



Flux calculation using CARIBIC DOAS aircraft measurements – SO₂ emission of Norilsk

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Based on a case-study of the nickel smelter in Norilsk (Siberia), the retrieval of trace gas fluxes using airborne remote sensing is discussed.

CARIBIC (Civil Aircraft for the Regular Investigation of the atmosphere Based on an Instrument Container, www.caribic.de) observes physical and chemical processes in the atmosphere using a fully automated measurement container aboard a Lufthansa Airbus 340-600. A special inlet system is mounted on the aircraft with probes for trace gases, water vapor and aerosol particles. The inlet system also includes DOAS (Differential Optical Absorption Spectroscopy) telescopes for remote sensing.

In October 2010, enhanced NO₂ and high SO₂ Slant Column Densities up to $6 \cdot 10^{17}$ molec/cm² were detected near Norilsk with the nadir channel of the DOAS instrument.

The retrieved column densities were combined with ECMWF wind data to derive the SO₂ flux crossing the vertical plane of the flight route. With that, the SO₂ output of the Norilsk industrial complex is estimated to be ~1 Mt per year, which is in agreement with various independent estimates.

We also compare our value to results obtained using data from satellite remote sensing (GOME-2, OMI). The validity of the assumptions we used to obtain our estimate is discussed. We also discuss the adaption of our method to other gases and sources like the NO₂ emissions of industrial complexes or major cities.