

## Changes of E-W observed by the Quartz-tube Extensometer in the Matsushiro extending after the 2011 Tohoku Earthquake

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We observed a coseismic step of  $5.8 \times 10^{-7}$  strain in the E-W direction by the quartz-tube extensometer at Matsushiro during the 2011 off the Pacific coast of Tohoku earthquake. After that, an aftereffect of  $0.4 \times 10^{-7}$  strain continued extending in the E-W direction about 1 month. And more, the E-W extension has continued since October, 2011 and it becomes over  $0.5 \times 10^{-7}$  strain. Similar phenomena were observed by superconducting gravity meter in Matsushiro and Kamioka (Imanishi, personal communication). Therefore, we think that these data of the E-W extension indicate true crustal deformation.

Figure shows data of the quartz-tube extensometer, water-tube tiltmeter, thermometer, and the other points of the extensometer. The air temperature in the tunnel heated up  $0.03 \text{ }^\circ\text{C}$  in this range. But the influence of the temperature change hardly caused the extension, because it is very small extension of  $1.6 \times 10^{-8}$  as  $5.4 \times 10^{-7}$  of the temperature response of the quartz-tube. And more, the tiltmeter and the other point data of the extensometer show a similar change, therefore, the change seems to be true. We can catch geophysical phenomena such as the seismic waves (not shown in the figure) of the 2011 off the Pacific coast of Tohoku earthquake, the coseismic step, the aftereffect and continuing extensive change by the one device. This extensive change may indicate a part of crustal upheaval in a geological meaning.

Acknowledgement: We thank Yuichi Imanishi Associate Professor of ERI for teaching us about the continuity of decreasing gravity by the superconducting gravity meters in Matsushiro and Kamioka after the Tohoku earthquake.

Keywords: extensometer, tiltmeter, aftereffect, the 2011 off the Pacific coast of Tohoku Earthquake

