SIGNALS RECORDED BY DEMETER SATELLITE OVER ACTIVE VOLCANOES DURING THE PERIOD SEPTEMBER 2004 – DECEMBER 2006

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On land more and more reliable observations show unambiguous signals before volcanic eruptions. In electromagnetism, many land observations outline resistivity changes, long time evolution of the magnetic field, transient magnetic and electric signals before volcanic outbursts. But, only some tens of volcanoes in the world are monitored by complex geophysical equipments, while a hundreds of volcanoes remain without any adequate observations and monitoring systems. Multi-platform satellites could partly contribute to the mitigation of volcanic risks and trap some of the pre-eruptive signals, even if the data sampling between consecutive orbits over a volcano is of some hours or more. Since June 2004, the micro-satellite Demeter, launched by CNES (French National Space Agency) records over the Earth several parameters (electrons (ISL) and plasma (IAP) temperature and density), along with the magnetic and electric fields. The objective of this study is to analyze Demeter data around the time of volcanic eruptions over several years. Therefore, a database was built as follow: (1) the period under study starts in September 2004 when DEMETER is fully in operation and ends in December 2007, (2) only volcanoes located between latitudes -55° and +55°N are taken into account, (3) volcanoes characterized by a Volcanic Explosivity Index VEI ≥ 1 are considered, independently of their location and eruptive behaviour, (4) the database is shaped by observations from downwards (north to south) and upwards (south to north) orbits, from 30 days before the eruption to 15 days after, and (4) for any orbit data are analysed if the maximum distance between the footprint of the satellite and the volcano under study is 500 km for VEI < 3 and 900 km for VEI ≥ 3.
74 volcanic eruptions have respected the above criteria, which represents the analysis of about 6600 orbits. They concern 50 volcanoes. 30 eruptions are accompanied by anomalies during the time window starting 30 days before the eruption and ending 15 days after. It means that 41% of the considered eruptions are accompanied by anomalies recorded by Demeter satellite. In total, 48 anomalies are found and classified in three types. 81% of the anomalies are observed before the eruptions. For most of the eruptions only one type of anomaly is recorded, and anomalies seem to appear independently of the characteristics of the volcano (i.e. dynamism, VEI index, location, regional setting). It is still rather difficult to find any correlation between the characteristics of the anomalies (i.e. amplitude, duration, and frequency content) and the strength of the future activity. Nevertheless, one can noticed that the number of anomalies is at most 3 for 4 volcanoes, the VEI of which is ≥ 2 (Lascar, VEI=3; Lopevi, VEI=2; Kartala, VEI=2; Fernandina, VEI=2).

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