Patterns of Seasonal Seismicity in the Koyna-Warna Area: Field Data and Laboratory Experiments

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Based on the analysis of the catalog of earthquakes in the Koina-Warna RTS region in Western India over the entire history of seismological observations in this region, seasonal components of seismic activity associated with annual oscillations in the water level in reservoirs have been identified, and features of the spatiotemporal dynamics of these components have been found. Seasonal oscillations in seismic activity associated with annual variations in the water level in reservoirs demonstrate local maxima within a year, which correspond to the mechanisms of immediate and delayed response of reservoir seismicity. To explain them, a hypothesis was put forward about the difference in fluid diffusion rates at different stages of the evolution of seasonal seismicity. Within the annual cycle of seismicity variations, regular changes in the GR b-value are revealed and assumptions are made about their nature. The nature of the change in seismic activity, together with b-value variations, indicates the implementation of the scenario of the redistribution of the fracture process from lower to higher scale levels. To test the hypotheses and assumptions put forward based on the results of field data analysis, laboratory studies of the features of fluid initiation of fracture in rocks (including cores from wells in the Koyna-Warna area) were carried out. The difference between the delays in the activation of acoustic emission during the injection of fluid into dry samples and with an increase in pore pressure in fluid-saturated samples was revealed, and the reasons for the differences were considered. With smooth changes in the pore pressure of the fluid in saturated samples, regularities in the change in the acoustic regime were found, similar to those found in the seasonal seismicity of Koina-Warna. The laboratory results thus support the conclusions of field studies of trigger seismicity.

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