Localization of strain rates estimated from GNSS data and its relation to the basis-function interval

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We observe active crustal deformation in Japan. Proper knowledge on crustal deformation is important, for example, for estimating coupling ratio on plate interfaces and for understanding tectonic processes. Therefore, it has been an important issue to estimate continuous deformation fields from spatially discrete GNSS data.

In estimating deformation fields, the method of basis function expansion is a powerful tool. In a study of basis function expansion, Okazaki et al. (2021) used the cubic B-spline as basis functions, because it has good nature in estimating continuous and smooth deformation fields. Nozue & Fukahata (2022) quantitatively compared the performance of the boxcars with that of the cubic B-splines as basis functions, changing the basis-function interval *L*. The cubic B-splines showed much better performance than the boxcars in terms of the computational cost.

The estimated deformation fields generally depend on the basis-function interval *L*. For larger *L*, the computational cost is lower, but the resolution of the estimated deformation field is also lower. For the change of *L*, the change of displacement-rate fields is usually limited, while that of strain-rate fields is much more significant [Okazaki et al. (2021)]. In this study, using the cubic B-spline as basis functions, we systematically investigated the dependence of estimated strain-rate fields on *L*.

The result shows that the width and peak of the strain concentration zone across the Arima-Takatsuki fault zone are almost the same for $L <= 40$ km. On the other hand, for $L >= 50$ km, the width becomes larger and the peak becomes smaller for larger *L*; the width of the strain concentration zone is roughly proportional to *L*. The same feature was also observed for the Niigata-Kobe Tectonic Zone.

Keywords: Strain-rate field, Basis function, Strain concentration zone