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Extremely fast retrieval of volcanic SO2 layer heights from UV satellite data using inverse learning machines

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Precise knowledge of the location and height of the volcanic sulfur dioxide (SO_2) plume is essential for accurate determination of SO_2 emitted by volcanic eruptions, however so far not available in operational near-real time UV satellite retrievals. The FP_ILM algorithm (Full-Physics Inverse Learning Machine) enables for the first time to extract the SO_2 layer height information in a matter of seconds for current UV satellites and is thus applicable in NRT environments.

The FP_ILM combines a principal component analysis (PCA) and a neural network approach (NN) to extract the information about the volcanic SO_2 layer height from high-resolution UV satellite backscatter measurements. So far, UV based SO_2 layer height retrieval algorithms were very time-consuming and therefore not suitable for near-real-time applications like aviation control, although the SO_2 LH is essential for accurate determination of SO_2 emitted by volcanic eruptions.

In this presentation, we will present the latest FP_ILM algorithm improvements and show results of recent volcanic eruptions.

The SO_2 layer height product for Sentinel-5p/TROPOMI is developed in the framework of the SO_2 Layer Height (S5P+I: SO_2 LH) project, which is part of ESA Sentinel-5p+ Innovation project (S5P+I). The S5P+I project aims to develop novel scientific and operational products to exploit the potential of the S5P/TROPOMI capabilities. The S5P+I: SO_2 LH project is dedicated to the generation of an SO_2 LH product and its extensive verification with collocated ground- and space-born measurements.