Geophysical Research Abstracts
Vol. 14, EGU2012-10408, 2012
EGU General Assembly 2012
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Estimating the lifetime of SO_2 from space: A case study of 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 point sources.

Here we present an analysis of the downwind evolution of the SO_2 plume from the Kilauea volcano (Hawaii) in 2008. Both the SO_2-patterns observed from space (GOME-2) and the wind fields according to ECMWF stay rather stable over several months, making this an ideal case for lifetime determination. 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 to be about 2-3 days. The potential and the limitations of our approach are discussed, and the consequences for the OH concentrations and the chemistry occurring within the volcanic plume are investigated.