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# Applying inverse learning machines to TROPOMI $SO_2$ data: first results of $SO_2$ plume height retrieval

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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. Current UV based $SO_2$ plume height retrieval algorithms are very time-consuming and therefore not suitable for near-real-time applications. Here we present a novel method called the Full-Physics Inverse Learning Machine (FP-ILM) algorithm for extremely fast and accurate retrieval of the $SO_2$ plume and apply it to the pre-operational Sentinel-5 Precursor (S5P). S5P was launched on October 13, 2017 carrying the TROPOspheric Monitoring Instrument (TROPOMI), which has a spatial resolution of 7x3.5 $km^2$, hence providing an unprecedented level of details.

In this presentation, we introduce the FP-ILM algorithm, which is based on dimensionality reduction techniques and machine learning. We show the first results obtained with the FP-ILM algorithm applied to a selection of volcanic $SO_2$ eruptions detected by TROPOMI and compare them to other plume height datasets available. The sensitivity of the plume height retrieval to various parameters is analyzed as well.