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The Airborne ROmanian Measurements of Aerosols and Trace gases (AROMAT) campaigns: preparation, execution, results

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The Airborne ROmanian Measurements of Aerosols and Trace gases (AROMAT) campaigns took place in Romania in September 2014 and August 2015. They involved observations from different types of airborne platforms (manned aircraft, weather balloons, and UAVs) completed by ground measurements. The AROMAT activity focused on two geophysical targets: the Bucharest urban area and the coal-fired power plants of the Jiu Valley. The objectives of the AROMAT campaigns were: (i) to test recently developed airborne observation systems dedicated to air quality studies such as the AirMAP (IUP-Bremen), SWING (BIRA-IASB), and the NO_2 sonde (KNMI), (ii) to investigate the 3D fields of air quality related species in Romania, and (iii) to verify the concept of such a campaign in support of the validation of spaceborne atmospheric missions such as TROPOMI/S5P.

We present an overview of the AROMAT campaigns and a sample of our findings related to the aforementioned objectives. The joint field operations allowed us to assess the capabilities and limitations of the different observation systems in terms of instrumental stability, covered area, and uncertainties of the retrieved products. In Bucharest, we have measured the horizontal distribution of NO_2 and H_2CO with maximum columns of 4 x 10^{16} molec.cm^{-2} and 7 x 10^{16} molec.cm^{-2}, respectively. We estimated the total NO_x flux from the city at about 15 mol.s^{-1}. In the Jiu Valley, we observed from the ground NO_2 columns up to 1.3 x 10e^{17} molec.cm^{-2}) and SO_2 columns up to 4 x 10e^{18} molec.cm^{-2}, but such high columns are localized in narrow exhaust plumes which are diluted in spaceborne measurements. We estimated the NO_x flux from the Turceni power plant around 8 mol.s^{-1}, while the SO_2 emissions varied between 15 and 140 mol.s^{-1}.

Regarding the practical validation of the TROPOMI products it appears that, for tropospheric NO_2 and in the two investigated areas, AirMAP-type of measurements would cover a sufficient number of polluted TROPOMI pixels to reach statistical significance. For the SO_2 and H_2CO products, long term ground-based measurements are still needed, yet airborne measurements may provide useful information on key inputs of the product algorithms, such as lifetime or vertical distribution.