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Space Weather and Earthquakes: A Case Study of Solar Flare X9.3 Class on September 6, 2017

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Abstract : The studies completed to-date on a relation of the Earth's seismicity and solar processes provide the fuzzy and contradictory results. For verification of an idea that solar flares can trigger earthquakes, we have analyzed a case of a powerful surge of solar flash activity early in September 2017 during approaching the minimum of 24th solar cycle was accompanied by significant disturbances of space weather. On September 6, 2017, a group of sunspots AR2673 generated a large solar flare of X9.3 class, the strongest flare over the past twelve years. Its explosion produced a coronal mass ejection partially directed towards the Earth. We carried out a statistical analysis of the catalogs of earthquakes USGS and EMSC for determination of the effect of solar flares on global seismic activity. New evidence of earthquake triggering due to the Sun-Earth interaction has been demonstrated by simple comparison of behavior of Earth's seismicity before and after the strong solar flare. The global number of earthquakes with magnitude of 2.5 to 5.5 within 11 days after the solar flare has increased by 30 to 100%. A possibility of electric/electromagnetic triggering of earthquake due to space weather disturbances is supported by results of field and laboratory studies, where the earthquakes (both natural and laboratory) were initiated by injection of electrical current into the Earth crust. For the specific case of artificial electric earthquake triggering the current density at a depth of earthquake, sources are comparable with estimations of a density of telluric currents induced by variation of space weather conditions due to solar flares. Acknowledgment: The work was supported by RFBR grant No. 18-05-00255.
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