Detailed crustal strain distribution around hypocentral regions of large earthquakes and its temporal change

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An earthquake is a release process of strain energy stored in the crust. Investigation of stress and strain around the source region of large earthquakes is important in understanding their generation mechanism. For example, Sagiya et al. (2000) found a good agreement between the large strain rate areas, based on the dense GPS observation in Japan, and the source regions of past large earthquakes. On the other hand, Sagiya et el. (2002) reported that the 2000 Western-Tottori earthquake occurred in a small strain rate area. Therefore, it is not so straightforward to say that a large earthquake is apt to occur in large strain rate areas. However, the data used by Sagiya et al. (2002) were based on a smooth strain rate field by averaging surrounding area for several tens of kilometers. In this paper, we estimate the detailed strain distribution and its temporal change around the hypocentral region.

In order to calculate crustal strain rate, we compose a triangulation network of the GPS observation stations, and estimate strain rate tensor for each unit triangle. In the hypocentral region of the 2000 Western-Tottori earthquake, we find that a unit triangle corresponding to the hypocenter has anomalously large (0.2-0.3ppm/yr) NW-SE compression. Furthermore, the amplitude of this compressional strain was decreasing toward the occurrence of the Western-Tottori earthquake. The physical mechanism of this concentrated strain and its temporal change is not understood yet, but such a phenomena has a potential to be utilized to specify the location and the time of a future large earthquake. We will also report results from other regions, such as Parkfield in California, where the M6.0 earthquake occurred on September 28, 2004.