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The use of satellite-based remote sensing to quantify the contribution of volcanoes to the global SO_2 budget

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Volcanic degassing is a major contributor to the global sulphur dioxide (SO_2) budget, characterised by permanent quiescent emissions in the lower troposphere punctuated with sporadic and spatially variable explosive eruptions into the upper troposphere and lower stratosphere (UTLS). The Moderate Resolution Imaging Spectroradiometer (MODIS), the Atmospheric Infrared Sounder (AIRS) and the Ozone Monitoring Instrument (OMI) on the A-Train suite of satellites, have the combined ability to measure both passive and explosive volcanic emissions of SO_2. Near-coincident thermal infrared (TIR; MODIS and AIRS) and ultraviolet (UV; OMI) observations with different vertical sensitivity allow SO_2 emissions in the UTLS to be delineated from lower tropospheric degassing, with ramifications for climate impacts. This study compares MODIS and AIRS TIR and OMI UV retrievals of SO_2 for a number of recent, large volcanic eruptions on a case-by-case basis in order to compare the performance of each of the sensors for different eruptive scenarios (latitude, plume altitude, season etc.). Using this approach, we attempt to quantify rates of SO_2 loading, residence times, and the overall performance of each of the sensors in a range of settings in order to produce a global estimate of volcanic SO_2 emissions to the atmosphere.