[EJ] Evening Poster | S (Solid Earth Sciences) | S-SS Seismology

[S-SS09]Crustal Deformation

convener:Tadafumi Ochi(Institute of Earthquake and Volcano Geology, Geological Survey of Japan, The National Institute of Advanced Industrial Science and Technology), Mako Ohzono(Institute of Seismology and Volcanology, Graduate School of Science, Hokkaido University)
Sun. May 20, 2018 5:15 PM - 6:30 PM Poster Hall (International Exhibition Hall7, Makuhari Messe)
Study of crustal deformation plays an extremely important role in the investigation of wide scale earth dynamics those are earthquake and volcanic activity, plate motion and so on. In our session, we discuss the study related to crustal deformation, such as development of observation instrument, observed crustal deformation, analysis method, and simulation study.

[SSS09-P07]Horizontal crustal strain field derived from dense GPS observation network in southwest Japan

*Arata Orinaka[1], Takao Tabei[2], Makoto OKUBO[2] (1.Graduate School of Integrated Arts and Sciences, Kochi University, 2.Faculty of Science and Technology, Kochi University)
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Crustal deformation field in southwest Japan during the interseismic period is characterized by "regional elastic deformation and relative block motion " and "local disturbance around active faults". In regional scale, subduction of the Philippine Sea plate (PHS) and strong coupling on the plate boundary has caused elastic shortening of the overriding southwest Japan arc in the direction of PHS convergence. At the same time oblique subduction has formed a mobile forearc sliver moving along an inland strike-slip block boundary, the Median Tectonic Line (MTL). In local scale, many active faults have been formed within the overriding plate especially in central Kyushu and Kinki districts, which may cause local disturbance of the deformation field. However, it is difficult to clearly identify local disturbance from regional deformation field since deformation rate and spatial extent of the local disturbance are roughly one-order smaller than those of the regional deformation. In this study we calculate horizontal crustal strain rates from GPS displacement data to better quantify and distinguish regional and local deformations. We use three methods for comparison; (1) a conventional triangulation network method that directly calculates strains from line length changes between stations, (2) a spatial smoothing method (Shen et al., 1996) in which general smoothness of the deformation field is characterized by a distance decay constant (DDC), and (3) a Kriging method (Mase and Takeda, 2001) known as the spatial optimal interpolation method that adequately extracts local disturbance. Basic data are horizontal displacement rates derived from GEONET final coordinate time series at 529 sites from Kyushu to Kinki districts during the period of 2006-2009.

General feature of the regional strain field is very similar regardless of the strain analysis method. Southern part of Shikoku district has been shortened at a rate of 0.15-0.45 ppm/yr in the NW-SE direction due to the PHS convergence. Strain rates decrease rapidly with increasing distance from the plate boundary. The direction of the principal strain axis rotates counterclockwise from western Shikoku to southern Kyushu and extension becomes significant gradually, which implies PHS convergence becomes less effective and other deformation source must be taken into consideration. In local scale, however, strain rate fields from three methods show very different features. The triangulation network method results in irregular small-scale fluctuation, which may be due to site-specific noise and erratic network configuration. In contrast, the spatial smoothing method tends to underestimate local deformation even when the lowest DDC value (= 15 km) is adopted. The Kriging method shows moderate results. We find local deformation around some active faults

and volcanos at a strain rate of about 0.10 ppm/yr. However, any systematic local disturbance expected near MTL and other geological structures is not clear in this study. Average station distance of GEONET (15-20 km) is still insufficient to extract local disturbance and dense campaign measurements for a specific target will play an important role when it is linked to GEONET.