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Earthquake monitoring with Superconducting Gravimeters and Seismometers – Looking for Rayleigh waves

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It is a common fact that earthquakes generate surface waves that can cause a big damage in a region. These waves, known as Rayleigh and Love waves, can be measured with different instruments such as gravimeter or seismometer, and likewise analysed in view of understanding the nature of earthquakes and the determination of the Earth's properties. The main focus of this study is the identification of recurring Rayleigh waves after an earthquake. Induced by an earthquake, two waves can reach a station. One wave travels from the earthquake epicentre to the station by the shortest, direct way and the second one arrives at the station from the other side taking the longer way around the globe. As both waves do not end at the station, they can travel several times around the Earth and thus can come back to the station for more than one time. The number of such cycles depends on the amplitude of the waves and therefore on the magnitude of the earthquake. The amplitude decreases with every cycle around the Earth. Both the gravimeter and the seismometer will be analysed to see if there are differences in the observations after an earthquake, e.g. different amplitudes of Rayleigh waves.
For this analysis data from the observatories Moxa (Germany), MunGyung (Korea) and Sutherland (South Africa) are chosen, and in addition three large earthquakes: the Peru earthquake at August, 15th, 2007, with a moment magnitude of 8.0, the Sumatra earthquake at September 12th, 2007, with a moment magnitude of 8.5, and the Sichuan earthquake at May 15th, 2008, with a moment magnitude of 7.9. All stations are equipped with superconducting gravimeters (SG) and seismometers.
For the station MunGyung a second analysis is done for a time span in October 2007. Fortunately, four different instruments (a superconducting and an absolute gravimeter, a borehole seismometer and a borehole accelerometer) measured three earthquakes with moment magnitudes between 5.3 and 6.0 near Korea from October 7th to 10th, 2007. This gives us the unique opportunity to compare these four instruments in the earthquake analysis.
The analysis shows that SGs have some advantages compared to seismometers for the observation of recurring Rayleigh waves. We can clearly identify more than two Rayleigh waves in each observation of a seismometer and SG, but additionally two more waves in the SG records. The Rayleigh waves are compared to theoretical data for different earth models, which allows an evaluation of these models. The investigation yields information that can be used to study and understand crustal seismic velocities, attenuation, and dispersion.