

# **Eliminating Critical Gaps In Global, High-Resolution Profile Measurements Of Ozone and Water Vapour In The Upper Troposphere Lower Stratosphere (UT/LS):**

## **A Request To CEOS and WMO Members From The IGACO-Ozone Community.**

*The IGACO ozone consultative committee advises meteorological services, space agencies and other research funding organizations in the strongest possible terms to fill the existing and upcoming critical gaps in the observing system that affect our ability to understand the effect of these greenhouse gases on climate, ozone and large scale air quality issues. The community is concerned that because there is an operational system for total column ozone and vertical profiling that CEOS and WMO Members may overlook the following gaps in high resolution profiling that can be readily addressed:*

- 1. insufficient profiling of atmospheric ozone from 0 to 40 km using surface based ozonesondes.*
- 2. the impending dearth of high-vertical-resolution satellite profiles down to the upper troposphere for ozone and other trace gases. We need to replace the loss of SAGE, POAM, HALOE and ILAS measurements and provide an operational capability for the provision of solar occultation data. It is recommended that an instrument combination of an FTS and a UV/Vis/NIR spectrometer be flown; however, a filter instrument like POAM would make a significant contribution.*
- 3. operational implementation of the MOZAIC/IAGOS commercial airline measurement programme.*
- 4. developing an automated, long-life surface-based LIDAR ozone network focussed on high resolution in the UTLS and mid troposphere.*
- 5. A limb-emission, satellite instrument for high-vertical-resolution measurements in the infrared and microwave in the UTLS with better spatial coverage. Instruments like MLS, SMILES and MIPAS are illustrative of appropriate technologies.*

The Upper Troposphere/Lower Stratosphere (UTLS) region, particularly in the tropics and north polar region, is the region with the highest impact for changes to the radiative forcing of climate by ozone and water vapour. Observations of trace gases in this region at high vertical resolution are crucial to a better understanding of the climate effect on global ozone and the water vapour budget and in turn the effects of these greenhouse gases on climate, ozone and large scale mid-to-upper troposphere air quality issues. Future aviation activity in the UT/LS need to be carefully monitored and understood.

The maintenance of existing networks for long-term monitoring of global atmospheric composition is a high-priority requirement. Even though ozone-depleting substances in the troposphere have peaked because of half lives in the atmosphere of 50 to 100 years, their decline will be slow. Ozone depletion will continue for at least a half century under a changing climate. The IGACO ozone consultative meeting participants wish to bring to the attention of CEOS and WMO members the continuing need for the above ground-based and space-based observing systems.

While there is preliminary evidence that mid-latitude ozone is no longer declining or perhaps slightly

increasing, it appears that there may be a continuing decline in ozone in the Arctic region in winter associated with declining temperatures in the upper atmosphere in the Arctic. It is not clear how long that decline will continue, nor is it clear what impact these changes in climate and ozone will have on the global distribution of ozone. Long-term monitoring of ozone for this reason should be continued at least until such time as it is established that pre-CFC levels of ozone have been achieved.

At the same time, measurements of ozone column and ozone profile are required to provide diagnostic information and be available for assimilation into the emerging generation of environmental prediction (air quality) models which will forecast chemical concentrations throughout the full range of altitudes of the forecast atmosphere (roughly 0 to 100 km).

In order to maintain this monitoring capacity, it is necessary to maintain the requisite level of technical competence in the observing techniques required and provide adequate spatial coverage.

The current temporal and spatial coverage of the global ozonesonde network should be maintained and, in some regions, enhanced. Lower tropospheric data are critical diagnostics for environmental prediction models, free tropospheric information is required for climate change studies and stratospheric data are needed to validate satellite measurements and to study ozone depletion processes, particularly in the Arctic. Ozone plays a significant role in the radiation balance in the stratosphere and thereby influences the performance of models in making long-term forecasts. It is noted that the tropical region and the southern hemisphere remain inadequately represented in the global ground-based observing system in terms of both total column ozone and ozone profiles.

Aircraft-based observations (MOZAIC) provide important coverage in areas, such as over the ocean, where the availability of other *in situ* data is limited and are particularly relevant to studies of the UTLS. This measurement technique also provides high-vertical resolution with good temporal coverage in urban areas where it is difficult to operate ozonesondes.

NASA/AURA, ESA/ENVISAT, US/NPOESS and EUMETSAT/METOP are or will provide excellent measurements of total ozone and other important atmospheric trace gases and their profiles using backscatter, limb scanning and thermal emission observations. However, long-term planning to provide high-vertical-resolution measurements of ozone and other important trace gases in the future is lacking.

Space-based observations of ozone and other constituents with the highest vertical resolution achievable and over as wide a vertical span as possible are needed as input for models, process studies and trend analyses. Solar occultation provides the best possible resolution and vertical coverage performance of the passive, space-based observing techniques currently available. The community is facing a critical gap in observational capacity at this time with only the ACE experiment data and occasional SCIAMACHY occultation observations now available and no future missions currently planned to rectify this situation. Limb emission observations, such as those available at this time from MLS and MIPAS, are complimentary in providing better global coverage and sounding critical, additional chemical species but currently there is no plan to provide this type observation in the future.