D006-002 Room: 303 Time: May 29 9:12-9:24

On Truncated Co-seismic Geoid and Gravity Changes

Wenke Sun[1], Shuhei Okubo[2]

[1] ERI, Univ Tokyo, [2] Earthquake Res. Inst. , Univ. Tokyo

A number of dedicated satellite missions, i.e., CHAMP, GRACE and GOCE, is and will be available for gravity field determination from space. They will provide an unprecedented accuracy, global and high-resolution estimates of the constant and time-variable part of the earth's gravity field. It can be expected that almost all time change problems in geosciences can be detected and well studied in the near future. The temporal gravity variations causing a global signature is usually considered to result from atmospheric mass redistribution, ocean circulation, sea level changes due to polar ice melting or aggregation, and the visco-elastic response of the Earth's lithosphere to past and present loads. However, another potential application of the gravity missions is that they provide us with powerful means to detect gravity and geoid changes caused by earthquake, which have never been detected up to the present. A case study of 1964 Alaska earthquake (Sun and Okubo, 1998) indicated that the gravity change could be detected on the earth surface by super-conducting gravimeter even as far as 5,000 km away. A geoid height change due to the earthquake could reach at 1.5 cm. Such gravity and geoid height changes are expected to be detectable by modern space techniques, like Altimetry and gravity missions. However, due to the limit spatial resolution of the gravity satellite missions, co-seismic deformations must calculated with a truncation of the harmonic degrees, i.e., the contribution of higher degree part then the resolution of the space missions should be removed out. This requires a corresponding investigation for individual or group wavelength, i.e., a theoretical work and simulation on truncated co-seismic deformation is necessary. This purpose can be approached by the dislocation theory (Sun and Okubo, 1993) for a spherical model since it is expressed in spherical harmonics. For this purpose, in this research, a concept of truncated co-seismic geoid and gravity changes is proposed and corresponding expressions are presented to compute co-seismic geoid and gravity changes for spherical harmonic degree within the spatial resolution of the gravity satellite missions. So that numerical results of any individual harmonic degree or summation to an interested degree can be used to compare with the precession of the gravity missions, to investigate whether the co-seismic gravity and geoid changes are detectable. A numerical computation of truncated co-seismic gravity and geoid changes is performed for a source equivalent to the fault size of the Alaska earthquake (1964, mw=9.2). Results indicate that both gravity and geoid changes are about two orders larger than the precession of the gravity missions. It implies that co-seismic deformations caused by a smaller earthquake are still detectable.