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Background on ground-based observations and their role in providing information to the Parties to the Montreal Protocol

Note by the Secretariat

1. Over the past few years, the Scientific Assessment Panel has been informed of serious problems related to the operation of various ozone measurement stations around the world. Several key countries are scaling back their observations and analyses. The degradation of many observational data sets is creating difficulties in the scientific community that require such data sets for research on atmospheric changes. If the situation persists in the coming years it will greatly impair the ability of the Scientific Assessment Panel to provide accurate information to the Parties through its assessments.

2. The co-chairs of the Scientific Assessment Panel have written to the Ozone Secretariat to bring this important issue to the attention of the Parties to the Montreal Protocol and the Vienna Convention. The annex to the present note is a document prepared by the co-chairs of the Scientific Assessment Panel that describes how ground-based observational data has played a key role in the past and is needed now and in the future to facilitate clear answers to the questions asked of the scientific community by the Parties to the Montreal Protocol. The document has not been formally edited.

Annex

Background on ground-based observations and their role in providing information to the Parties to the Montreal Protocol

Three key issues are of great interest to the Parties to the Montreal Protocol and are being addressed by the scientific community:

1) How is the stratosphere recovering from the effects of chlorofluorocarbons and Halons?
2) How will the stratosphere change in response to increasing levels of greenhouse gases?
3) How does human induced ozone depletion interact with surface climate variability and change?

These questions require multiple observations, but all three require column ozone observations, and vertically resolved observations over different regions of the globe (tropics, mid-latitudes, and polar regions).

Observation of ozone and other gases in the stratosphere provides the foundation for the Science Assessments. These Assessments are required under Article 6 of the Montreal Protocol, which expanded the requirements laid out in the Vienna Convention's Article 3. Ground-based observations are an essential key component of such information.

As a background, we note the role played by such observations in: (a) the discovery, diagnosis, and explanation of the Antarctic ozone hole and (b) the realization that the global ozone layer was also indeed thinning and that this was due to the anthropogenic emissions of Ozone-Depleting Substances (ODSs).

Discovery, diagnosis, and explanation of the ozone hole:

Ground measurements of total column ozone (Dobson spectrophotometer) from the British Antarctic Survey's Halley Bay ground station alerted the world to the presence of the Antarctic ozone hole. Observations of total column ozone from a U.S. satellite and from Japan's Syowa station quickly followed with the confirmation of the ozone hole. Satellite data showed the spatial extent of the ozone to be continental in scale. Ozone profile observations made using balloon-borne instruments (ozonesondes) from Japan's Syowa station made in 1982 demonstrated that the ozone hole losses were confined to the 12-20 km layer of the stratosphere. Observations of the ozone column and profile from around the globe were critical to the awareness of countries of the scale of depletion of the ozone layer. Early expeditions to McMurdo to carry out ground-based measurements of various chemical constituents in addition to ozone column, followed by some key aircraft measurements, enabled the establishment of the connections between the ozone hole and anthropogenic ODSs. These scientific findings were critical to subsequent Science Assessments and the adoption of the Montreal Protocol by the countries of the world.

Global ozone layer depletion and its understanding:

Ground-based measurements formed the earliest basis for detecting the global ozone layer depletion. Again, the various vertical profile measurements from mid-latitudes, both in the NH and SH, were critical for our understanding and attribution of the ozone layer depletion to ODSs.

The scientific understanding the processes that caused the ozone layer depletion, including the ozone hole and Arctic ozone depletions, was communicated through the report of the Scientific Assessment Panel, and provided the basis for accelerating the implementation and strengthening of the Montreal Protocol.

Need for ground-based observations to shepherd the ozone layer to its recovery:

The Montreal Protocol is likely the most successful international agreement. Its implementation has led to reduced emissions of the ODSs. However, the ozone layer has not recovered to its pre-1980 levels! Indeed, a clear signal of the ozone layer recovery is yet to be detected. Therefore, this decade is a critical time to ensure that the ozone layer is on a recovery path as predicted by models.

Because of year-to-year variations of stratospheric ozone, slowly occurring ozone changes are obscured. Hence, seeing long-term ozone change requires continuous multi-year ozone data sets. The slow decline (decadal scale) of ODSs will result in a slow increase of ozone. The concurrent increase

of GHGs will also influence global ozone changes. These slow ozone changes will not occur at the same rates in different parts of the globe, hence, multiple stations are required in order to understand changes in the tropics, mid-latitudes of both hemispheres, the Arctic, and Antarctica. Compared to relatively numerous weather stations, there are few stations making regular launches of balloons that measure the vertical structure of ozone. The loss of even a few stations has a major effect on our ability to discern ozone trends.

Potential impacts of loss of observational data and expertise:

Recent decisions by the Parties have reinforced the necessity and importance of long-term ozone observations of high scientific quality. At the 9th Conference of the Parties to the Vienna Convention in Bali, Indonesia in 2011, the report of the 8th meeting of the Ozone Research Managers was presented. Through Decision IX/2, Parties to the Vienna Convention were encouraged "To maintain, expand and integrate systematic ozone-related observations that are critical to understanding and monitoring the long term changes in atmospheric composition and the associated response in ground level ultraviolet radiation" and also (under item 2b) to continue to "maintain research capabilities that enable measurements and scientific understanding of ozone depletion and evolution in a changing atmosphere." In spite of these Decisions and ones taken by previous COPs, some Parties appear now to be eliminating or scaling back basic ozone observations.

There appear to have been a number of strategies used by Parties to reduce costs in this area. These strategies involve either cuts to observations from column instruments and balloons, or cuts to personnel. These lost observations will directly affect the Assessments and the ability of the Parties to make decisions. In addition, any erosion to the expertise via the loss of scientific experts will have equally deleterious impacts. Without both observations and scientists from the national institutes and universities, the Scientific Assessment Panel will be unable to provide the detailed Assessment reports the Parties seek.

Because of the threat to the ozone layer posed by ODSs, a network of ozone observations has been developed along with a strong body of international scientists dedicated to understanding the physics and chemistry of the stratosphere. Without the observations and scientists, we are undermining the very science foundation of the Montreal Protocol.

Therefore, it is important for the relevant Parties to be aware of the dangers of losing these capabilities. It would be beneficial to ensure that ozone-monitoring activities are prioritized, maintained and enhanced where possible to allow continued progress of the Montreal Protocol in meeting its objectives and thereby ensuring that ozone layer protection and restoration continues into the future.