



Closing the Gaps in Top-Down Regional Emissions Quantification: Needs and Action Plan

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**presenting for the
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The Protection of the Ozone Layer**

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Decision XXXI/3 paragraph 8 at the Thirty-First Meeting of the Parties of the Montreal Protocol

- “To request the Scientific Assessment Panel to work with the Ozone Research Managers at their meeting in 2020 to identify gaps in global coverage of atmospheric monitoring of controlled substances and to provide options on ways to enhance such monitoring as well as exploring options for informing the parties of preliminary information indicating unexpected emissions of controlled substances for the consideration of the Thirty-Second Meeting of Parties and the Twelfth Conference of Parties, in 2020.”
- The recent discoveries of anomalous CFC-11 emissions have shown that the “bottom-up” reporting to the Montreal Protocol is vulnerable to unknown or unreported emissions. This risk exists for all substances regulated under the Montreal Protocol.
- In response to these concerns, a “white paper”, written in consultation with members of the ozone research community and the Scientific Assessment Panel, has been posted for discussion and potential endorsement at this Eleventh Meeting of the ORM .



Current Limitations in Global and Regional “Top-Down” Emissions Quantification

- Global monitoring of abundances and trends of substances controlled by the Montreal Protocol, including ozone depleting substances (ODSs) and Kigali Amendment hydrofluorocarbons (HFCs), are well-covered by current measurement networks.
- This global monitoring does an excellent job of detecting global and hemispheric emissions anomalies, as the recent discoveries for CFC-11 have shown. Global monitoring is less well-suited to identifying the locations of such anomalous emissions on finer regional scales.
- High-frequency measurements made in locations that are impacted by regional emission sources, combined with inverse atmospheric transport modelling, can identify and quantify regional sources. The geographic coverage of such measurements is currently very limited.



Mapping the Gaps in Regional Coverage: Sensitivity “Footprints” of the AGAGE and NOAA Current Measurement Network Locations

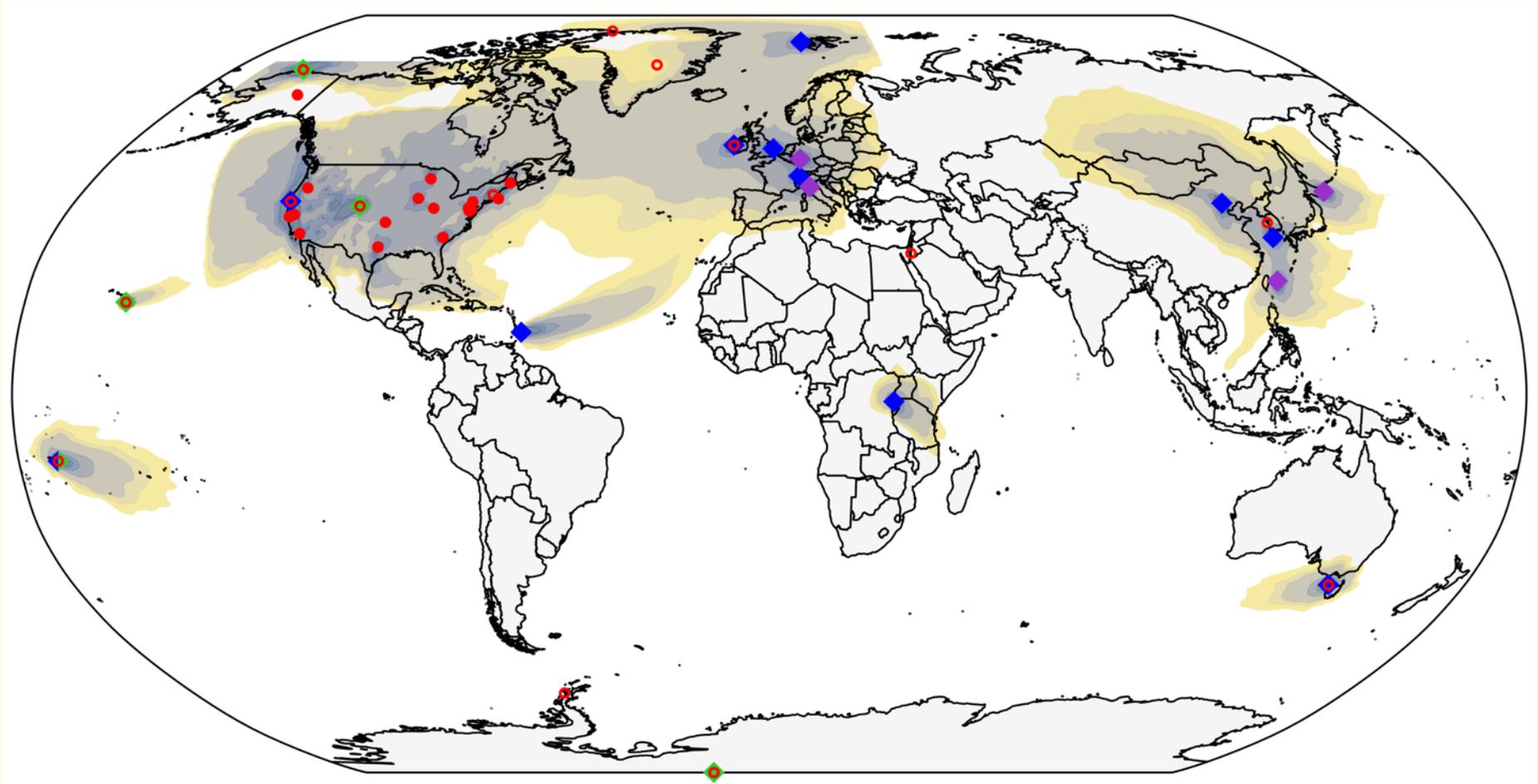


Figure 1 in the “white paper”: NOAA sites are green and red, AGAGE sites are blue and purple.



Closing the Gaps by Expanding Measurements and Modelling: Needed Resources

- **High-frequency measurement stations:** Initial costs of order \$400K USD per site depending on existing infrastructure, and annual operating costs of order \$150K to \$350K depending largely on personnel costs.
- **Flask sampling locations:** Initial costs of order \$15K to \$100K USD for flasks and pumps per site, depending on weekly to daily frequency and on modest existing infrastructure, and annual costs of order \$25K to \$90K, also depending on frequency.
- **Calibration standards:** Robust and well-maintained calibration scales are critical to any large-scale monitoring effort. The metrology community can play an important role in this.
- **International collaboration:** Exchanges of technical knowledge, expertise, calibration standards, open data access and model sharing are all critical to a successful collaborative effort.



Closing the Gaps: Pilot Project Planning and Implementation

- **Identify optimal new measurement locations:** Observing System Simulation Experiments (OSSEs) provide an objective means of assessing the potential benefits of adding new observing sites to the existing observational networks, as will be discussed by Ron Prinn in the following talk.
- **Endorsement of the ORM:** The Scientific Assessment Panel seeks the endorsement (with inputs, if any) of the “white paper” by the Ozone Research Managers, so that it may then be considered by the Open-Ended Working Group of the Parties at its forty-second meeting.
- **Identify sources of pilot project support:** The scale of what can be accomplished will depend upon the availability of financial and infrastructure resources that can assure the 5- to 10-year continuity that is needed to fully realize the benefits of this initiative.

Thank you for your attention...