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An in-depth investigation of the life cycle of sulfate from the Kilauea volcano using satellite observations and EMAC model calculations

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The Kilauea volcano (Hawaii), currently perhaps the most active volcano on Earth, has been continuously erupting since the beginning of 1983. A pronounced degassing phase in March-November 2008 caused the formation of an extensive SO_2 plume, which in turn led to the formation of sulfate aerosols. The steady trade winds and lack of interfering sources previously allowed us to determine the life time of SO_2 using only satellite-based measurements (no a priori or model information). The current investigation is focused on improving our understanding of the processes contributing to sulfate aerosol formation, processing, and loss. We use space-based aerosol measurements by MODIS, MISR, and CALIOP to characterize the aerosols (amount, size, altitude) and study the evolution of aerosol optical depth as a function of distance from the volcano to determine formation and loss rates. The outcome is compared to results from calculations using the EMAC (ECHAM/MESSy Atmospheric Chemistry) model to test the state of understanding of the sulfate aerosol life cycle.