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Contribution of sentinel 4, 5 and s5p for further understanding of air quality – climate and ozone layer – climate interactions

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The Sentinel 4 and 5 missions, including the Sentinel-5 precursor mission, will continue data records on atmospheric composition that started with ESA's ENVISAT and NASA's EOS-Aura missions. The Sentinels are of paramount importance for building long term atmospheric composition data records for climate purposes. The ESA CCI projects are essential for building the long term climate data records, that will be continued with data from sentinel 4,5 and s5p. An important application of the data records is protocol monitoring, i.e. observations in support of the Montreal Protocol for the ozone layer, the Kyoto Protocol and possible future climate agreements concerning climate forcing, as well as observations supporting air quality legislation on national and European scale, as well as within the framework of the UN Convention on Long-Range Transboundary Air Pollution (CLRTAP) .

Important are the interactions between air quality and climate forcing, since short-lived trace gases and aerosols play a double role. For example, the necessary measures to improve upon air quality may counteract climate mitigation policies. Strategies need to be sought that take into account the complex chemical feedback mechanisms between air pollutants and climate forcing (Shindell, D.T., G. Faluvegi, D.M. Koch, G.A. Schmidt, N. Unger, and S.E. Bauer, 2009: Improved attribution of climate forcing to emissions. Science, 326, 716-718, doi:10.1126/science.1174760.). Similar complex climate-couplings exist with respect to stratospheric ozone and climate forcing, see for example the climate forcing prevented by the Montreal Protocol (Velders GJM, Andersen SO, Daniel JS, Fahey DW, McFarland M (2007) The importance of the Montreal Protocol in protecting climate. Proc Natl Acad Sci USA 104:4814–4819.) and the anticipated interactions between climate change and ozone recovery in the 21st century.

The atmospheric Sentinel data are further needed to improve our understanding of the physical and chemical processes concerning climate change, air quality, and ozone layer. Improvements in the Earth System modelling combining climate and atmospheric chemistry is for a large part dependent on availability and improvement of long-term atmospheric composition data records in terms of frequency of observation (daily or even diurnal observations), accuracy, spatial resolution, vertical resolution, and global coverage. The data of Sentinels 4 and 5, including the Sentinel-5 Precursor mission, will be used for emission source identification and quantification using inverse modelling techniques. This information will improve the boundary conditions for the climate and air quality models, as well as better constrain current emission monitoring. Currently climate and air quality models use bottom-up estimates (i.e. a calculation of the atmospheric emissions based on certain assumptions) and are thus not based on direct measurements of emission sources..

The presentation will elaborate on the science potential of the sentinel 4, 5 and s5p missions for atmospheric monitoring and climate research.