension of rocks, deviation from a regular course of slow strains with typical time of tens minutes, amplitude up to few units of 10(-9), frequency of local microseism occurrence etc.); seismoacoustic precursors (the coherent micro-oscillations on industrial frequencies Fi = 50/i Hz, i = 1, 2, ..., which appearance is synchronized to the most strong earthquakes happening periods with probability over 0.9); strain-baric anomalies (wave-shape disturbances of the atmospheric pressure, strains of the earth surface and underground water level variations with velocity spreading of 30-60 km/h); seismic energy conversion and electromagnetic phenomena (including synchronous recorded lithosphere and ionosphere disturbances). The progress has been obtained owing to the introducing the system of spatially separated (up to 0.5-140 km) ground based instruments and their integration with the remote sensing and satellite monitoring methods.