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Satellite IASI estimates of SO_2 degassing at Mt Etna

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Sulfur dioxide (SO_2) is an important atmospheric constituent that plays a fundamental role in the style of eruptive activity and in many atmospheric processes. Mt Etna is one of the bigger source of volcanic SO_2 that present satellite signal in both eruptive stages and during degassing/quiescent period. The Infrared Atmospheric Sounding Interferometer (IASI) on the METOP satellite is used to study volcanic emission of SO_2 using high-spectral resolution measurements from 1000 to 1200 and from 1300 to 1410 cm-1 (the 7.3 and 8.7 micron SO_2 bands).
By analysing IASI measurements from 2007 to 2018, we categorized the emission of sulphur dioxide (SO_2) by Mt Etna into two regimes:
1. Quiescent outgassing and low-levels of volcanic activity.
2. Eruptive degassing that inject SO_2 into the troposphere and in stratosphere.
For Quiescent outgassing periods the IASI SO_2 (monthly average) always present circoncentric features with a maximum of SO_2 in correspondence of Etna and an SO_2 degassing 'cloud' often spreading in the East part of Sicily and nearby Mediterranean sea. Iterative retrieval is performed assuming the altitude of Etna vent. Successively the flux is estimated with an optimal estimation algorithm, by fitting the measurements with an exponential function of the distance e-folding time and wind speed. These estimates are then compare with measurements of SO_2 observed by the ground-based ultraviolet scanning spectrometer network FLAME and independent satellite measurements (OMI) dataset on monthly and annual mean basis. The different datasets are consistent within the error estimates but present different level of agreement that are discussed. Overall the estimate of Etna quiescent SO_2 outgassing fluxes (for the 10 years considered) is estimated between 500 and 1000 kton/year.