Post-seismic gravity change modelling based on spectral finite element method

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Simulation of gravity change in post-seismic condition serves as an explanation for gravimetry data acquired from space and land. Recent development of space gravimetry technology, which includes the application of GRACE and GRACE-FO satellites, provides a new source of data in the research of post-seismic problems. This would help us understand more about what may happen after a major earthquake strikes. Some reports show that the rise of sea level after an earthquake, which is linked to post-seismic change, could be a great threat for island countries close to seismic active zones. If we could improve the estimation of the rate of displacement of the land after an earthquake in decades, it would be very helpful for disaster prevention and risk estimation.

Former research presented several ways of calculating the gravity change in post-seismic stage. However, many methods only consider of the change caused by visco-elastic deformation. The other two main mechanisms: after-slip and poroelasticity is not well included. To serve for further discussion of the mechanisms behind the post-seismic gravity change, we attempt to develop a way of unified explanation containing all three mechanisms. This unified model would be a flexible tool for use in the post-seismic gravity change explanation.

Here, we present examples of post-seismic gravity change modelling based on the spectral finite element method (FEM). Our work mostly covers the interpretation of gravity change after the 2011 M9.0 Tohoku-oki earthquake and 2010 M8.8 Chile Maule earthquake. A new program was written for the application of the method. It could serve as a tool for future interpretation of GRACE-FO mission recorded gravity changes after major earthquakes. Still, it could provide another way of explaining the observation of ground displacement recorded by the GPS network.

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