



Check of Main Fracture Characteristics of the Wenchuan 8.0Ms Earthquake with EFO Modes Recorded by Three Superconducting Gravimeters

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There was a large earthquake 8.0 Ms suddenly happened in the Wenchuan area of the Sichuan Province in China on May 12, 2008, which was one of the largest nature hazards in China in recent thirty years and resulted in the death of about seventy thousands of people. The effective rescue work needed to know the real position of the heavy disaster areas. As the geological structure is very complex in the area of the earthquake faults and the effect of possible multi-resolution problem, it was difficult to quickly determine the main fracture zones of the large earthquake with the seismic data of high-frequency P and S waves. Considering that the earthquake sources excited the Earth's free oscillations (EFO), we attempted to investigate the main fracture characteristics of the Wenchuan earthquake with the EFO modes recorded by the GGP superconducting gravimeters (SG).

There was a distance of about 1242 km between the start epicenter of Wenchuan earthquake [U+FF08] 30.94°N, 103.47°E [U+FF09] and the Wuhan SG station, which did not arrive at the near-earthquake condition for the P and S wave observation but satisfied the condition for the check of EFO modes. After the correction of gravity tides and atmospheric pressure, we gained the EFO data coming from the Wuhan SG station. The spectral peaks of EFO modes were obtained by applying the FFT technique to the EFO data. The spectral signals were very strong for the mid-class normal modes from 0S20 to 0S30 and we accurately investigated the frequencies and qualities of the mid-class modes, which were basically according to the predictions provided by PREM model.

The epicenter of Wenchuan earthquake was an exciting pole for the Earth's free oscillations. If a station was located in the wave ridge of an EFO mode namely the epicentral distance of $N+1/4$ or $N+3/4$ multiple of wave length, the EFO mode would have the higher peak than other modes nearby. It was noticed that both 0S22 and 0S28 modes had this kind of phenomena at Wuhan station, which hinted the Earth's free oscillations were excited by two branch sources of Wenchuan earthquake. We estimated the distance between the two branch earthquake sources about 120 km, which was close to the observation result published by USGS.

At the same time, we analyzed the observation SG data from a station in Japan and a station in Taiwan island to validate the two branch source excitation of the Earth's free oscillations and it directly reflected the main fracture characteristics of the Wenchuan earthquake.

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