



Do the Earth's rotation velocity decelerations lead to volcanic activation?

Boris Levin (1,2), Elena Sasorova (1), Vjacheslav Gurianov (2), Aleksandr Rybin (2), and Vladimir Yarmoljuk (3)
(1) Shirshov Institute of Oceanology RAS, Tsunami Laboratory, Moscow, Russian Federation (sasorova_lena@mail.ru), (2) Institute of Marine Geology and Geophysics, FEB RAS, Yuzhno-Sakhalinsk, Russia (levinbw@mail.ru), (3) Institute of Geology of Ore Deposit, Petrology, Mineralogy and Geochemistry (IGEM) RAS, Moscow.

A comparative analysis of time series of the density of seismic events and variations in angular velocity of the Earth's rotation (AVER) during period from 1720 to 2017 previously showed that each stage of deceleration of the AVER (braking stage) is accompanied by an increase in the density of seismic events [Levin and Sasorova, 2015]. It is suggested that the effect of deceleration of the Earth's rotation should lead to an intensification of various geophysical processes. The main attention of this work focuses on the comparative analysis of the global volcanic activity and variations in the AVER during period from 1720 to 2017. The analysis of the volcanic activity based on the Smithsonian Institute (USA) [http://volcano.si.edu/gvp_about.cfm] and its Catalog of Volcanoes for the observation period 1720 - 2017. We used information about volcanic eruptions with a Volcanic Explosivity Index $VEI \geq 4$ (the volume of tephra $\geq 0.1 \text{ km}^3$). To analyze the variations in the Earth's rotation velocity, two data sources were adapted. The first source contains daily observations of variations in angular velocity from 1962 to the present, collected by the agency International Earth Rotation Service [IERS]. The second source [McCarthy, and Babcock, 1986] collected data for the period 1657-1984 (one observation per six months). The period from 1657 to 1720 is characterized by annual and one and a half year observation gaps; thus, to prepare the working catalogue, we used the period from 1720. Then, a combined catalog was compiled on variations in the rotation velocity of the earth for the period from 1720 to the present. Data for the period from 1962 were averaged over the semiannual intervals (averaging error less than 5%).

The time series of volcanic eruptions were processed by averaging the VEI values over a fixed time interval (moving average method). A smoothed time series is a curve containing clear expressed local maxima and minima. Local maximums of volcanic activity according to this time series are observed in following intervals: 1810-1820, 1845-1855, 1870-1880, 1900-1915, 1925-1935, 1945-1955, and 1975-1985. According to the comparative analysis of two time series, the local maxima of volcanic activity correspond to the braking stages of the AVER. It should be noted that the most significant braking of both seismic and volcanic activity is observed at the beginning of the 20th century in the period 1900-1915, in accordance with the most powerful period of deceleration of the AVER for the entire observation period (since 1720). From the second half of 2013, the angular velocity of the Earth's rotation decreases. Thus, at present the Earth enters the initial phase of a new braking stage. According to our results, a new braking stage can lead to increase volcanic activity, which is confirmed by recent events.

The work was carried out at the Institute of Marine Geology and Geophysics, Far East Branch of RAS, Yuzhno-Sakhalinsk, the Shirshov Institute of Oceanology of RAS, Moscow, and the Institute of Geology of Ore Deposits, Petrology, Mineralogy and Geochemistry (IGEM) RAS, Moscow.