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A cloud product for Sentinel-4 to support the Geo-Ring for Air Quality

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The Geo-Ring for Air Quality consists of three geostationary instruments to monitor the air quality and atmospheric composition over large parts of the northern hemisphere with a high temporal cadence. These are the Korean Geostationary Environmental Monitoring Spectrometer (GEMS, launched 2020), the US-American Tropospheric Emissions: Monitoring of Pollution (TEMPO, launched 2023) and the European UVN spectrometer on Sentinel-4 (S4, to be launched 2025). These geostationary instruments can benefit substantially from the knowledge gained by heritage LEO missions like OMI/Aura, GOME-2/MetOP-ABC and TROPOMI/Sentinel-5P and provide a great synergistic potential to combine the global spatial coverage of the LEO missions with the regional high temporal coverage of the GEO missions.

Although trace gases and greenhouse gases are the main focus of the Geo-Ring for Air Quality, knowledge about the presence and characteristics of clouds is a pre-requisite for an accurate retrieval of the aforementioned species for air quality. On top of that, clouds by themselves are an important parameter for climatological studies and applications via their importance and impact on the Earth's radiation budget.

In this contribution, we present the operational cloud product developed for Sentinel-4. It is based on the algorithms called OCRA (Optical Cloud Recognition Algorithm) and ROCINN (Retrieval of Cloud Information using Neural Networks), which are already being in operational use for several heritage missions like GOME-2 and TROPOMI. The main retrieval parameters are cloud fraction, cloud mean height, cloud top height, cloud optical thickness and cloud albedo, achieved via two different cloud models: a simplified Lambertian reflector approach (CRB, clouds as reflecting boundaries) and a physically more realistic scattering layer approach (CAL, clouds as layers). As a testing scenario for the Sentinel-4 development, the OCRA algorithm has been adapted to the GEMS instrument. We will show application results and also further comparisons of the S5P OCRA/ROCINN cloud product with the GEMS cloud product.