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Timescales of aerosol formation and depletion: a case study for the Kilauea volcano

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Satellite observations of atmospheric trace gases have revolutionized our insights regarding the location and amount of various pollutants. In addition, it has been demonstrated recently that atmospheric lifetimes can be derived by analyzing the downwind decay of the pollution plumes from point sources.
Here we present an analysis of the downwind evolution of the SO_2 (GOME-2) and the aerosol (MODIS) plume from the Kilauea volcano (Hawaii) during a period of strongly enhanced passive degassing in March-October 2008. The SO_2 and AOD patterns observed from space and the wind fields according to ECMWF stay rather stable over several months, making this an ideal case for such kind of process study.
Using a relatively simple mathematical analysis, an e-folding lifetime of SO_2 and the total release of SO_2 can be estimated simultaneously on the basis of monthly mean SO_2 maps and wind fields. We estimate the lifetime of volcanic SO_2 from Kilauea to be about 1-2 days.
By assuming first order time constants for both the AOD formation and depletion, the observed downwind pattern of AOD can be described, and the AOD formation can be clearly related to the SO_2 depletion. For the aerosol depletion, a time-constant of 2-6 days was estimated.