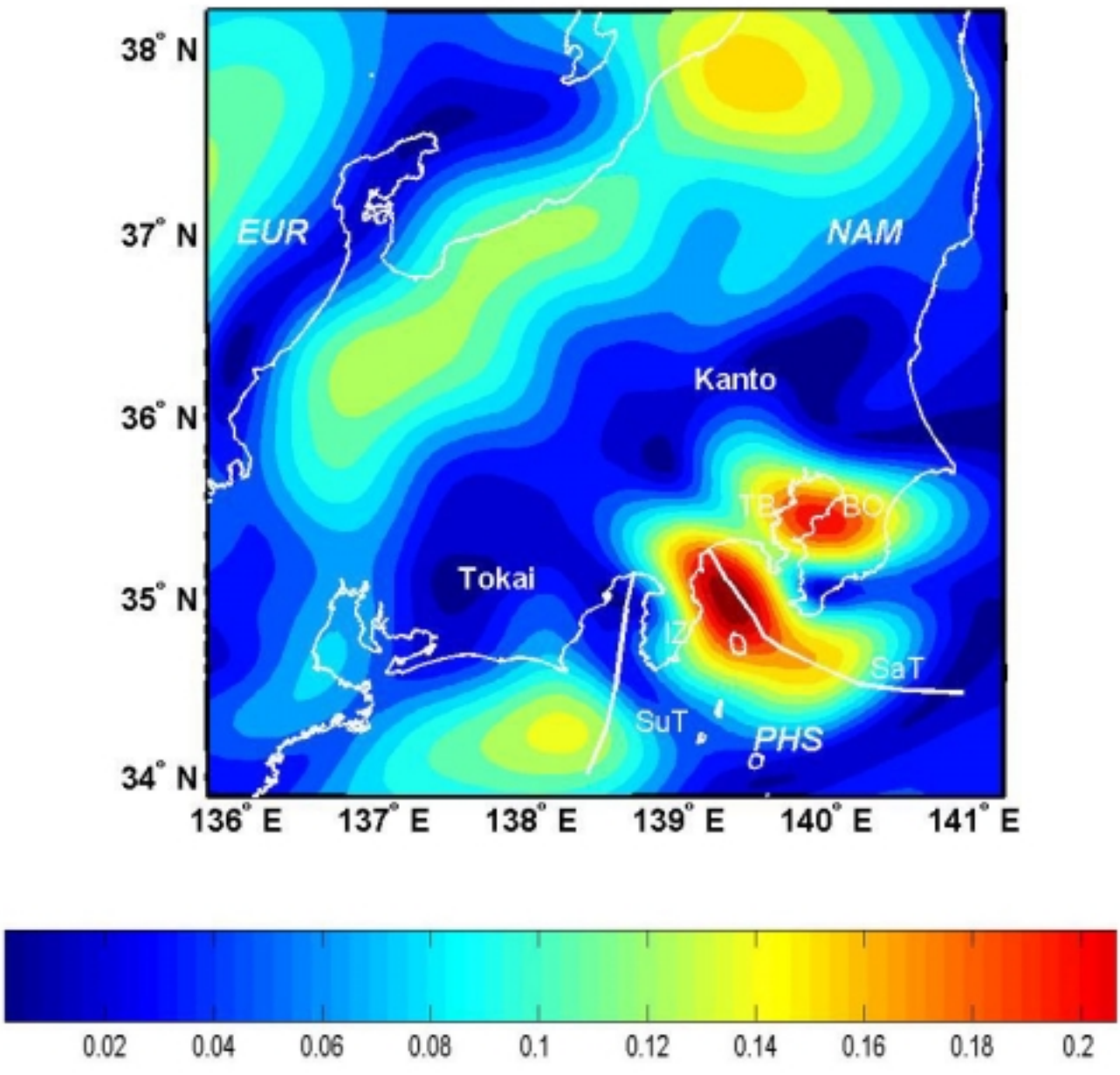
Estimation of Secular Crustal Deformation in central Japan from Wavelet Analysed GPS Time-series

Vijaykumar Kathamana[1], Kaoru Miyashita[2], Jianxin Li[3]

[1] Space & Earth Sci., Grad. School of Sci. & Eng., Ibaraki Univ., [2] Dept. of Environmental Sciences, Ibaraki Univ., [3] Space and Earth Sci., Ibaraki Univ

In order to investigate the secular crustal deformation based on the space geodetic technique, we analyzed the GPS time-series data from the nation wide continuous GPS array, GEONET, operated by the Geographical Survey Institute of Japan. A four-year period GPS time-series data of daily coordinates was analyzed by using the wavelet analyzing technique. We used daily estimates of the positions of 340 sites in the 400 X 400 km^2 region, which have been estimated in the common reference frame of ITRF94. We first removed the data jumps associated with earthquakes and due to artificial errors by using the ARMA technique. We also removed seasonal variations and white noises from the original time-series data by using the wavelet technique to estimate the secular tectonic signals, which further contributed to the study of the deformation fields in central Japan. We define here the secular deformation as a linear trend of the deformation without seasonal variations and abrupt discontinuities. The secular displacement vectors obtained were used to calculate horizontal crustal strain fields in the central Japan by means of the least squares prediction technique. The secular displacement field estimated was significantly different from those including non-secular components, and we would have overestimated the secular strain components without considering them. The main characteristic features of the secular strain fields were as follows: (1) there existed a compressive regime in the entire region; (2) there was a remarkable peak around Tokyo Bay in the maximum shear strain distribution; (3) along the Shinanogawa seismic zone there existed a distinguishing boundary zone in the several kinds of strain fields.

Figure1 shows the distribution of maximum shear strain rates estimated from the above analysis, where we can see distinguishing high strain patches near Tokyo Bay and Sagami Bay areas. The very high maximum shear strain patch located along the Sagami trough could be attributed to the contamination of the crustal deformations due to earthquake swarm activities around this region.


38° N
37° N
36° N
35° N
34° N
136° E
137° E
138° E
139° E
140° E
141° E
EUR
NAM
Kanto
Tokai
TB
BO
IZ
SaT
SuT
PHS
0.02
0.04
0.06
0.08
0.1
0.12
0.14
0.16
0.18
0.2