Characteristics of the Tenryu-Funagira laser extensometer and its detection ability of slow slips

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Katsumata et al. (2010) installed a long-baseline laser extensometer in Funagira tunnel in Hamamatsu, Shizuoka Pref. Its baseline length is 400 m. Short-term slow-slips were detected with the extensometer. From spectral analysis, it was shown that a long-term slow-slip can be detected with the laser extensometer earlier than the GNSS network. However. iodine-stabilized He-Ne laser, which was used formerly, had a relatively short life time. It was difficult to continue observation for more than several years. We replaced the stabilized laser with the iodine-stabilized YAG laser developed by Araya et al. (2002), and started observation from March, 2018. The sampling rate was changed from 1 kS/s to 10 kS/s to catch up fast phase change due to quick strain change.
We compared the obtained data with that previously obtained with He-Ne laser. It was found that the atmospheric pressure response and tidal response were not changed. However, trend was changed. Trend of about 10^{-7} strain/year was previously observed. No such trend is observed currently. A trend change was observed before and after the 2011 Tohoku earthquake. The trend might be affected by local condition. We compared spectrum levels of the detrended previous and current data. The spectrum level was almost the same over a period range from 0.1 s to several months.
Ide et al. (2007) presented a scaling law of slow earthquakes, in which seismic moment is proportional to event duration. It is considered that strain rate would be the same level regardless of its seismic moment based on the scaling law. Katsumata et al. (2001) showed that the Tenry-Funagira laser extensometer would detect strain change with strain rate the same as those of short-term slow-slips in a day. If there were a slow-slip of one day duration, the Tenryu-Funagira laser extensometer could detect it.

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