

Bayesian merging of earthquake catalogs from multiple sources

*Jiancang ZHUANG¹, Zhengya Si²

1. The Institute of Statistical Mathematics, 2. Beijing Earthquake Agency

For the same earthquake, different seismic networks may give different solutions for its time, location, and magnitude. In particular, the differences in the estimated magnitudes are large due to many factors including correction of site responses, determination methods, and operation modes. Therefore, earthquake catalogs that are compiled by different networks cannot be merged into one by some simple operations. To solve this problem, we propose a Bayesian algorithm to solve this problem. By assuming that an observed magnitude follows a Gaussian distribution, with a mean of its unknown true value and a certain variance, both of which are dependent on the network and that the true magnitude follows a uniform trivial prior, we derive the posterior probability density of the true magnitude, based on the framework of Bayesian inversion. We use this method to merge the earthquake catalog recorded by a local temporary seismic network into the standard CENC catalog and to combine several Italian catalogs. The proposed method is fast and improves the stability and accuracy of the estimated magnitudes. The key point of this technique is making use of the consistency in magnitudes recorded by each network.

Figure 1: Revised magnitudes for the INGV ISIDe catalog (IV) and the Regional Seismic Network of North Western Italy catalog (GU).