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TROPOMI: An Important Step Towards Global Monitoring of the Troposphere

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TROPOMI is a nadir viewing shortwave spectrometer to measure the tropospheric composition for climate and air quality applications. The TROPOMI instrument, an initiative from the Netherlands and co-funded by ESA, is planned for a launch in 2014 as a single payload on the Sentinel 5 Precursor mission. This mission is an important step forward from the current OMI on NASA EOS Aura and SCIAMACHY on Envisat towards the operational Sentinel 5 mission that is planned around 2020.

The primary data products of TROPOMI are nitrogen dioxide, carbon monoxide, tropospheric ozone column, methane and aerosols. In addition, also formaldehyde, bromine monoxide, total ozone and cloud parameters will be detected. Together, this forms a set of key species for air quality and climate applications. These applications will include forecasting of the air quality, improving emissions inventories, and monitoring of the atmospheric composition.

TROPOMI will measure the UV-visible wavelength range from (270-500 nm), the near infrared (710-770 nm) and the shortwave infrared (2314-2382 nm). In the UV-visible and near infrared the spectral resolution is 0.5 nm, except for the wavelengths below 308 nm, where the spectral resolution is 1.0 nm. In the shortwave infrared the spectral resolution is 0.25 nm. TROPOMI will have an unprecedented spatial resolution of about 7x7 km^2 at nadir. The spatial resolution is combined with a wide swath to allow for daily global coverage. The high spatial resolution serves two goals: (1) emissions sources can be detected with more accuracy and (2) the number of cloud-free ground pixels will increase substantially. The latter is especially important for TROPOMI data products that are very sensitive for cloud contamination, such as the methane product. In addition to an improved spatial resolution, also the signal-to-noise of TROPOMI will be improved as compared to OMI and SCIAMACHY.

The Sentinel 5 Precursor will be launched into a Sun-synchronous early afternoon orbit. By using this orbit, the TROPOMI data can be used together with the GOME-2 measurements in the morning to detect diurnal variations. This has already been demonstrated for NO_2 using OMI and SCIAMACHY observations. Over Europe, the diurnal variations will be observed by the geostationary Sentinel 4 mission after 2018. It is planned to fly the Sentinel 5 Precursor within 10 minutes of the NPP/NPOESS missions. The high spatial resolution imagery of the VIIRS instrument onboard of these missions can be used for additional information on clouds and aerosols, which is especially important for the methane, but can also improve the quality of several other data products.