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## VAPOR a novel radar system for improving the ash dispersal forecasting at Etna volcano

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The modeling of the volcanic plumes needs to know accurately and timely the Mass Discharge Rate (MDR) and Particle Size Distribution (PSD) of the pyroclastic material that, during an explosive eruption, is able to rise from the volcanic vent up to the stratosphere and then is dispersed by wind from tens to thousand kilometers far from the volcano. MDR and PSD are key parameters for initializing ash dispersal models, as well as an accurate wind distribution, to simulate the time-space trend of the volcanic cloud, which contaminating the atmosphere may disturb seriously the air traffic. Up today, the direct measurement of volcanic and atmospheric parameters during an eruption is not easy to achieve. Etna volcano made more than 200 ash-plume forming eruptions in the last 35 years, which caused several problems to the operations of nearest airports and airspace. This fact represents at the same time a problem and a resource for improving the observation and prediction system of volcanic plumes. Compared to other remote sensing techniques able to detect only the outer cloud surface, radars can probe the inside plume for 3D measuring of MDR and PSD. A novel radar system, named VAPOR (Volcanic Ash and Plume Observation by Radar), is now operative on Etna volcano, offering better sensitivity than weather radars and a capability to measure plumes in optimal view conditions. It consists of two devices, a Doppler-radar at S-band located near the summit vents, and a transportable polarimetric radar at X-band to observe the plume from different sites on the volcano slopes. During first tests have achieved very good results and are promising to integrate them in the forecasting system of Etna's ash cloud dispersal, aimed mainly to improve the aviation safety in the region.