WORKSHOP
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BANGKOK

Detecting and monitoring unexpected emissions of controlled substances

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There are two essential components for detecting unexpected emissions of controlled substances:

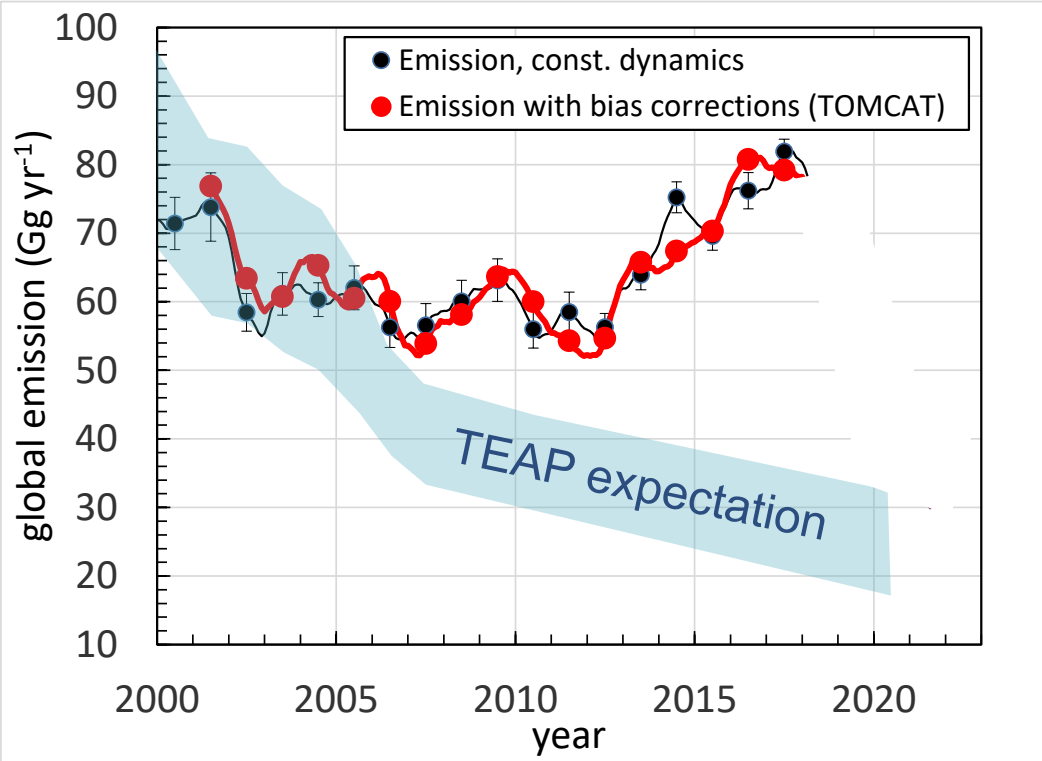
1) ***Well-quantified emissions*** derived from atmospheric measurements
   * global totals
   * regional totals

2) ***Well-defined expectations***
   * activity-based inventories
     (from active use, production, banks, feedstocks, etc.)

Other examples:
CCl_4
HFC-23
Other possibilities (?):
CFCs:
-12, -13, -113/a, -114/a, -115
HCFCs:
-141b, -133a, -132b, -31

Unexpected emissions are indicated when atmosphere-derived ≠ expectation

Prominent example: CFC-11



For long-lived ODSs and their substitutes (e.g., not HFOs),

Global-scale atmospheric measurement networks

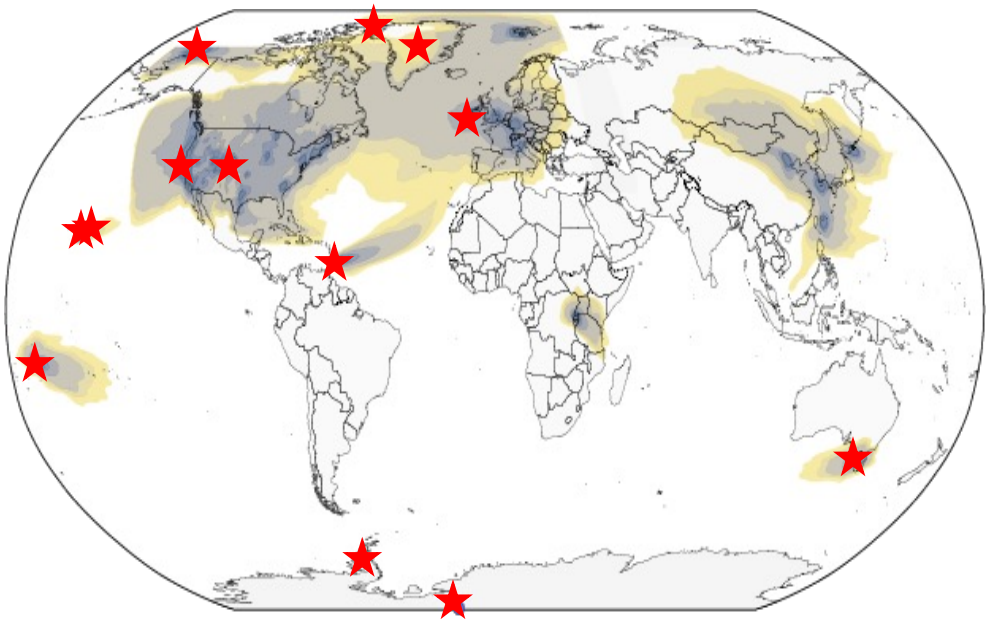
provide a measure of global emissions and changes over time

→ *from all emissive processes*
→ *with some information about emission distributions*
→ *with low- or high-intensity operations*

Atmosphere-derived global emissions are:

Key to identifying unexpected emission trends overall

But have limitations arising from
* *poor regional attribution*
* *uncertainties in loss (lifetimes) and its variability*
* *uncertainties in transport*



Red stars indicate sites typically used to derive global mean ODS and HFC abundance

For long AND short-lived ODSs and their substitutes (e.g., also HFOs),

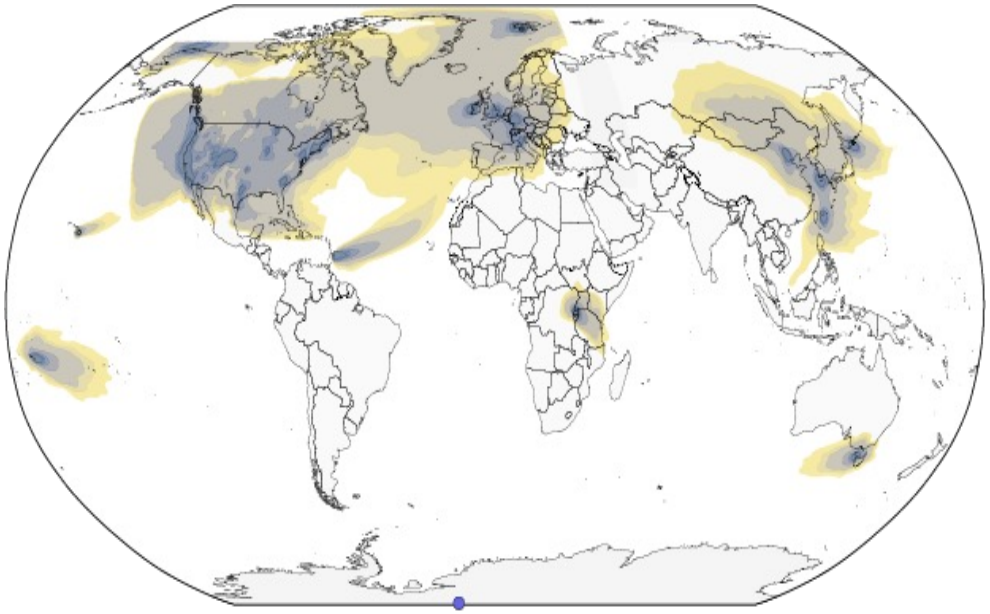
Regional-scale atmospheric measurement networks

provide a measure of regional emissions and changes over time

→ *from regions upwind (within 1000-2000 km)*
→ *are key for attributing global changes to specific regions*

- **Gaps in the network** limit our ability to account for global totals and attribute global changes to specific regions
- **A range of methodologies provide the existing global coverage** *e.g., on-site* vs. *flask sampling*

Circa 2020



Shading indicate areas where emissions can be quantified on regional scales

Looking forward:

For atmosphere-based estimates

Improvements are slowly being realized

* to enhance accuracy, regional specificity, and timeliness

Current limitations are mostly related to capacity vs. capability

* *i.e.*, network gaps
* multiple technical approaches can fill those gaps, depending on resource availability and on-the-ground expertise (flasks, on-site instruments, periodic surveys)