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Determination of physical parameters of volcanic ashes during intense eruptions using IASI

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During a volcanic eruption, a huge amount of aerosols are emitted into the atmosphere which can be transported over long distances. By absorbing and scattering radiation, volcanic ashes influence strongly the Earth radiative budget. These particles may also affect human health and for some intense events may perturb or interrupt air traffic.

These interruptions are mainly due to a poor knowledge of optical, chemical and physical properties of volcanic ashes. Recent work1 showed the potential of using hyperspectral infrared spectrometer to detect and quantify volcanic ashes contained in the plume especially using IASI (Infrared Atmospheric Sounding Interferometer). However, in order to fully exploit IASI's spectra, a perfect knowledge of complex refractive index (CRI) of ashes is required.

In that purpose, a new methodology2,3 based on laboratory measurements of volcanic ashes in suspension coupled with an optimal estimation method has been developed. This approach allow to get access to CRI of several volcanic ash samples with various chemical compositions.

These specific CRI has been successfully used to retrieve physical parameters (effective radius and concentration) from two intense volcanic eruptions: Puyehue Cordon Caulle (Chile) and Grimsvötn (Iceland). A comparison with other studies4,5, using other CRI, has been performed and show a significant impact of CRI on physical parameters retrieved.

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