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Small Whiskbroom Imager for atmospheric compositioN monitorinG (SWING) from an Unmanned Aerial Vehicle (UAV): status and perspectives

Alexis Merlaud (1), Frederik Tack (1), Daniel-Eduard Constantin (2), Caroline Fayt (1), Jeroen Maes (1), Florin Mingireanu (3), Ionut Mocanu (4), Lucian Georgescu (2), and Michel Van Roozendael (1)

(1) Belgian Institute for Space Aeronomy, bruxelles, Belgium (alexism@oma.be), (2) University "Dunarea de Jos", Faculty of Sciences and Environment, Galati, Romania, (3) Romanian Space Agency (ROSA), Bucharest, Romania, (4) Reev River Aerospace, Galati, Romania

The Small Whiskbroom Imager for atmospheric compositioN monitorinG (SWING) is a recently developed instrument dedicated to trace gas measurements from Unmanned Aerial Vehicles (UAVs). The payload is based on a compact ultra-violet visible spectrometer and a scanning mirror. Its weight, size, and power consumption are respectively 920 g, 27x12x12 cm3, and 6 W. The custom-built UAV is an electrically powered flying wing and can reach an altitude of 3 km at a mean airspeed of 100 km/h. The whole flight can be preprogrammed and controlled by an autopilot. The spectra are analyzed using Differential Optical Absorption Spectroscopy (DOAS). One major objective is the mapping of NO_2 columns at high spatial resolution allowing to subsample satellite measurements within the extent of a typical ground pixel.
We present the preliminary results of two test flights of the SWING-UAV observation system in the vicinity of Galati, Romania (45.45°N, 28.05°E), performed on 11 May 2013 and 20 September 2013. Several atmospheric species are identified in the spectral range covered by the spectrometer (300-600 nm): NO_2, water vapor, O4, and O_3. From the measurements, the detection limit for NO_2 is estimated to lie around 2 ppb. We investigate: (1) the georeferencing issues and the effective spatial resolution achievable with SWING-UAV from the instantaneous field of view and the plane dynamics (2) the main parameters influencing the air mass factors, and (3) the reproducibility of NO_2 measurements over the same area during the second flight which included repeated transects. We also present the near-future (2014-2015) campaigns planned for the SWING-UAV observation system.