(76-240416-C) **2024 Keynote Presentation: Quantifying Emissions of Ozone Depleting Substances and Greenhouse Gases: Building and Maintaining an Effective Atmospheric Monitoring Network**

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As Jim Butler correctly foresaw and effectively promoted decades ago, the societal need for “top-down” quantification of anthropogenic emissions of stratospheric ozone depleting substances (ODSs) and greenhouse gases (GHGs) based on atmospheric measurements has increased greatly in recent years. This need is exemplified by the recent NOAA and AGAGE (Advanced Global Atmospheric Gases Experiment) discovery, mapping and quantification of spurious emissions of CFC-11 from East Asia, and by the subsequent verification that these emissions were successfully abated. Partly as a result of these and other spurious emissions findings, discussions are now ongoing for the expansion of global atmospheric monitoring networks to fill the large existing gaps in regional monitoring under UNEP’s Ozone Secretariat, for the ODSs and HFCs (Figure 1), and under the World Meteorological Organization’s Global Greenhouse Gas Watch (GGGW), for the dominant GHGs carbon dioxide, methane and nitrous oxide. Such initiatives create opportunities to better verify compliance with the Montreal Protocol and the Paris Agreement, respectively, but they also come with significant practical and scientific challenges. These include building the required observational infrastructure, training the necessary technical personnel, advancing scientific interpretive and modeling capabilities, and, of course, securing the necessary long-term financial support. Station location selections are complex and depend upon the availability of local infrastructures and resources, as well as on using Observing System Simulation Experiments (OSSEs) and exploratory flask sampling to assess location suitability. Calibration standards are also a major issue, with national metrology institutes (NMIs) only now recognizing the overriding need to establish and maintain ambient-level real air calibration scales. Open sharing of instrument-level data is also critical to maintaining quality and comparability across stations and networks. Examples from the existing AGAGE and NOAA networks illustrate some of these concerns. Maintaining the long-term quality of large and growing observing networks has proven to be more difficult than their initial establishment. The best way to achieve an “operational” status is to assume that it is not.

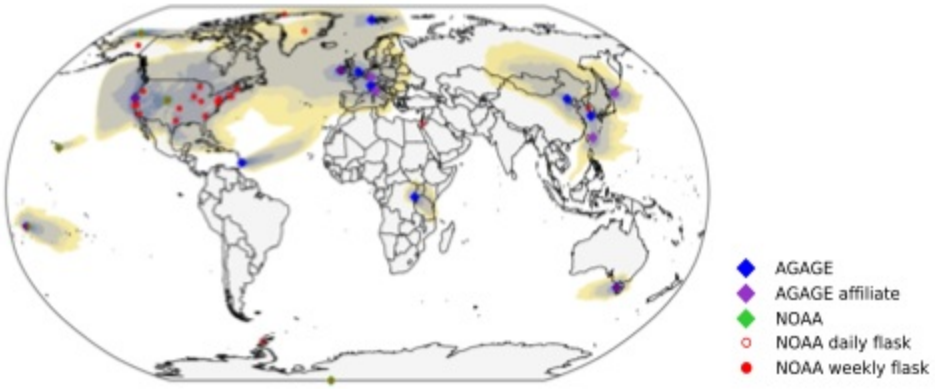

Figure 1.

From the UNEP “Closing the Gaps” White Paper (UNEP/OzL/Conv.ResMgr/11(II)/4) showing the current observational network for ODSs. The shading reflects the “footprint” sensitivities of areas where current atmospheric measurements can quantitatively constrain emissions.