Constraining the focal mechanism of the 2015 Gorkha earthquake by using the continuous gravity observations

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The amplitudes of the Earth’s free oscillations have a close relationship to earthquake focal mechanisms. Focal mechanisms of large earthquakes can be well analyzed and constrained with observations of long period free oscillations.On 25 April 2015, a magnitude Ms 8.1 interplate thrust earthquake ruptured a densely instrumented region of Gorkha. After Earthquake, the focal mechanism solutions of Gorkha earthquake were provided by well-respected international earthquake research institutions based on different data and methods, which were different. We compared free oscillations observed by 18 spring gravimeters of continuous gravity stations with synthetic normal modes corresponding to 3 different focal mechanisms for the Gorkha earthquake, and the focal mechanisms solutions of Gorkha earthquake were analyzed and constrained by spherical normal modes in a 2 to 5 mHz frequency band. Based on the best focal mechanisms solution, the accurate magnitude was searched. The results show that the focal mechanism of Gorkha earthquake can be estimated by spherical modes in the 2 to 5 mHz frequency band. The synthetic modes corresponding to the focal mechanism determined by the Gcmt Moment Tensor Solution showed agreement to the observed modes, the average of misfit factors *F* was 0.03, and the average of scaling factors was 1.04, which was closest to 1, suggesting that earthquake magnitudes predicted in this way can reflect the total energy released by the earthquake. Based on the focal mechanisms solution provided by Gcmt, keeping the strike, dip, slip, depth constant, adjusting the scalar moment, the real scalar moment was searched. When the average of scaling factors was 1, the average of misfit factors *F* was only 0.03. After calculation, the scalar moment of Gorkha earthquake was 8.09×10^{20} Nm, and the corresponding magnitude was Mw7.91.

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