Influence of rainfalls on the Earth's surface movements

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Deviations of the vertical crustal movements measured by the broadband seismic stations from the Earth's tides predicted by theory are calculated. The deviations are compared with meteorological data at station sites. To do this, we selected the seismic stations in the North America located near meteorological stations. We analyzed only the intervals where no one-second seismological data value was missing. The changes in surface displacements relative to tidal amplitudes under rainfalls are established. The amplitude of the changes reached 50 % of the tidal daily variations. The duration of the changes was one to two days. The physics of the formation of displacement anomalies induced by meteorological conditions can be described by the following hypothetical scheme. Sometimes, the dynamic processes in the atmosphere generate a pressure low at the station location. This causes movements of the ground surface, changes the structure of the pore space, and increases the permeability of the subsurface rock layers. The arrival of clouds from the neighboring regions causes rain. Penetration of water into the pore space and wetting of a wide range of minerals causes the Rehbinder effect. The growth of the new cracks and the increase in surface displacement is the consequence. It is not the intensity of pressure low and not the amount of precipitation that determine the amplitude of the anomalous fluctuations. The depth of the precipitation layer in the cases analyzed in this study was about 20 mm, whereas the total amplitude of tidal changes reached the hundreds of mm. This phenomenon is hypothetically explained by loss of rock strength, increasing of brittleness and cracks development owing to Rehbinder effect. The rain played the role of a trigger releasing the energy accumulated in the Earth.