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Air Quality Observations from Space: Results from the Ozone Monitoring Instrument (OMI) and Expected Results from the TROPOspheric Monitoring Instrument (TROPOMI)

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Air quality is one of the largest societal challenges, especially in large urbanized and industrialized regions of the world. Reduced air quality has adverse health effects, and also results in reduced crop yields. In addition, there are strong links between air quality and climate change. Air quality has traditionally been monitored by ground-based networks. In the previous decade the observation capabilities have been extended with measurements from space, most notable from the Ozone Monitoring Instrument (OMI), the SCanning Imaging Absorption spectroMeter for Atmospheric CartograpHY (SCIAMACHY) and the Global Ozone Monitoring Experiment (GOME-1/2).

Whereas the satellite instruments do not provide concentrations at the surface level, they provide unique global information on the spatial distribution and transport of pollutants. Over the last decade the quality of the satellite data for tropospheric species like nitrogen dioxide, carbon monoxide, sulfur dioxide, formaldehyde and aerosols have matured rapidly. Several data products now contribute to the monitoring and forecasting of air quality through data assimilation techniques, as for example developed in the MACC (http://www.gmes-atmosphere.eu/) project. Apart from directly contributing through data assimilation, satellite data are also used for the top-down quantification of emission sources and understanding of atmospheric processes, thus improving chemistry transport models.

The OMI instrument, which was launched in July 2004, was the first instrument that combined daily global coverage with high spatial resolution of 13x24 km^2 at nadir. The OMI data have attracted many new users and have resulted in several new applications. The TROPOMI instrument on the ESA/GMES Sentinel 5 precursor satellite, planned for launch in 2015, will be the first in a series of European satellite sensors dedicated for monitoring atmospheric composition changes in the timeframe 2015-2030. The TROPOMI instrument has a heritage to both OMI and SCIAMACHY. With a spatial resolution as high as 7x7 km^2, higher signal-to-noise and extended spectral coverage, TROPOMI will provide exciting new information on the changing composition of the troposphere. The planned formation flying with the US afternoon NPP/JPSS satellites will enable important synergies, including the usage of high spatial resolution imager (VIIRS) data for enhanced cloud clearing of the TROPOMI data. The availability of the morning EUMETSAT MetOp (GOME-2 and IASI) operational observations will provide complementary information on the diurnal variability.

In this contribution an overview will be given of successes of OMI for air quality monitoring and research. In addition, the European satellite missions for atmospheric composition within the ESA/GMES Sentinel programme will be presented, with a focus on the TROPOMI instrument design and performance status.