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Clean Air Globally - Science

Working Group chairs:
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Rapporteurs:
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Background:
Ambient air pollution is a leading risk associated with an estimated 4.1 million premature deaths year. It is also a threat to ecosystems and biodiversity as well an important contributor to climate change. One of the major sources is combustion and emissions are thus very closely related to CO_2 emissions. Air pollution is not only derived from emissions from energy production and transport, but also a multitude of other activities including agriculture and industrial activities. It includes particles, gases and toxic compounds such as POP's and mercury, not only degrading human health, but also seriously affecting the global environment and its ecosystems. It is a global problem, also strongly affecting the most developed countries. It is estimated that air pollution causes more than 350 thousand premature deaths in the EU.

The increasing awareness and the transboundary scale of air pollution call for a coordinated action on a global scale. Even though there are large differences in societies and economies, there are several common factors such as the close connection to combustion for energy production, transport, heating and cooking. Another common factor is that public awareness of the health risks often is lacking.

The discussions in the science track of the Clean Air Globally session identified three main areas where more science is needed to better support the policy process aimed at a better air quality.. **Observations** are the foundation of a good mitigation strategy and essential to monitor progress. Observations are necessary both for public awareness rising of air pollution and bringing the science forward. Funding and development agencies need to include investment in observational capacity in their projects, where technical guidance can be provided by WMO. Currently an overall investment strategy is missing and organizations such as the World Bank, should team up with UNEP, WMO, WHO to provide this strategy. Even though satellite observations give very good global coverage it has basic limitation with resolution, it needs additional assumptions to convert column amounts into surface concentrations, and can at best only provide limited information on the chemical composition of the aerosol particles. In addition large parts of the world have insufficient observations of air pollution making it difficult to estimate the effects and making links to sources, and thus to develop cost effective mitigation.

There is also a basic need to develop accurate **emission inventories and scenarios** for large parts of the world. Scenarios should be based on a likely range of future developments in different countries considering the fast moving technological development and possible transformation in energy production and transport systems.

The ability to **model** the transport and deposition of air pollutants has developed very well and today's models have a high accuracy, however still the abilities to model effects as e.g. climate change impacts and to include some pollutants lacks necessary accuracy to be fully exploited in the development of policy strategies for mitigation. Further the large integrative models e.g. Earth System models, and integrated models that connect biophysical models to economical or energy models still needs developments.

Recommendations:

Investments in Observations
(to WMO, World Bank, with engagement of UNEP, UNECE Air Convention, AMAP, other experts and national/regional bodies)

Expansion and Improvement of Observation Infrastructure

- Should be made in a globally coordinated fashion based on equality through the World Bank and other development agencies with technical guidance from WMO.
- Should be shared in a way similar to other major research infrastructure investments (e.g., major physics experimental facilities).
- Should be multipollutant; include an appropriate mix of supersites and distributed sites, active and passive sampling, urban/rural/remote sites, new sensor technology; and be coordinated with new satellite observation capabilities, as the Global Earth Observation Systems and related activities where appropriate.

Investments need to be accompanied by Engagement

- Design of infrastructure should be appropriate for local needs and circumstances.
- Value of monitoring information needs to be demonstrated to local people and decision makers

Development of Emission Inventories & Scenarios
(to UNEP through emission scientists (GEIA, UNECE Air Convention), scenario developers (IPCC, UNECE Air Convention, AMAP, CCAC, etc)

Improve Consistency and Alignment of Emissions Inventories for Multiple Pollutants for Modeling and Assessment

- Increase Transparency of Drivers/Methods
- Assure education and quality control (TFEIP, ICOS, ACTRIS)
- Improve current emission data repositories information on availability, quality and education to achieve high quality multiple pollutant inventories with a regional and global coverage.

Evaluate Emissions through Inverse Modeling

- Particularly taking advantage of developed observation capabilities
- Methods Intercomparisons will be needed e.g. as through the IGAC/GEIA AMIGO

Coordinate the Development of Future Emissions Scenarios

- Make use of integration of Air Pollutants, GHGs, Hg, POPs
- Identify packages of measures of interest to different policy forums or stakeholder groups for wider community to analyze, e.g. coordinate with climate scenarios and make use of Shared Socioeconomic Pathway (SSP's) for reach relevant Sustainable Development Goals (SDG's).

Necessary Model Development & Application
(to European Commission with support of CLRTAP, AMAP, other Conventions)

Coordinate Models at Different Scales/Processes/Complexity

- Global to Regional to Local scale linkages, downscaling techniques
- Seamless prediction from AQ to Climate
- Evaluate Fitness for Purpose

Continue Move Towards Earth System Modeling

- Multi-Pollutant, Multi-Compartment
- Decrease uncertainty in AQ - Climate projections

Further Develop Attribution Methods and Tools

- Source/Process/Policy Attribution
- A priori Evaluation of Costs and Benefits of Measures
- A posteriori Evaluation of Outcomes and Effectiveness