

Challenges Facing Global Measurements of Atmospheric Composition

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The need for a more homogeneous and comprehensive set of long-term global measurements of greenhouse gases, ozone (also a greenhouse gas), aerosols, and related precursors is critical to answering many of the outstanding questions in climate change, ozone depletion, and atmospheric chemistry. Measurements are divisible into two types, namely, those originating from nonsatellite (ground-based, aircraft, sondes) and from satellite instrumentation. The nonsatellite observations are made by a host of different networks operated by various agencies and organizations. For greenhouse gases and ozone, the Global Atmosphere Watch (GAW) program operated by members of the World Meteorological Organization (WMO) and its partners takes a lead in defining measurement protocols, quality assurance, and data exchange. In some cases, such as CO₂, CH₄, and total column ozone, the GAW family of stations constitute most of the global long-term network; in other cases, such as ozonesonde measurements, CFCs, and aerosol optical depth, there is a substantive contribution from networks operated by non-GAW members or partners. Satellite observations are an emerging force in atmospheric chemistry. Despite challenges in retrieval accuracy, long-term continuity between different satellite instruments, and vertical resolution, there are tremendous benefits to be gained from greater global coverage offered by satellites. The greatest impact of these two types of observations will be achieved by integrating satellite and non-satellite measurements into a global atmospheric chemistry observing system, as depicted in Figure 1. Developing this system is a major challenge to the measurement community.

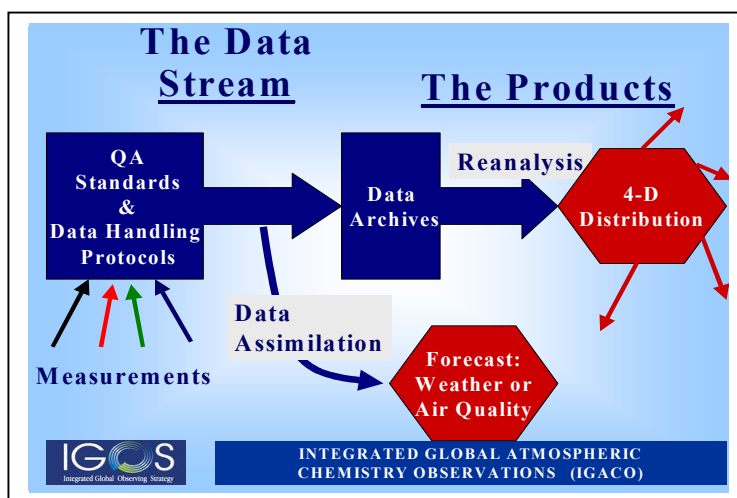


Figure 1. A schematic of the system for integrating global atmospheric chemistry observations being developed for the Atmospheric Chemistry Theme of the Integrated Global Observing Strategy (IGOS) by an international panel co-convened by WMO/GAW and the European Space Agency (ESA).

A basic requirement for meeting this challenge is ensuring that the fundamentals of measurement (calibration, standardization of measurement protocols, adequacy of coverage, quality assurance, data archiving, and data analysis) are in place. The GAW program is an important mechanism for making this happen through its calibration, quality assurance, and data centers, and through its access internationally. The current state of the global network of nonsatellite observations of greenhouse gases, ozone, aerosols, and their precursors is reviewed in this presentation.