The Use of High-Resolution Pléiades Images to Extract Volcanic-Cloud Top Heights and Plume Elevation Models: examples on Mount Etna (Italy) and Mount Ontake (Japan)

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Accurate and spatially-detailed knowledge of Volcanic Cloud Top Height (VCTH) and velocity is crucial in volcanology. As an example, the ash/gas dispersion in the atmosphere, their impact and lifetime around the globe, greatly depends on the injection altitude. The VCTH is critical for ash dispersion modelling and air traffic security. Furthermore, the volcanic plume height during explosive volcanism is the primary parameter for estimating mass eruption rate. Satellite remote sensing offers a comprehensive and safe way to estimate VCTH. Recently, it has been shown that high spatial resolution optical imagery from Landsat-8 OLI sensor can be used to extract Volcanic Cloud Top Height with a precision of 250 meters and an accuracy or ∼300m (de Michele et al., 2016). This method allows to extract a Plume Elevation Model (PEM) by jointly measuring the parallax between two optical bands acquired with a time lag varying from 0.1 to 2.5 seconds depending on the bands chosen and the sensors employed. The measure of the parallax is biased because the volcanic cloud is moving between the two images acquisitions, even if the time lag is short. The precision of our measurements is enhanced by compensating the parallax by measuring the velocity of the volcanic cloud in the perpendicular-to-epipolar direction (which is height independent) and correcting the initial parallax measurement. In this study, we push this methodology forward. We apply it to the very high spatial resolution Pleiades data (1m pixel spacing) provided by the French Space Agency (CNES). We apply the method on Mount Etna, during the 05 September 2015 eruptive episode and on Mount Ontake eruption occurring on 30 September 2014. We are able to extract VCTH as a PEM with high spatial resolution and improved precision. Since Pléiades has an improved revisit time (1day), our method has potential for routine monitoring of volcanic plumes in clear sky conditions and when the VCTH is higher than meteo clouds.