A thermal anomaly as a precursor for predictions of strong explosive volcanic eruptions

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Study of eruptions precursors in order to reduce a volcanic risk for the population is an urgent problem of Volcanology. Kamchatka is home to thirty active volcanoes. Five of them are producing paroxysmal explosive events: Klyuchevskoy, Molodoy Sheveluch, Bezymianny, Kizimen, Karymsky. In average one strong explosive eruption occur here every year. The papers on satellite monitoring of the 1997 and 1998 Bezymianny eruptions by Dehn and Schneider and the others, 2000, are one of the first works in which variations of temperature and size of a thermal anomaly in the volcano are considered to be operative precursor of explosive eruption. The experience of KVERT scientists on satellite monitoring of Kamchatka volcanoes proved this precursor to be effective also for volcanoes with different composition of erupted products. This precursor is based on the classical definition of the term volcanic eruption: an eruption is a process when a magma matter reaches the Earth surface. Both size and temperature of the anomaly are linearly associated with the amount of juvenile material which comes on the Earth surface at the moment of the anomaly detection in satellite image. Thermal anomaly which appears in a volcanic area evidences on warning signs of explosive eruption or that explosive event is likely in the nearest future. Hazard that poses such eruption to people and environment depends on composition of magma matter of the volcano. A thermal anomaly over Klyuchevskoy was for the first time revealed eight days in 2005 eruption, the crater was filled with cinder material, and two months in 2007 eruption, the crater was empty, prior to Strombolian eruption. There demonstrate that in any case a thermal anomaly over the volcano evidences that the volcano is likely to start explosive eruption soon. Since March 1956, the lava dome continuously growing in Bezymianny crater. Activity of the volcano between explosive eruptions is very weak, though slow extrusion of lava flows on the dome flank is observed, and a weak thermal anomaly is detected in satellite images. When a preparation of Bezymianny explosive eruption is starting, a size and temperature of anomaly over the dome began to increasing very quickly. Thanks to monitoring of variations of size and temperature of the anomaly, from 2001 till 2012 KVERT predicted 10 explosive eruptions of this volcano. Published in Internet VONA/KVERT Releases (http://www.kscnet.ru/ivs/kvert), containing warning of impending strong eruption before the eruptions realize forecasts in real time.