Nowcasting Earthquakes in Sulawesi Island, Indonesia

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Large devastating events such as earthquakes often display frequency-magnitude statistics that exhibit power-law distribution. In this study, our objective is to implement a new technique of nowcasting (Rundle et al. 2016) to evaluate the present state of earthquake hazards in the seismic prone Sulawesi province, Indonesia. The nowcasting technique considers statistical behavior of small event counts, known as natural times, to infer the seismic progression of large earthquake cycles in a defined region. To develop natural time statistics in Sulawesi island, we employ eight probability distributions: Brownian passage time (inverse Gaussian), exponential, exponentiated exponential, gamma, inverse Weibull, lognormal, Pareto and Weibull. Statistical inference of natural times reveals that (i) exponentiated exponential distribution has the best representation to the observed data, (ii) estimated nowcast scores (%) corresponding to M>=6.5 events in the 300 km circular city regions around Palu, Makassar, Manado, Kendari, Bitung, Gorontalo, Palopo, Bau-bau, Luwuk, Toli-toli, Pare-pare, Poso, Bone, Kolaka, Buton, Watampone, Polewali, Donggala, Taliabu, Mamuju, and Morowali reach about 71, 60, 22, 34, 22, 43, 35, 54, 48, 66, 84, 43, 56, 36, 53, 67, 72, 71, 48, 67 and 39, respectively, and (iii) the results are broadly consistent to the changes of magnitude thresholds and area of local regions. Therefore, the present nowcasting analysis, as an alternative to the traditional earthquake hazard assessment techniques, offers a simple yet versatile metric to the scientists, engineers and policymakers to examine the present state of earthquake hazards in the thickly populated Sulawesi island.

Keywords: Natural times, Nowcast scores, Sulawesi island, Probability models

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