

연세대학교 대기과학과/지구환경연구소
BK21 플러스 지구대기천문사업단 세미나

Observing the changing Anthropocene from space and from aircraft: GOME, SCIAMACHY, GOME2, Sentinel 5-P, and the EMeRGe campaign.

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Research Career

March 1992–present, Professor (Chair Title “Physics of the Oceans and the Atmosphere”) Faculty of Physics and Electrical Engineering, University of Bremen

2010–2016, Science Director, Natural Environment Research Council, United Kingdom

November 1981–March 1992, Research Group Leader, Max Planck Institute for Chemistry, Atmospheric Chemistry Department

March 1979–November 1981, Higher Scientific Officer, Environmental and Medical Sciences Division, Atomic Energy Research Establishment, United Kingdom

March 1979–November 1981, Guest Scientist, Physical Chemistry Laboratory, Oxford University, United Kingdom

October 1978–March 1979, Research Scientist, Harvard–Smithsonian Center for Astrophysics, United States



Prior to the Neolithic Revolution around 12 000 Yr BP, the Earth’s population was around 4 million hunter gatherers. Population grew to around 1 Billion at the beginning of the Industrial Revolution in the UK (1750–1800). Thereafter, its growth began to accelerate and population is now over 7.6 Billion with more than 50% living in megacities or urban agglomerations, known as Major Population Centres. The energy to fuel this growth has been in large produced from fossil fuel combustion. It has resulted in improved longevity, a rapidly increasing standard of living, supplied by an evolving industrial sectors. However, this has resulted in ever increasing and evolving emissions of pollutants (both short lived climate pollutants and long lived greenhouse gases) and global land use change This is impacting on air and water quality, human health, ecosystem services and climate change. Pollution extends from the local to global scale. The world has now entered a new geological epoch the Anthropocene. To assess accurately the impact of man in the evolving Anthropocene both space based and airborne measurement of atmospheric composition are a pre requisite. The SCIAMACHY (SCanning Imaging Absorption spectrometer for Atmospheric CHartography) project was proposed in 1988 to meet this need. SCIAMACHY flew on the ESA Envisat (2002 to 2012), which flew in a sun synchronous polar orbit in descending node,

having an equator crossing time of 10:00 am local time. SCIAMACHY, a passive remote sensing double monochromator, measured the up-welling radiation from the top of the atmosphere. The GOME (Global Ozone Monitoring Experiment) was a smaller version of SCIAMACHY, on ESA ERS-2 (1995 to 2011) viewing only in nadir. GOME-2 is a somewhat improved version of GOME, aboard the ESA/EUMESAT. SCIAMACHY, GOME, and GOME-2 are best known for the retrievals of trace gases in the troposphere and the stratosphere, where measurements of the total and tropospheric columns of the trace gases O₃, NO₂, HCHO, CHO, CHO, BrO, IO, H₂O, CO as well ocean colour, cloud and aerosol optical properties. In addition, SCIAMACHY observations made the first dry column mixing ratios of CO, CH₄ and CO₂.

In addition to space measurements, aircraft are needed to provide high spatial resolution measurements of trace atmospheric constituents to test our understanding of the transport and transformation of atmospheric emissions. EMeRGe (Effect of MEGacities on the Transport and Transformation of Pollutants on the Regional to Global Scales) was proposed to exploit the capabilities of the German HALO research aircraft to study the outflow from MPC. This presentation will provide highlights from both space based remote sensing and provisional observations from EMeRGe, which is currently ongoing.

Abstract

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