Addressing Science and Policy Needs with Community Emissions Efforts

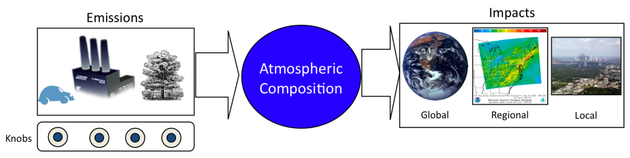
Gregory J. Frost[1,2]*, Claire Granier[1,2,3], Leonor Tarrasón[4], Sabine Darras[5], Stefan Falke[6], Alex Guenther[7], Johannes W. Kaiser[8], Terry Keating[9], Jean-François Lamarque[7], Cathy Liousse[5], Megan Melamed[10], Paulette Middleton[11], Aude Mieville[3,5], Mireille Paulin[12], Gabrielle Pétron[1,2], Vincent Pignot[5], and Steven Smith[13]

*For more information about GEIA and its associated activities, contact Greg Frost, gregory.j.frost@noaa.gov

(1) ESRL, NOAA, Boulder, Colorado, USA
(2) CIRES, Univ. Colorado, Boulder, Colorado, USA
(3) LATMOS-IPSL, CNRS/INSU, Univ. Pierre et Marie Curie, Paris, France
(4) Norwegian Institute for Air Research (NILU), Kjeller, Norway
(5) Laboratoire d'Aérologie, CNRS, Toulouse, France
(6) Northrop Grumman, Chantilly, Virginia, USA
(7) NCAR, Boulder, Colorado, USA
(8) ECMWF, Reading, United Kingdom
(9) OAR, US EPA, Washington, DC, USA
(10) IGAC, JISAO, Univ. Washington, Seattle, Washington, USA
(11) Panorama Pathways, Boulder, Colorado, USA
(12) CNES, Toulouse, France
(13) JGCRI, PNNL & Univ. Maryland, College Park, Maryland, USA

Motivation for Understanding Emissions

Actions and decisions about the atmosphere focus on emissions



Quantitative emission information is needed for:
- Accounting for the past
- Observing and calculating the present
- Predicting and projecting the future
- Taking action on emissions
- Making choices: Which "knob" to turn? Is one better than the other?
- **Do current emissions data meet our needs?**
- **How can these data be improved while maximizing sparse resources?**

Emissions Information Challenges

Many emissions data requirements are common to air quality and climate research, regulation, & policy

- Transparency
- Accuracy
- Uncertainty
- Consistency
- Timeliness

At the same time, there are many issues and needs associated with emissions data

Complexity
- Spatial/temporal scales
- Source types
- Interdisciplinary

Analysis
- Evaluations
- Uncertainties
- Impacts

Development
- Inconsistencies
- Timeliness
- Traceability

Communication
- Data access and sharing
- Literature access
- Producer – user feedbacks

Rationale for Community Emissions Efforts

- Involve scientific, regulatory, and operational communities
  - International/national/local agencies, academia, private sector
- Leverage existing expertise, data, and technology
  - Much of what is needed is already being done
- Use current resources more efficiently
  - Modest investments add significant value
- Connect air quality and climate change science and policy
  - Bridge scales and link common sources
  - Investigate feedbacks between energy, land use, emissions
- Broad expert community to evaluate and assess data
  - Bottom-up + top-down approaches
  - Benefit from interdisciplinary overlap
- Robust interagency feedback and cooperation essential
  - Understand drivers, needs, and constraints
  - Communicate and integrate diverse information

ECCAD

http://eccad.sedoo.fr/

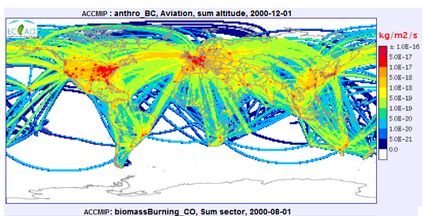
Emissions of chemical Compounds & Compilation of Ancillary Data

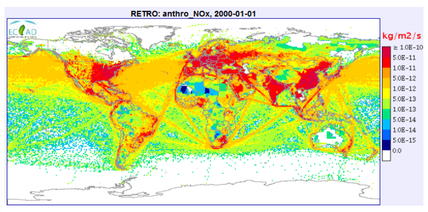
ECCAD is GEIA's new interactive emissions data portal

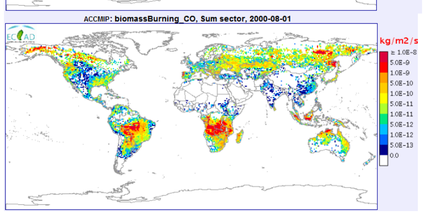
- Consistent access to GEIA's emission inventories and ancillary data with easy-to-use tools for analysis and visualization
- Supports EU science & forecasting projects
- *Funding*: French National Center for Space Studies (CNES)
- *PIs*: Claire Granier, Cathy Liousse

Emissions Inventories

- Relational database contains all emissions inventories in GEIA-ACCENT portal
- Interactive mapping tools

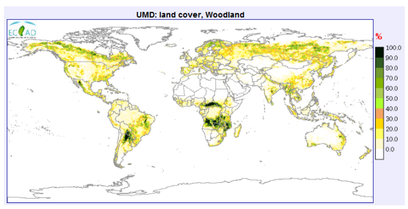


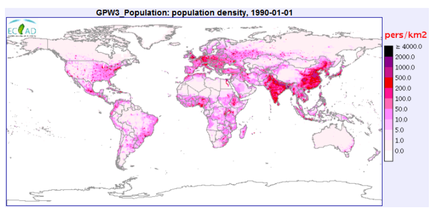


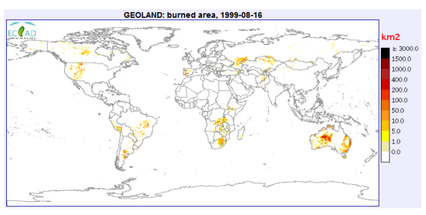


Ancillary Data

- Access to ancillary data used to construct emissions inventories, including
  - Population
  - Vegetation
  - Fires



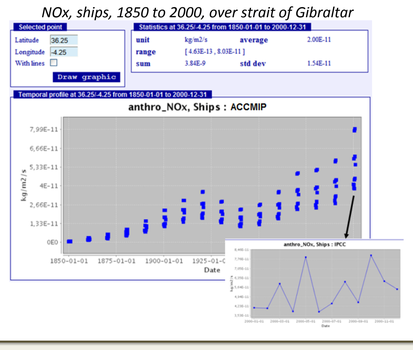


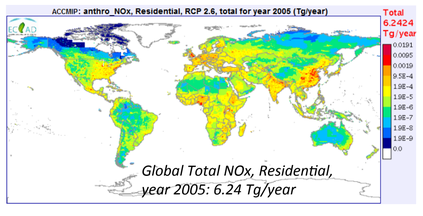


Interactive Graphical Tools

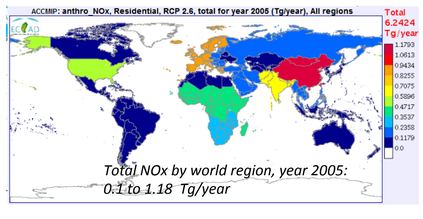
- Mapping
- Time series
- Analysis

NOx, ships, 1850 to 2000, over strait of Gibraltar





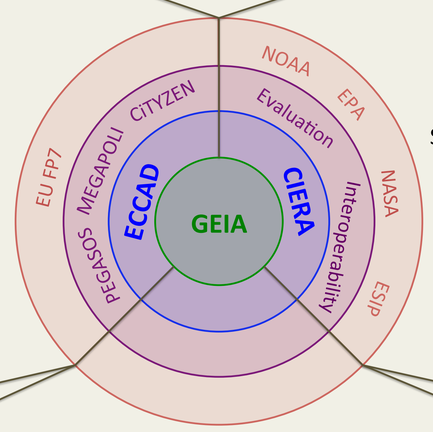
Global Total NOx, Residential, year 2005: 6.24 Tg/year



Total NOx by world region, year 2005: 0.1 to 1.18 Tg/year

GEIA Community Emission Efforts

Programs, Activities, Support, and Focus



GEIA

Global Emissions InitiAtive

http://www.geiacenter.org/

GEIA, a joint IGAC/iLEAPS/AIMES initiative, seeks to build on the success of the past two decades as a forum for the exchange of expertise and information that unites the scientific, regulatory, and operational emissions communities.

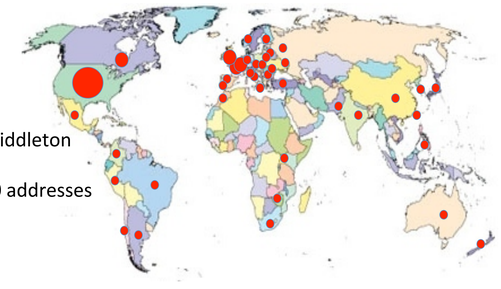
- Founded in 1990 with a mission to:
  - Quantify anthropogenic emissions and natural exchanges of trace gases and aerosols that drive Earth system changes, and
  - Facilitate use of this information by the research, assessment, and policy communities
- Provides access to various global and regional emission inventories in a consistent framework, in collaboration with ECCAD and CIERA
- Organizes workshops, conference sessions and schools that bring together inventory developers and users
- Facilitates emissions data evaluation and assessment
- Prepares state-of-the-science emissions summaries and provides these data to international scientific projects.

In its new phase, GEIA aims to demonstrate the potential of improving emission inventories by promoting the interoperability of datasets and tools and by making use of near-real-time observations.

Funding: NASA, EU programs
Chairs: Greg Frost, Leonor Tarrasón

GEIA Network

- Managed by Paulette Middleton
- NASA funding
- Network of almost 1200 addresses



CIERA

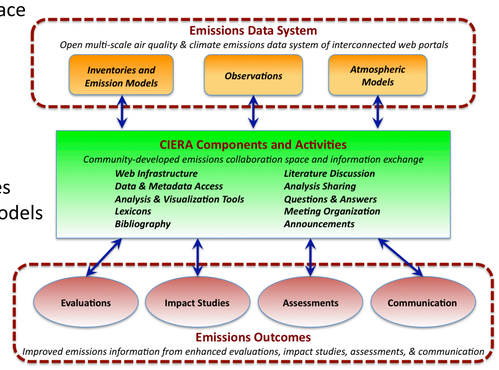
http://ciera-air.org/

CIERA Community Initiative for Emissions Research and Applications

Community Initiative for Emissions Research and Applications

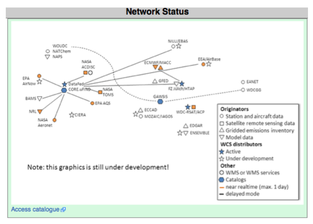
Holistic community effort to improve emissions information

- GEIA's new emissions collaboration space
  - Developing interoperability
  - Facilitating evaluations
  - Innovating in communications
- Community developed and driven
- Global and regional emissions data distributed across multiple portals
- Dynamic data access using web services
- Access to inventories, observations, models
- Standardized analysis tools
- New emissions information resources
  - Blogs and web forums
  - Emissions bibliography
  - Emissions lexicon
- *Support*: EPA, NOAA, ESIP



Air Quality Community of Practice

CIERA and ECCAD are part of the AQ COP, http://wiki.esipfed.org/index.php/GEO_AQ_CoP which connects an international community of air quality data providers working on common data structures, data standards & conventions, and standardized tools.

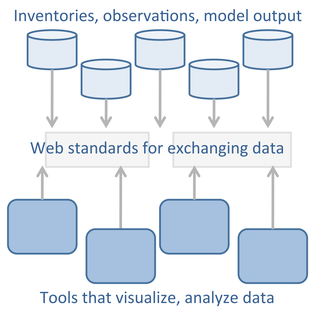


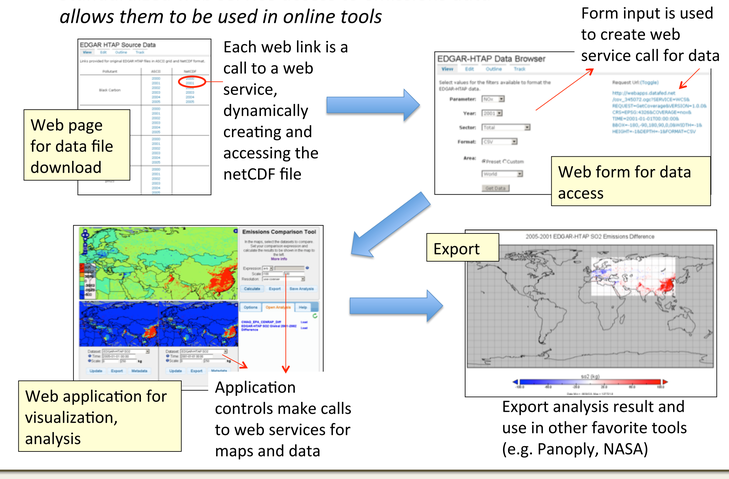
Why Use Web Standards?

Common, shared "pool" of data distributed across multiple organizations (made available on the 'cloud')

Standardized ways for accessing the data allow data providers to more easily share their data with a broader user base

Standardized data access enables data consumers across multiple organizations to build and tailor tools on top of data services



CIERA's Emissions Web Services

Standardized web service access to emissions data allows them to be used in online tools