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Crustal strain-rate fields estimated from GNSS data with a Bayesian approach and its correlation to seismic activity

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We proposed a new Bayesian approach to estimate continuous crustal strain-rate fields from spatially discrete displacement-rate data, based on Global Navigation Satellite System (GNSS) observations, under the prior constraint on spatial flatness of the strain-rate fields. The optimal values of the hyperparameters in the model of strain-rate fields are determined by using Akaike's Bayesian Information Criterion. A methodological merit of this approach is that, by introducing a two-layer Delaunay tessellation technique, the time-consuming computation of strain rates can be omitted through the model estimation process. We applied the Bayesian approach to GNSS displacement-rate data in Mainland China and examined the correlation between the estimated strain-rate fields and seismic activity by using Molchan's Error Diagram. The results show that the increase rate of maximum shear strain is positively correlated with the occurrence of earthquakes, indicating the strain rate can be used to augment probability earthquake models for background seismicity forecasting.