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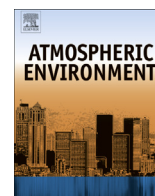
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New Directions: GEIA's 2020 vision for better air emissions information[☆]



We are witnessing a crucial change in how we quantify and understand emissions of greenhouse gases and air pollutants, with an increasing demand for science-based transparent emissions information produced by robust community efforts. Today's scientific capabilities, with near-real-time in-situ and remote sensing observations combined with forward and inverse models and a better understanding of the controlling processes, are contributing to this transformation and providing new approaches to derive, verify, and forecast emissions (Tong et al., 2011; Frost et al., 2012) and to quantify their impacts on the environment (e.g., Bond et al., 2013). At the same time, the needs for emissions information and the demands for their accuracy and consistency have grown. Changing economies, demographics, agricultural practices, and energy sources, along with mandates to evaluate emissions mitigation efforts, demonstrate compliance with legislation, and verify treaties, are leading to new challenges in emissions understanding. To quote NOAA Senior Technical Scientist David Fahey, "We are in the Century of Accountability. Emissions information is critical not only for environmental science and decision-making, but also as an instrument of foreign policy and international diplomacy."

Emissions quantification represents a key step in explaining observed variability and trends in atmospheric composition and in attributing these observed changes to their causes. Accurate emissions data are necessary to identify feasible controls that reduce adverse impacts associated with air quality and climate and to track the success of implemented policies. To progress further, the international community must improve the understanding of drivers and contributing factors to emissions, and it must strengthen connections among and within different scientific disciplines that characterize our environment and entities that protect the environment and influence further emissions.

The Global Emissions Initiative, GEIA (<http://www.geiacenter.org/>), is a center for emissions information exchange and competence building created in 1990 in response to the need for high quality global emissions data (Graedel et al., 1993). While the past two decades have seen considerable progress in developing, improving and assessing emission estimates, emissions continue to be a major contributor to overall uncertainty in atmospheric model simulations. Moving forward, GEIA aims to help build emissions knowledge in a rapidly evolving society by: 1) enhancing understanding, quantification, and analysis of emissions processes; 2) improving access to emissions information; and 3) strengthening the community of emissions groups involved in research, assessment, operations, regulation and policy.

Analysis. To improve the scientific basis for emissions information, GEIA will help facilitate analyses of emissions data with a combination of bottom-up methods, in-situ and remote observations, and atmospheric modeling, which have already proven to be powerful tools to survey emission changes and identify gaps in inventories (e.g., Kononov et al., 2008; Mellqvist et al., 2010; Fioletov et al., 2011; Polson et al., 2011; Pétron et al., 2012; Berezin et al., 2013; Brioude et al., 2013; Hilboll et al., 2013; McDonald et al., 2013). We envision a virtual clearinghouse of scientific emissions analysis that could enable construction of inventory ensembles and assimilation of observations for emissions evaluation and atmospheric forecasting. These efforts are advanced by GEIA working groups that focus on specific topics (<http://www.geiacenter.org/analysis/working-groups>). GEIA also liaises with other scientific initiatives addressing emissions, including the IGAC/iLEAPS/WMO Interdisciplinary Biomass Burning Initiative (<http://mpic.de/projekte/ibbi>), and with teams developing historic emissions datasets for the Coupled Model Intercomparison Project and the Intergovernmental Panel on Climate Change Assessment Reports. More groups and partnerships will form through dialogues identifying emissions challenges (e.g., changes in energy sources) and establishing paths for translating these challenges into improved emissions databases.

Access. GEIA seeks to advance accessibility to, and improved transparency of, emissions data and observations by improving how databases interact with each other and building on evolving interoperability efforts (Husar et al., 2008). In collaboration with the GEO Air Quality Community of Practice (http://wiki.esipfed.org/index.php/GEO_AQ_CoP) and the Federation of Earth Science Information Partners (<http://www.esipfed.org/>), GEIA is implementing the infrastructure and insights demonstrated by the Community Initiative for Emissions Research and Applications (<http://www.geiacenter.org/access/interoperability>). These and other groups are working to develop data standards, conventions, and metadata for Earth science datasets. Data interoperability is enabling the Earth science community to develop on-line visualization and evaluation tools, with the goal of creating a virtual workspace for emissions analysis and forecasting applications. GEIA will continue to provide and expand the datasets, algorithms, and documentation available through its Emissions of atmospheric Compounds and Compilation of Ancillary Data (ECCAD) portal (<http://pole-ether.fr/eccad>), with an emphasis on distributing consistent emission inventories and models for research and assessment efforts (e.g., TF HTAP, CCMI, and observational field studies) and ancillary datasets that inform inventory development. GEIA is also building a searchable bibliography for journal articles and reports on emissions.

Community. GEIA works to broaden and strengthen interactions between producers and users of emissions information by

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introducing innovative communication strategies, including its highly interactive new web site with forums for discussing emission information and challenges, and by organizing international events, such as the upcoming GEIA 2014 Conference (<http://www.geiacenter.org/community/geia-conferences/2014-conference>).

GEIA aims to facilitate the communication of emissions information to decision-makers by promoting the synthesis of high-quality emissions science into broadly accessible reports. GEIA helps to build emissions information capacity worldwide, especially in developing countries in Asia, Africa and Latin America, by endorsing regional emissions working groups and advocating for the development and dissemination of best practices for emissions estimation and uses.

By 2020, we envision addressing the critical need for better emissions understanding through more robust efforts to analyze emissions data, greater access to emissions information, and stronger connections across the emissions information community. The GEIA Steering Committee invites you to contribute to this vision by becoming an active member on the GEIA web site, sharing your expertise and data, participating in working groups, and using GEIA resources to carry out your professional endeavors.

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