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### **Extracting the Volcanic Ash Plume Elevation Model (PEM) from Landsat-8. Application to the 2014 Holuhraun (Iceland) Eruption**

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In this paper we introduce a method to reconstitute the volcanic gas/ash Plume Elevation Model (PEM) from optical satellite imagery. As the volcanic plume is moving rapidly, conventional satellite based photogrammetric height restitution methods do not apply as the epipolar offset due to plume motion adds up to the one generated by the stereoscopic view. This is because there are time-lags of tens of seconds between conventional satellite stereoscopic acquisitions, depending on the stereo acquisition mode. Our method is based on a single satellite pass. We exploit the short time lag and resulting baseline that exist between the multispectral (MS) and the panchromatic (PAN) bands to jointly measure the epipolar offsets and the perpendicular to the epipolar (P2E) offsets. The first are proportional to plume height plus the offsets due to plume velocity in the epipolar direction. The second, are proportional to plume velocity in the P2E direction only. The latter is used to compensate the effect of plume velocity in the stereoscopic offsets by projecting it on the epipolar direction assuming a known plume direction, thus improving the height measurement precision. We apply the method to Landsat 8 data taking into account the specificities of the focal plane modules. We focus on the Holuhraun 2014 fissure eruption (Iceland). We validate our measurements against ground based measurements. The method has potential for detailed high resolution routine measurements of volcanic plume height/velocity. The method can be applied both to other multi focal plane modules push broom sensors (such as the ESA Sentinel 2) and potentially to other push-broom systems such as the CNES SPOT family and Pléiades.