Geophysical Research Abstracts
Vol. 17, EGU2015-12499, 2015
EGU General Assembly 2015
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Small Whiskbroom Imager for atmospheric compositioN monitorinG (SWING) from an Unmanned Aerial Vehicle (UAV): Results from the 2014 AROMAT campaign

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The Small Whiskbroom Imager for atmospheric compositioN monitorinG (SWING) is an instrument dedicated to atmospheric trace gas retrieval from an Unmanned Aerial Vehicle (UAV). The payload is based on a compact visible spectrometer and a scanning mirror to collect scattered sunlight. Its weight, size, and power consumption are respectively 920 g, 27x12x12 cm^3, and 6 W. The custom-built 2.5 m flying wing UAV is electrically powered, has a typical airspeed of 100 km/h, and can operate at a maximum altitude of 3 km. Both the payload and the UAV were developed in the framework of a collaboration between the Belgian Institute for Space Aeronomy (BIRA-IASB) and the Dunarea de Jos University of Galati, Romania.

We present here SWING-UAV test flights dedicated to NO_2 measurements and performed in Romania on 10 and 11 September 2014, during the Airborne ROmanian Measurements of Aerosols and Trace gases (AROMAT) campaign. The UAV performed 5 flights in the vicinity of the large thermal power station of Turceni (44.67˚N, 23.4˚E). The UAV was operated in visual range during the campaign, up to 900 m AGL , downwind of the plant and crossing its exhaust plume.

The spectra recorded on flight are analyzed with the Differential Optical Absorption Spectroscopy (DOAS) method. The retrieved NO_2 Differential Slant Column Densities (DSCDs) are up to 1.5e17 molec/cm^2 and reveal the horizontal gradients around the plant. The DSCDs are converted to vertical columns and compared with coincident car-based DOAS measurements. We also present the near-future perspective of the SWING-UAV observation system, which includes flights in 2015 above the Black Sea to quantify ship emissions, the addition of SO_2 as a target species, and autopilot flights at higher altitudes to cover a typical satellite pixel extent (10x10 km^2).