Geophysical Research Abstracts
Vol. 17, EGU2015-11109, 2015
EGU General Assembly 2015

Retrieval of near-surface sulfur dioxide (SO_2) concentrations at a global scale using IASI satellite observations

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Sulfur dioxide (SO_2) is an atmospheric trace gas with both natural and anthropogenic sources. In the troposphere, SO_2 released by industrial activities mainly stays close to the ground level. The IASI/MetOp infrared remote sensor has shown over the years good performances for tracking SO_2 plumes in the free troposphere. Probing anthropogenic SO_2 pollution on the other hand is a challenge due to the generally low sensitivity of infrared measurements to the near-surface atmosphere, itself caused by the weak thermal contrasts between the ground and the air above it. Recent studies, which have focused on local sources (the industrial area of Norilsk and of the North China Plain), have however demonstrated that IASI was able to retrieve SO_2 near-surface concentrations in favorable meteorological situations, and in particular in case of large temperature inversions.
Expanding on these findings, this work presents new observations of near-surface SO_2 at global scale from IASI observations. The method, which includes the determination of the SO_2 plume altitude and SO_2 boundary layer column, will be briefly presented. Global distributions of anthropogenic pollution will be shown, focusing on the identification of the principal hotspots and of exceptional pollution events. A first assessment of the retrieved columns with correlative measurements will be provided for some local sources. IASI measurements and new OMI SO_2 retrievals will be compared. This will highlight the complementarity of these current TIR and UV sounders for measuring SO_2 pollution, which could be exploited in the future with IASI-NG and Sentinel-5 instruments.