The overall goal of the Global Emissions Inventory Activity (GEIA) of AIMES is to quantify the anthropogenic emissions and natural exchanges of trace gases and aerosols that drive Earth system changes. GEIA is currently chaired by Claire Granier (Service d’Aéronomie/ IPSL and CSD/ERSL/NOAA) and Alex Guenther (NCAR).

GEIA activities over the past year have focused on (1) formation of a steering committee and leaders for specific activities, (2) the further development of the GEIA/ACCENT emissions web portal, (3) the development of a database of driving variables, (4) the organization of a summer school, (5) the organization of an intercomparison of biomass burning emissions, (6) the participation into the organization of a workshop on climate change and air quality, and (6) the organization of an intercomparison of past emissions inventories.

The ACCENT network is coordinating the development of an emissions web portal, and is providing partial travel funds for participants to GEIA activities. Details on the ACCENT network can be found on the webpage. It should be noted that several non-European institutions are associate members in the network. The ACCENT network will continue its funding of the GEIA activities until approximately December 2009.

The GEIA Center (http://www.geiacenter.org) is directed by P. Middleton, who is responsible for the GEIA web site (http://www.geiacenter.org) and network and for the development and maintenance of the GEIA network, which currently includes over 8600 people around the globe. Information on GEIA activities are sent regularly to all the members of the network. Additional information on the center is included on the website.
Recent Details of activities organized within GEIA activities are summarized below:

1. Development of the GEIA/ACCENT data portal

With the help of the ACCENT network, a GEIA/ACCENT data portal has been developed, and the first dataset was available for download in summer 2005. The 1st version of the GEIA inventories (for years 1985 and 1990) is also available from the portal. The inventories currently available from the web portal are indicated in Table 1. It should be noted that, over the past decade, emissions have increased dramatically in Asia. Such an increase is currently not well reproduced in most global emissions inventories, which do not provide surface emissions after year 2000. Hajime Akimoto, a member of the GEIA steering committee, from the Frontier Research Center for Global Change (FRCGC) group in Japan, has provided the REAS (Regional Emissions Inventory in Asia), which provides emissions for several gases and particles for Asia from 1980 to the present, as well as different emission scenarios up to 2020.

All the datasets included in the database are available under the same format, either ASCII or NetCDF. The data portal can be accessed through the GEIA web site (http://www.geiacenter.org), the ACCENT network website (http://www.accent-network.org), or directly through the portal website: http://www.aero.jussieu.fr/projet/ACCENT/database.php

The GEIA-ACCENT web portal emissions is developed by A. Mieville (aude.mieville@aero.jussieu.fr).
Global Inventories

<table>
<thead>
<tr>
<th>Inventory</th>
<th>categories</th>
<th>spatial resolution</th>
<th>temporal resolution</th>
<th>years</th>
<th>Home site (for detailed data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POET</td>
<td>anthropogenic biomass burning natural</td>
<td>1° x 1°</td>
<td>annual (anthro), monthly (nat.)</td>
<td>1990 - 2000 period</td>
<td>[Link]</td>
</tr>
<tr>
<td>RETRO</td>
<td>anthropogenic biomass burning</td>
<td>0.5° x 0.5°</td>
<td>monthly</td>
<td>1990 - 2000 period</td>
<td>[Link]</td>
</tr>
<tr>
<td>EDGAR 3.2F72000</td>
<td>anthropogenic biomass burning</td>
<td>1° x 1°</td>
<td>annual</td>
<td>2000</td>
<td>[Link]</td>
</tr>
<tr>
<td>GFED v2</td>
<td>biomass burning</td>
<td>1° x 1°</td>
<td>monthly</td>
<td>8-day available on GFED home site</td>
<td>1997 - 2005</td>
</tr>
<tr>
<td>CO2 Andres et al.</td>
<td>anthropogenic</td>
<td>1° x 1°</td>
<td>annual</td>
<td>1751 - 2003</td>
<td>[Link]</td>
</tr>
<tr>
<td>GEIA v1</td>
<td>anthropogenic biomass burning natural</td>
<td>0.5° x 0.5°</td>
<td>annual + monthly for NOx, SO2, and Hg</td>
<td>depends on the compound</td>
<td>[Link]</td>
</tr>
<tr>
<td>AMAP-Mercury</td>
<td>anthropogenic</td>
<td>0.5° x 0.5°</td>
<td>annual</td>
<td>1995 and 2000</td>
<td>[Link]</td>
</tr>
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</table>

Regional Inventories

<table>
<thead>
<tr>
<th>Inventory</th>
<th>categories</th>
<th>spatial resolution</th>
<th>temporal resolution</th>
<th>years</th>
<th>Home site (for detailed data)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABBI - Asia</td>
<td>biomass burning</td>
<td>1° x 1°</td>
<td>1 day</td>
<td>March to May 2000 - March to May 2011</td>
<td>-</td>
</tr>
<tr>
<td>REAS-Asia</td>
<td>anthropogenic</td>
<td>0.5° x 0.5°</td>
<td>1 year</td>
<td>1980-2020</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 1: List of inventories available from the GEIA-ACCENT emissions web portal. The currently available inventories are POET (1° x 1°, 1990 to 2000, gaseous species only), RETRO (0.5° x 0.5°, 1960 to 2000, gaseous species, as well as different types of aerosols), and AMAP-Mercury (0.5° x 0.5°, 1995 and 2000, 3 vertical levels). We have also started to include regional inventories in the data portal: the first of these inventories is the so-called ABBI inventory, which provides biomass burning emissions for a large number of chemical species in Asia. Each dataset is provided with a detailed dataset description, i.e., abstract, references, detailed dataset description, i.e., abstract, references, contact details, spatial and temporal details, and details on the methodology used to construct the dataset. The data portal can be accessed through the GEIA web site (http://www.geiacenter.org), the ACCENT network website (http://www.accent-network.org), or directly through the portal website.

A graphical tool, which allows users to plot on the same scale the different inventories available in the database is now available on the web portal. This tool enables users to plot 1 to 4 emission maps on one page, for all the species available in each inventory, and any year/month considered in the inventories. Figure 2 provides an example of the plots obtained when using this tool.

The GEIA/ACCENT inventories are available in 2 formats, ASCII and NetCDF. Format transformation tools, and other tools to manipulate the data have been developed, and will be available soon on the data portal, as soon as the corresponding documentation is finalized. Other tools, such as interactive graphics, are being developed. Discussions are also underway with several groups, in order to include more emissions inventories on the portal.
2. Database of driving variables

Formation of the GEIA steering committee

In addition to the two co-chairs, Claire Granier and Alex Guenther, a steering committee was formed that includes Paulette Middleton (USA), Hajime Akimoto (Japan), Ivar Isaksen (Norway), Cathy Lioussé (France), Jean-François Lamarque (USA), Jos Olivier (Netherlands), Claire Reeves (UK), John VanAardenne (Italy), Vigdis Vestreng (Norway), Frank Dentener (Italy), Jean Francois Muller (Belgium), Klaus Butterbach-Bahl (Germany), Laurens Ganzeveld (Netherlands), Zig Klimont (Austria). Each steering committee member was assigned the task of developing a specific activity associated with the overall GEIA goal. The committee met in Paris on November 28, 2006 and detailed report is available from the GEIA center (www.geiacenter.org).

Algorithms used to parameterize the processes controlling anthropogenic and natural emissions, as well as the integration of regional and global emissions require the knowledge of the distributions of many different quantities such as population, energy use, large point sources, ecosystems, fire pixels, land-use change, etc. The development of a dataset of driving variables is an important task for the GEIA project.
variables has continued within GEIA and ACCENT. The first version of the database should be opened to the scientific community during 2008.

GEIA Organization of focused conference and outreach workshops

3. Summer school on emissions and atmospheric composition

The title of the school was: "Surface emissions and Prediction of Atmospheric Composition Changes". Several institutions in Europe and in the USA were interested in the topics of the school, and we received support from the INTROP (Interdisciplinary Tropospheric Research: from the Laboratory to Global Change) program of the European Science Foundation (ESF) and from the US National Science Foundation (NSF). The school also received support from the French National Center for Scientific Research (CNRS), and from the French Agency for Environment and Energy Management Agency (ADEME).

The goal of the school was to gather young scientists from different disciplines, in order to address current issues in the field of surface emissions and modeling of changes in the composition of the atmosphere. Since a large number of chemical compounds including both, gases and particles had to be considered, the tutorials, discussions and training focused on the following themes: (1) Emissions and deposition of gaseous compounds, (2) Emissions of aerosols, (3) Development of chemical schemes for studies of regional and global changes in the composition of the atmosphere, (4) Modeling of changes in the composition of the atmosphere, and (5) Impact of changes in the atmospheric composition on vegetation and humans.

58 students attended the school; the students came from 13 different European countries, and from 8 non-European countries. A report on the school activities has been written by the students and the lecturers. The report is available from the GEIA web site or from the ACCENT web site, at http://www.accent-network.org/portal/publications/accent-series-reports.

4. Intercomparison of biomass burning emissions

Biomass burning emissions are driving the interannual and seasonal variations of several atmospheric compounds such as carbon monoxide and aerosols. An intercomparison exercise has been organized within GEIA and ACCENT: the exercise is called INTERMEDE-BBSO (INTERcomparison of MEthods to DErive global Burned Biomass from Satellite Observations). Several methodologies exist to estimate and spatialize burnt biomass from fire products (burnt areas, active fires or a combination of both) as derived from Earth Observation data. Burnt biomass distributions display large differences and the different uncertainties need to be quantified. The goal of the intercomparison is to quantify the differences between the fire products, to evaluate existing methodologies used to derive global burnt biomass distributions from satellite data, and to agree on a consistent methodology combining both active fires and burnt areas to derive consistent emission
inventories using satellite data. The groups participating in the intercomparison will meet in early Fall 2008 to finalize the work.

5. Organization of a workshop on climate change and air quality

GEIA participated in the organization of an international ACCENT workshop called “Impact of Climate Change on Air Quality”. The goal of this workshop has been to identify and review the key uncertainties in the impact of climate change on tropospheric oxidants and precursors, on surface-atmosphere interactions, and on primary and secondary aerosols. Discussions also took place on how to build observation systems and modelling tools for studying these issues. The full report for this workshop is available on the ACCENT network web page, under: http://www.accent-network.org/portal/publications/accent-series-reports.

6. Organization of an intercomparison of past emissions inventories

GEIA is participating in the definition of the emissions distributions which will be used in the next IPCC AR5 report. We are currently organizing a workshop, where the participants will come to an agreement on what the community sees as the most appropriate emissions for the next IPCC in terms of historical and 2000 emissions. We will ensure that this information is usable by the emission scenario community for joining the past and future emissions across the 2000 boundary. Standard formats and templates have been defined to help in the comparisons. The workshop will take place on May 14-16 2008. The results of the intercomparison of emission datasets will be published in the open scientific literature.

Very preliminary results of the intercomparison of inventories of CO anthropogenic and biomass burning emissions are given in Figure 3 [Please do not publish or draw any conclusions from these very preliminary results].
Figure 3: A few preliminary results of the emissions intercomparison; all emissions are given in Tg CO/year.

Plans for the coming year:

- Start of a common ILEAPS-IGAC-GEIA activity on biogenic emissions, in order to better characterize what we know and don’t know about biogenic hydrocarbons, their emissions and chemical cycles. This activity could also be linked with the TROPCHEM activity of the AC&C (Atmospheric Chemistry and Climate) joint project of IGAC-IGBP and SPARC-WCRP.

- Start the development of a wiki-based system including an e-learning/e-working module on emissions.

- Continue the development of the web portal on emissions.

- Add to the emissions portal a database of papers and reports publicly available concerning emissions.

- Update the GEIA emissions reviews: the first versions of these short reviews were written in 2002. They provide the status of current knowledge of emissions of many chemical species.

- Complete the evaluation of the 1990 to 2000 emissions; finalize the selection of emissions to be used in the IPCC simulations, and write papers discussing the results of the intercomparison.

A summer school on “Surface emissions and prediction of atmospheric composition changes” has been organized for the benefit of early career scientists from different disciplines and nations to address current issues in surface emissions and modelling of the changes in the composition of the atmosphere. The school will be held September 11-20, 2007 in ile d’Oleron, France and is being organized by Claire Granier. Due to space restriction, only a third of the 170 applicants were admitted to the summer school. The school will give attendees access to leading scientists in the field as well as the opportunity to form collaborations with scientists from other nations and disciplines. The tutorials, discussions, and training will focus on the following themes: (1) Emissions and deposition of gaseous compounds, (2) Emissions of aerosols, (3) Development of chemical schemes for studies of regional and global changes in the composition of the atmosphere, (4) Modeling of changes in
the composition of the atmosphere; (5) impact of changes in the atmospheric composition on vegetation and humans. The school will consist of organized tutorial lectures on fundamental issues in the mornings, and short illustrative talks in the afternoons. Posters presentations by the students will also be an important component of the program. Small groups of students from different fields of research will be designated to summarize the lectures and illustrations. Each group of students will work with a lecturer to formalize the summaries, which will form the basis for an e-learning module that will be published on a publicly available website.

GEIA 200 conference
The GEIA 2006 conference was held in Paris on November 29—December 1. It was well-attended with over 100 registered participants. The conference included posters and oral presentations organized into four main science themes: anthropogenic emissions, integrating spatial/temporal scales, terrestrial ecosystems and biomass burning, and aerosols. A concluding session provided an opportunity for participants to provide input on the development and direction of GEIA. A detailed description of the conference is available at www.geiacenter.org.

Different workshops were organized in 2005-2006, which focused on the development of a database of driving variables (see next section), on the quantification of biomass burning emissions using satellite observations, and on emissions from combustion sources in non-OECD countries.

Workshop on biomass burning emissions
The title of this workshop, organized by C. Liousse (Laboratoire d’Aérologie, France) and J.M. Gregoire (Joint Research Center, Italy), was: “Biomass burning from satellite observations (BBSO).” It was held in Toulouse, France on December 14-15, 2005. The program, list of participants, presentations and report are available on the ACCENT network website, in the http://www.accent-network.org/portal/integration-tasks/access-to-emissions-data/Workshops-and-meetings page. Two joint initiatives have emerged as a result of the discussions:

- A compilation of the global and regional inventories for the determination of burnt biomass will be done, based on a questionnaire on available fire products. Burned areas, active fires and fire radiative energy measurements will be considered.
- An intercomparison exercise of emissions of particulate matter and carbon monoxide will be carried out. The reference year that has been chosen for this exercise is 2003. The goal of this activity is to understand the origin of the observed differences between estimates of biomass burning emissions, in terms of overall budgets and spatial/temporal distributions.

Workshop on emissions from combustion sources
The “Joint ACCENT/GEIA workshop on anthropogenic emissions for non-OECD countries in global inventories” took place in Vienna, Austria on February 8-10, 2006. It was organized by M. Amman (Institute for Applied Systems Analysis, Austria), J. Olivier (Environmental Assessment Agency, The Netherlands), and J. van Aardenne (Joint Research Center, Italy). The workshop focused on the following emission sectors: mobile (road and off road) land-based sources, combustion in the power plant and industrial sectors, biofuel used in the residential sector and burning of agricultural waste. Different compounds were considered, greenhouse gasses (CH$_4$ and N$_2$O), air pollutants (CO, NO$_x$, NMVOCs, NH$_3$, SO$_2$) and primary aerosols (BC, OC, PM$_{2.5}$, and PM$_{10}$). The participants reviewed the information contained in
existing global and regional emissions inventories, and discussed appropriate improvements for key sectors in different world regions.

The program of the meeting and presentations can be obtained from the workshop web site: http://www.iiasa.ac.at/rains/meetings/ACCENT_GEIA/Accent-agenda.html.

Database of driving variables

The goal of this project is to provide the scientific users with ancillary data required to quantify the surface emissions of chemical species. These data will allow for example to improve existing inventories or to calculate emissions using either relatively simple algorithms or comprehensive models simulating emissions processes.

A GEIA/ACCENT workshop partially funded by the ACCENT network was held in Paris in April 2005, which helped defining define needs for the database: the program, participants and presentations given at the workshop are available from the ACCENT emissions workshops webpage: http://www.accent-network.org/portal/integration-tasks/access-to-emissions-data/Workshops-and-meetings. Pilot projects were identified, and a proposal, endorsed by AIMES and by IGBP, was sent to the French CNES, which was accepted in the summer of 2005. One person started to work on this project in October 2005, and the architecture of the database is now ready has been defined, together with graphical tools allowing interactive plots and statistical analyses of the data. The group in charge of this project has started to work on a protocol for the use of the data. It is expected that this database will be open to the scientific community at the end of the winter 2006. Links with the Atlas/AIMES project will also be formally established during the coming months.

GEIA 2006 Conference and 2007 summer school.

The GEIA 2006 Open Conference will take place in Paris, France on November 29, 30 and December 1st. Four discussion themes are considered, (1) Emission trends: from the past to the future, (2) Integration of spatial and temporal scales, (3) Terrestrial ecosystems/biomass burning, and (4) Natural aerosols. About 60 abstracts have been received at the end of 2006, and it is expected that about 90 people will attend the conference. On November, 28th, both the GEIA and ACCENT emissions steering committees will meet, and discussions on future activities and planning for the coming years will take place. During this joint meeting of the steering committees, discussions on collaborative projects within AIMES, and with other IGBP projects (IGAC, iLEAPS, SOLAS) are planned.

The organization of a summer school entitled “Surface emissions and prediction of atmospheric composition changes” has been proposed to different organizations. This idea has been welcomed by international organizations. A small budget has for now been allocated by the European Science Foundation to start the organization of the school, and several activities within the ACCENT network will help funding the school, which should be sufficient for the support of the European participants to the school. During 2007, other proposals will be submitted, in to help non-European students, post docs and young scientists to attend the school.