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浅い観測坑におけるレーザー伸縮計を用いた地殻ひずみの観測

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Crustal Strain Observation with a Laser Extensometer in a Shallow Tunnel

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Abstract

A laser extensometer was installed in a shallow observation room at Kwasan Astronomical Observatory, Graduate School of Science, Kyoto University in 1999. Since then, we have carried on precise observation of crustal strains with the laser extensometer. The purpose of this paper is to estimate the effect of meteorological changes (e.g. ambient temperature change, atmospheric pressure change, etc.) upon observation of crustal strains using a laser extensometer installed in a shallow tunnel. Results obtained are as follows: (1) Before closing the vacuum valve of the stainless steel pipe covering the light path of the laser interferometer, the strain data obtained from the laser extensometer showed significant influence of the atmospheric pressure change of 2.6×10^{-7}/hPa. This can be explained by the refractive index change in the light path caused by atmospheric pressure change. (2) After evacuating the air in the light path and closing the vacuum valve, long-term strain changes corresponding to ambient temperature changes were observed in the order of 1×10^{-5}/K. These changes can be fully explained by the thermal expansion coefficient of bedrock around the observation room, because linear thermal expansion of bedrock consisting of weathered granite is estimated to be $(0.4 \sim 1.0)\times10^{-5}$/K. (3) We then performed tidal analysis by applying FFT and BAYTAP-G programs to one-year strain data obtained from the laser extensometer. As a result, there exist significant discrepancies between the observed and the calculated tidal amplitudes. The discrepancy is caused by non-sinusoidal daily temperature changes around the observation site due to sunshine from the east direction in the morning.