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Sentinel-5p Validation Campaigns – Planned Activities in 2021-2022

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Sentinel-5 precursor (S-5p), launched on 13 October 2017, is the first mission of the Copernicus Programme dedicated to the monitoring of air quality, climate, ozone and UV radiation. The S-5p characteristics, such as the fine spatial resolution, introduce many new opportunities and challenges, requiring to carefully assess the quality and validity of the generated data products by comparison with independent measurements and analyses.

While routine validation is performed within the ESA Mission Performance Center (MPC) based on a limited number of Fiducial Reference Measurements (FRM), additional validation activities including aerial and ground-based campaigns are conducted in research mode as part of the S-5p Validation Team (S5PVT). The validation activities bring together various teams and instruments to address specific validation requirements and provide a more in-depth, complete insight into the S-5p instrument performance and the fitness for purpose of its data products. The acquired reference data sets allow to address product accuracy and precision, spatial and temporal validation requirements, algorithm parameters (a priori profiles, albedo, etc.) and specific requirements, such as validation of strongly polluted and heterogeneous scenes.

Here, we present a series of decentralized activities planned to take place in 2021-2022 (s5pcampaigns.aeronomie.be), which have been identified to address key priorities for S5-p validation.

A first set of activities concentrates on the main S-5p UV-Vis tropospheric products (NO₂, HCHO and SO₂). Airborne deployment, consisting of both in-situ spiral and remote sensing mapping flights, is planned over cities and industrial areas in Romania (Bucharest; Jiu valley), the German Ruhr area (Cologne; Duisburg; Dusseldorf), Berlin, and Belgium (Antwerp (port); Brussels). Airborne operations will be complemented with various deployments on the ground (MAX-DOAS, car-DOAS, sun-photometer, ceilometer, lidar, etc.). The validation activities over Berlin and Bucharest are focused on recurrent airborne observations with hyperspectral imagers in order to have a large number of flights (12 to 18) over a time interval of approximately one year, in order to have a large statistical data set covering variable meteorological and geo-physical conditions, as well as different overpass configurations.

A second set of activities will focus on the validation of SWIR data products (CO and CH₄). COCCON (COllaborative Carbon Column Observing Network) portable low-resolution EM27/SUN FTIR spectrometers will be deployed for an extended period at different sites in the world in order to obtain a good coverage of geophysical parameters (strong sources, background sites, sites with high humidity, etc.) and different ground scenes, e.g. very high/low albedo sites.

Additionally, synergies are created with large field campaigns, such as the Asian Summer Monsoon Chemical and Climate Impact Project (ACCLIP) and the 2021 NET-Sense HyTES Joint European Campaign which will provide airborne measurements of NO₂, CO, CH₄ columns and vertical profiles, among others.

The various airborne and ground-based instrument deployments will produce a key ensemble of independent reference observations. For each product, a core team will coordinate the validation tasks, making use of data collected in all relevant instrumental deployments.