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Future challenges in atmospheric composition observation from space and the potential contribution of the sentinel missions

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The chemical composition of the atmosphere is changing as a result of human activities. These changes have a direct impact on the environment, on climate, and on air quality and health on the global and regional scales. These effects need to be better understood and it is becoming very urgent due to an accelerating global population growth, massive urbanization, and increased transportation and further industrialization in developing countries to have access to reliable, global, vertically resolved observations with high horizontal resolution of both atmospheric gas phase species and particles.

In the lower troposphere in particular, the key uncertainties in atmospheric composition, climate chemistry coupling and air quality are coming from the description of the sources and sinks of trace gases and aerosols. The complex nature of the underlying processes requires observations ranging from a city to a global scale at hourly to yearly time scales. As illustrated in this presentation, future tropospheric sounding from space need to allow the identification of sources and sinks as well as the observation of long-range transport of air pollutants by capturing their high temporal and spatial variability. Furthermore, atmospheric composition changes in the troposphere are strongly coupled with meteorology and climate change, which require the simultaneous observation of chemically related species and aerosol particles. In order to significantly improve our understanding of atmospheric pollution and interaction of pollutants with climate, high quality, vertically resolved space measurements of a full set of tropospheric key constituents need to be measured for the same air mass with a daily near-global coverage and unprecedented spatial and temporal resolution.

The future atmospheric missions will also benefit from the advance in combined retrievals and inverse modelling to determine the emissions sources, and data assimilation techniques to incorporate remote observations into chemistry transport models. Forecast of ozone fields, surface ultraviolet radiation and pollution episodes will also impose strong constraints on the near-real time delivery of these satellites products to the user.