Postseismic streamflow changes after the 2016 Kumamoto earthquake

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It has been well known that large earthquakes sometimes cause hydrological changes widely in and around the region of strong ground motion. In several cases of those changes, stream flow and spring flow increases in lowland and water table drops in highland. It has often been explained by permeability enhancement in the region of strong ground motion (Rojstaczer et al. ,1995; Wang and Manga, 2004). Since Japan is relatively rich in water resources, people may have not paid much attention to these earthquake-related hydrological changes. But those hydrological changes are clearly one of the seismic risks and should also be examined in Japan because those changes sometimes continue for a period of several months to years (Rojstaczer et al. ,1995) .

The 2016 Kumamoto Earthquake, which occurred mainly in Kumamoto Prefecture, Japan in April 2016, caused severe damages in and around Kumamoto Prefecture. It also caused many changes in stream water and groundwater (Ichiyanagi and Ando, 2017; Sato et al., 2017). The region of strong ground motion of the main shock spreads from the coastal plain to the Aso caldera.

We analyzed the data of streamflow at fourteen flow rate observation stations of three major rivers in Kumamoto prefecture during the period from 1990s to 2017. After the 2016 Kumamoto earthquake, streamflow was increased at four of the fourteen observation stations, where the rivers flow from the Aso caldera or the foot of Mt.Aso. However the streamflow was not increased just after the 2016 Kumamoto earthquake. It was increased 2 months after the Kumamoto earthquake, when a heavy rainfall occurred. In addition it is found that (flood frow rate/precipitation amount) ratio tends to be increased when the precipitation amount is large after the 2016 Kumamoto earthquake. This can be explained not by permeability enhancement but by decrease of the soil moisture retention capacity. In and around the region of the strong ground motion of the 2016 Kumamoto earthquake there were many mudslides and landslides, which could reduce the soil moisture retention capacity. The earthquake-related decrease of the soil moisture retention capacity could have caused the streamflow increase in and around the region of the strong ground motion of the 2016 Kumamoto earthquake.

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