

GEIA Emissions Activities

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Thanks to...

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GEIA Co-Chair

Norwegian Institute for Air Research, Kjeller, Norway



Max-Planck-Institut
für Meteorologie



GEIA Overview

GEIA Mission

GEIA is a community initiative that builds bridges between environmental science and policy, by bringing together people, data, and tools to *create and communicate* the highest quality information about **emissions**.

GEIA Connections



GEIA Leadership Team

Co-Chairs: Gregory Frost, Leonor Tarrasón

Database Manager: Claire Granier

Network Manager: Paulette Middleton

GEIA Scientific Steering Committee

Gregory Frost

Leonor Tarrasón

Beatriz Cardenas

Hugo Denier van der Gon

Claire Granier

Alex Guenther

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Johannes Kaiser

Terry Keating

Zbigniew Klimont

Jean-François Lamarque

Catherine Liousse

Paulette Middleton

Slobodan Nickovic

Toshimasa Ohara

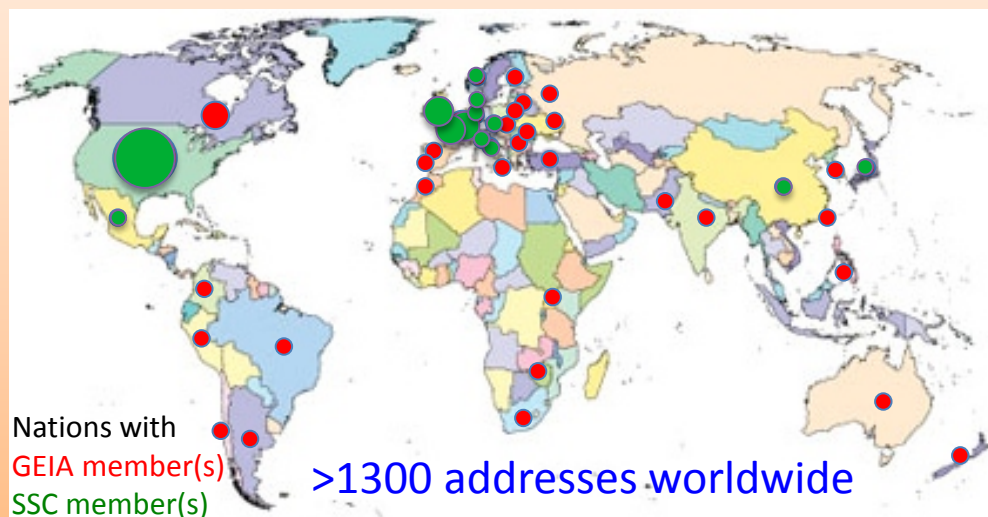
Martin Schultz

Ute Skiba

John van Aardenne

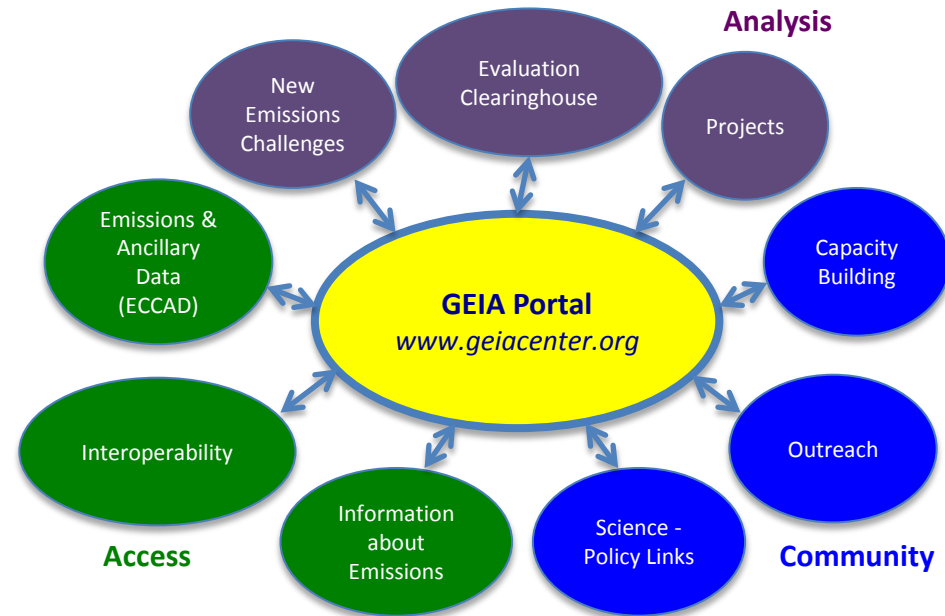
Yuxuan Wang

GEIA Network



Recent GEIA Activities

- New GEIA vision formulated
 - Frost et al. (2013) *Atmos. Environ.*
- New GEIA web site built
<http://www.geiacenter.org/>
- Welcomed China Emissions WG to GEIA
 - East Asian Emissions Assessment (ACP)
- Distributing data for research & assessment efforts via ECCAD
 - HTAP, CCMI, CMIP, MACC, SENEX/SOAS
- Organizing sessions at AGU Fall Meeting
 - 6 oral sessions (Wednesday-Friday), 1 poster session (Wednesday)
 - Town Hall: Thursday, 6:15-7:15 pm, Moscone West 2005
- Developing GEIA web forum for online discussion, FAQs about emissions datasets
 - Prototype system for HTAP
- Collaborating with Interdisciplinary Biomass Burning Initiative (IGAC/iLEAPS/WMO)
- Planning 2014 GEIA Conference
- Organizing community historical emissions effort



16th GEIA Conference

Bridging Emissions Science and Policy

Conference Objective

Explore role of emissions as crucial link between scientific innovation and societal development

Questions Addressed by Conference

How are recent measurement advancements helping to better quantify emissions?

What are new developments in emissions process understanding?

What are challenges in interpreting past emissions trends and projecting future emissions?

How does improved emissions knowledge inform critical societal issues?

Intended Audience

- Emissions information developers and users
- Research, regulatory, policy, and assessment communities



10-11 June 2014

NCAR, Boulder, Colorado

Abstract Submission Open!

Deadline: 17 January 2014



Conference Location: NCAR Center Green



ECCAD = Emissions of atmospheric Compounds & Compilation of Ancillary Data

GEIA's emissions database and visualization/analysis platform

The ECCAD team:

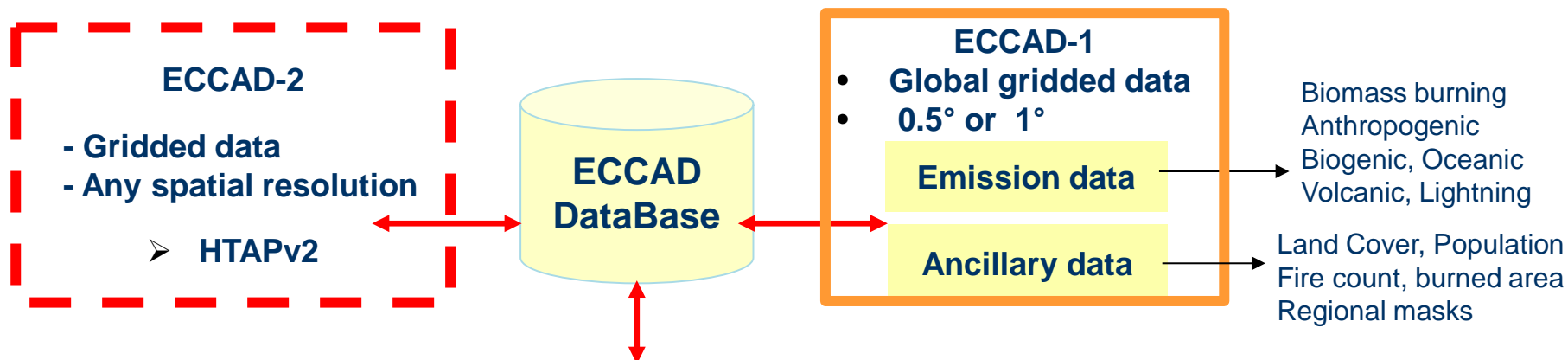
Chairs: Claire Granier (France/USA/Germany) and Cathy Liousse (France)

Project manager: Mireille Paulin (France)

Technical Team: Sabine Darras, Aude Mieville, Richard Hitier (France)

**Advisory Board: Greg Frost (USA), Martin Schultz (Germany),
Hugo Denier van der Gon (The Netherlands), Johannes Kaiser (UK/Germany),
Frederic Chevallier (France), Dominique Serca (France),
Beatrice Marticorena (France)**

ECCAD structure



ECCAD web application

Documentation

- Home page
- Project
- Users
- Partners

Data Catalog

- Datasets
- Species
- Sectors
- Totals
- Temporal Coverage

Tools

→ Geograph. area
→ Time Period

Data Selection

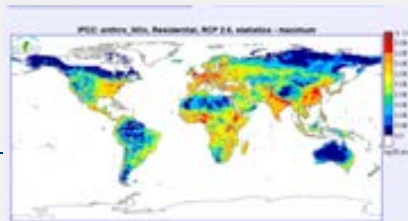
- Category
- Parameter
- Sectors

Map Compare

- Arithmetic operations
- Scatter plot

Map Display

- Grids 720*360, Zoom
- Colorbar, Scale type
- Scale range Min/Max



* for Biomass Burning

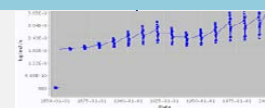
Emission Calculation

- Emission factor
- Landcover map
- Burned area

Data analysis

→ Totals computation
→ Regional masks

Time Series



Time series analysis

Parameter	Unit	Value	Unit	Value	Unit	Value	Unit	Value	Unit
Biomass	kg	1000	kg	1000	kg	1000	kg	1000	kg
Landcover	ha	1000	ha	1000	ha	1000	ha	1000	ha
Population	1000	1000	1000	1000	1000	1000	1000	1000	1000
Fire count	1000	1000	1000	1000	1000	1000	1000	1000	1000
Burned area	1000	1000	1000	1000	1000	1000	1000	1000	1000

Regridding

Download Data grid

- NetCDF
- ASCII

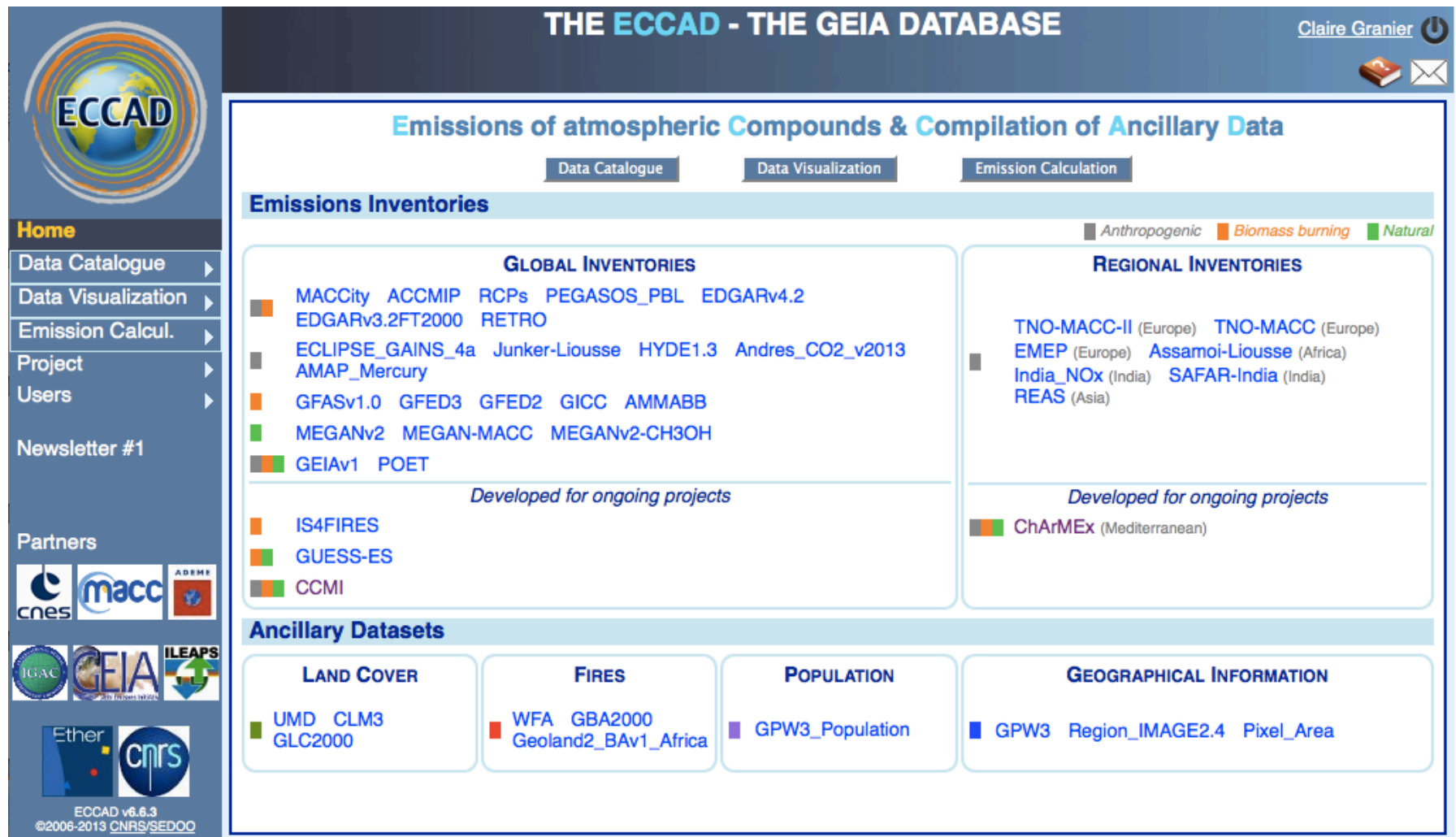
Export Metadata

- Pdf, Html

Outputs

- Png, EXcel

Current ECCAD Home Page and Data Catalogue



THE ECCAD - THE GEIA DATABASE Claire Granier

Emissions of atmospheric Compounds & Compilation of Ancillary Data

[Data Catalogue](#) [Data Visualization](#) [Emission Calculation](#)

Emissions Inventories

■ Anthropogenic ■ Biomass burning ■ Natural

GLOBAL INVENTORIES

- MACCity ACCMIP RCPs PEGASOS_PBL EDGARv4.2 EDGARv3.2FT2000 RETRO
- ECLIPSE_GAINS_4a Junker-Liousse HYDE1.3 Andres_CO2_v2013 AMAP_Mercury
- GFASv1.0 GFED3 GFED2 GICC AMMABB
- MEGANv2 MEGAN-MACC MEGANv2-CH3OH
- GEIAv1 POET

Developed for ongoing projects

- IS4FIRES
- GUESS-ES
- CCMi

REGIONAL INVENTORIES

- TNO-MACC-II (Europe) TNO-MACC (Europe)
- EMEP (Europe) Assamoi-Liousse (Africa)
- India_NOx (India) SAFAR-India (India)
- REAS (Asia)

Developed for ongoing projects

- ChArMEx (Mediterranean)

Ancillary Datasets

LAND COVER

- UMD CLM3 GLC2000

FIRES

- WFA GBA2000 Geoland2_BAv1_Africa

POPULATION

- GPW3_Population

GEOGRAPHICAL INFORMATION

- GPW3 Region_IMAGE2.4 Pixel_Area

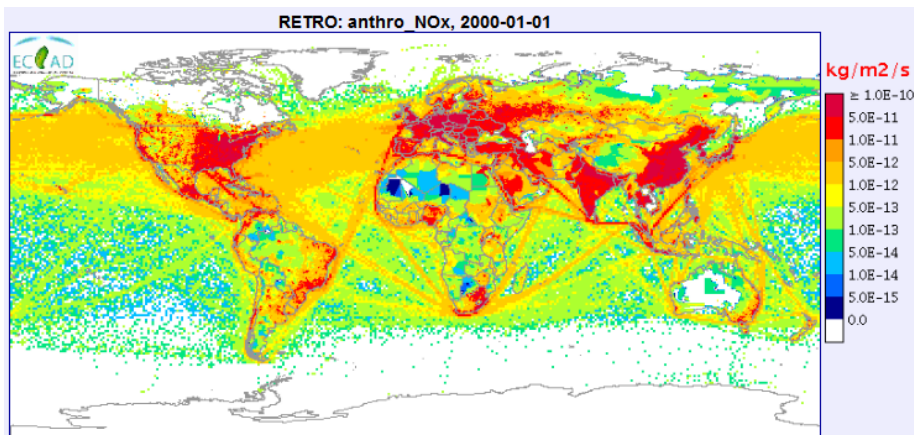
Partners

ECCAD v6.6.3
©2006-2013 CNRS/SEDOO

Many different inventories, including global and regional datasets

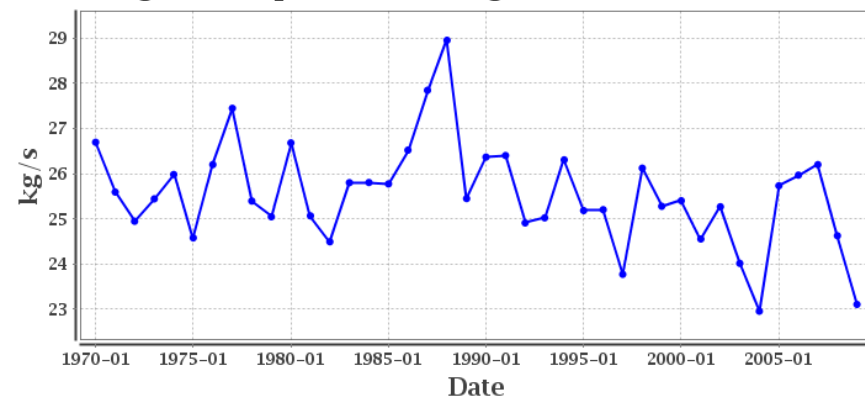
Examples of ECCAD tools

Visualization of emissions maps



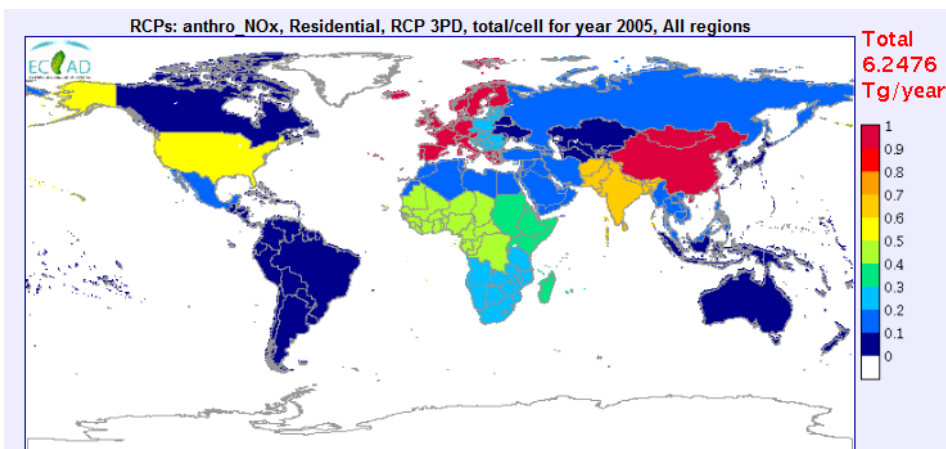
Temporal variation for a country over a period of time

biogenic_isoprene, total/region : GUESS-ES, USA

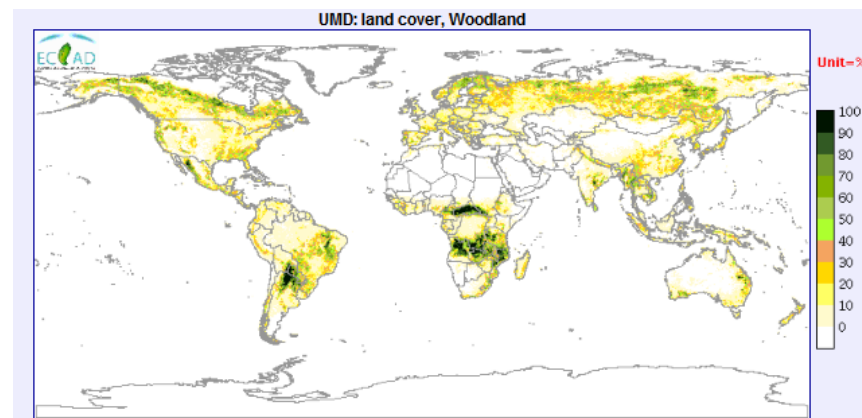


Temporal profile at 0.5/0.5 from 1970-01-01 to 2009-12-31

Total emitted for different regions



Ancillary data



Currently under development: maps of comparison calculations, scatter plots

Limitations of ECCAD-1 portal: 0.5° or 1° resolution only, complicated download system, data selection assumes prior knowledge of dataset

ECCAD-2 Home Page (Preliminary)

<http://eccad2.sedoo.fr/interface/>

New version of ECCAD under development - thanks to EPA!

Note:

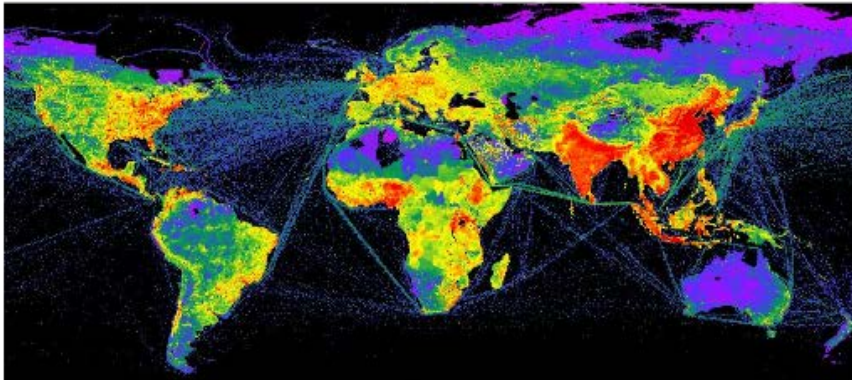
Since the site is still under development, expect frequent changes in the look and contents



ECCAD

Emissions of atmospheric Compounds & Compilation of Ancillary Data

Home ▾ Data catalogue ▾ Data Access ▾



News

- HTAPv2 anthropogenic inventory now available
- HTAP Global and Regional Modeling Workshop, 5-6 December 2013 - San Francisco

Data

- Any lat/lon resolution
- Country-level data (summer 2014)
- Data archive adapted to interoperability
- Detailed metadata & documentation

Download

- Regridding to any lat/lon grid
- Options for lon/lat order:
 - N/S or S/N; 0-360 or -180/180

Welcome to ECCAD - GEIA :

The ECCAD - GEIA portal provides access to HTAPv2 global inventories and a preliminary display tool.

- Spatial resolution 0.1x0.1°
- Years 2008 and 2010
- 9 Species and 7 sectors
- Data Flux and annual gridded totals
- Metadata See Data description
- Data are downloadable as interoperable NetCDF CF-compliant files
- [HTAPv2 documentation](#)

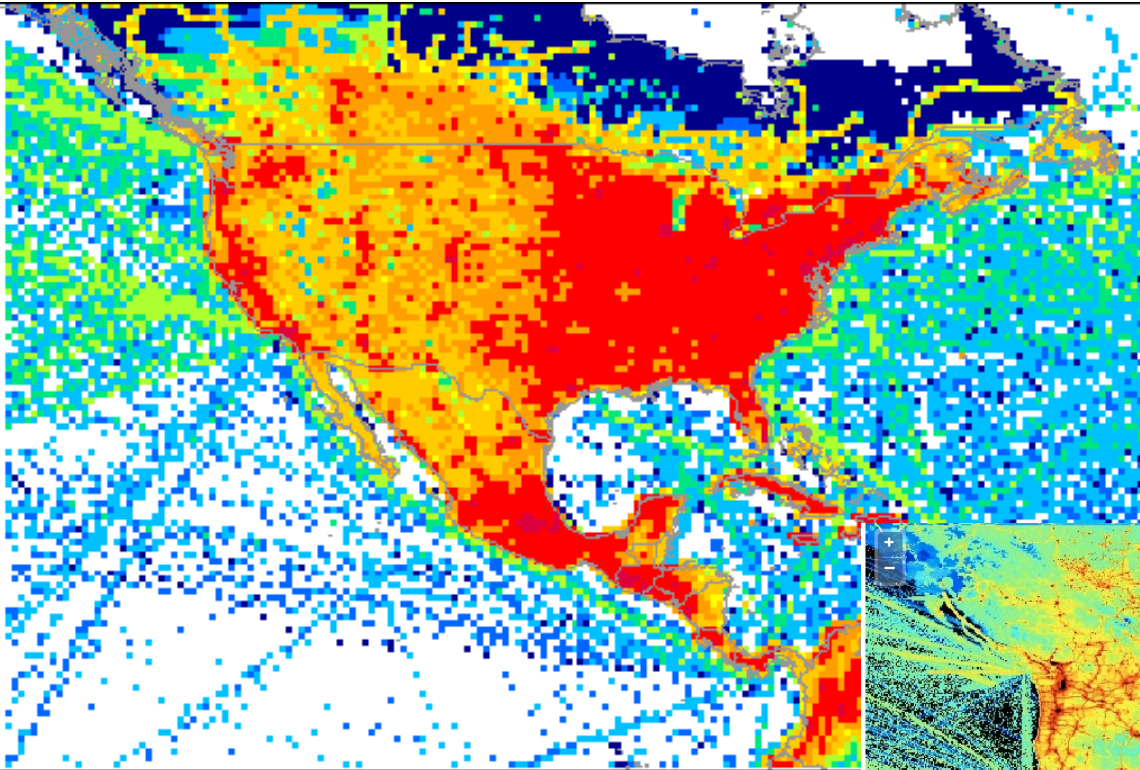


HTAPv2 is only dataset currently available

ECCAD-2: the new selection system available in 2-3 months

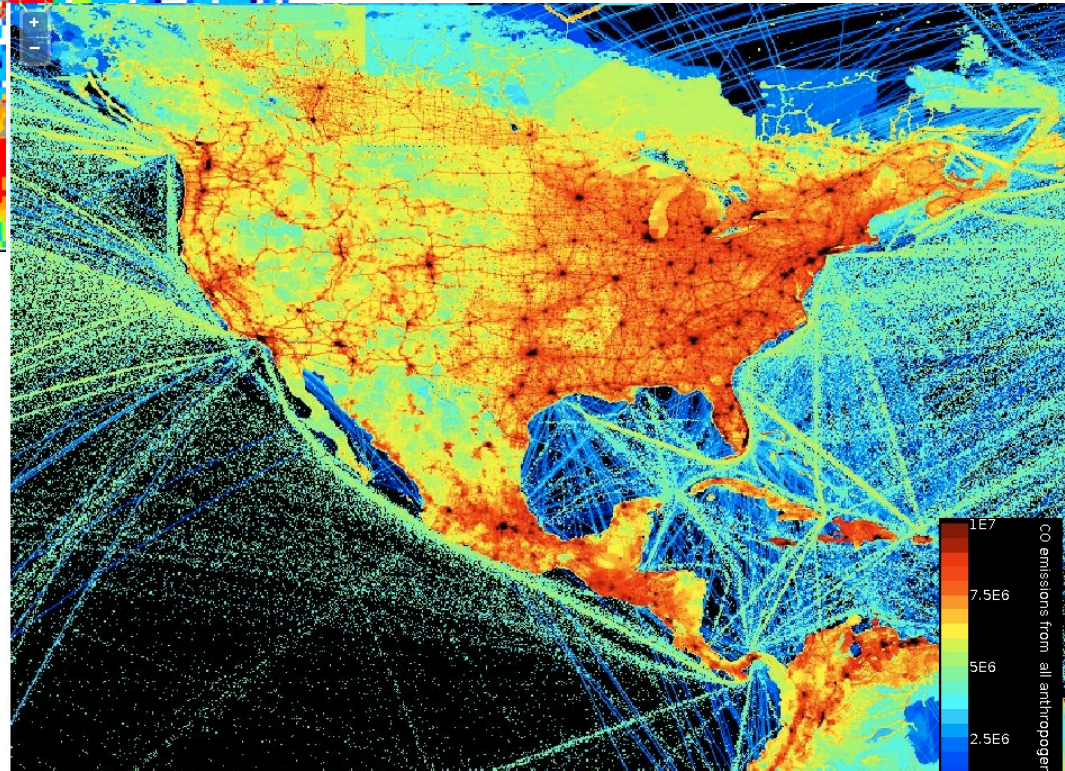
Home		Catalogue		Data Access		Help			
Emission Data		Selection		Map Display		Time Series		Download	
Datasets <u>Categories</u> Anthropogenic Biomass Burning Biogenic Oceanic Volcanic Lightning Total		Species <u>Groups</u> Greenhouse Gas Reactive Gas Aerosols Alk-anes/enes/ynes Aromatics Halogens ...		Geographical <u>Region Of Interest</u> Global Regional Africa Asia Europe North America South America		Spatial res. <u>Degrees</u> 0.1 0.25 0.5 1.1		Time <u>Step</u> Daily Monthly Yearly Decade <u>Temporal Coverage</u> 10 years 50 years 100 years	
Inventories MACCcity ACCMIP RCPs EDGARv4.2 EDGARv3.2FT2000 RETRO ECLIPSE Junker-Liousse HYDE1.3 Andres_CO2_v2012 AMAP_Mercury GFASv1.0 GFED3 GFED2 GICC AMMABB MEGAN-MACC MEGANv2 MEGANv2-CH3OH GEIAv1 POET IS4FIRES GUESS-ES TNO-MACC EMEP		Species All CO2 CH4 N2O CO NOx NMVOCs SO2 BC OC NH3 PM2.5 TPM H2 Hg DMS ethane propane butanes pentanes hexanes heptane butanes_&_higher_alkanes hexanes_&_higher_alkanes ethene		Sectors <u>ACCMIP</u> All Residential Industrial Transport Waste Agriculture Waste Agriculture Energy Solvents Ships Aviation Forest fires Biomass burning		<u>More sectors UNFCCC/IPCC - SNAPs +</u> Animal excreta Forest fires Enhanced N2O soil emission following tropical forest clearing Soils under natural vegetation and fertilized lands Fossil fuel burning Energy manufacturing and transformation, includes fugitive Energy manufacturing and transformation Energy industry and waste incineration Energy industry and waste Energy industry Refineries and transformation Transformation, Fossil fuel production, Refineries and steel Transformation and non-energy use of lubricants Combustion in manufacturing industry Road and non-road transportation Road transportation Non-road transportation Non-road ground transportation International and domestic aviation International and domestic shipping Residential and other sectors			

ECCAD-2 vs ECCAD-1: Improved inventory resolution



MACCity CO
0.5° resolution

HTAPv2 CO
0.1° resolution



Community Historical Global Emissions Effort

- Process to develop a comprehensive community historical emission inventory *framework*
- Multiple inventory products to be used in several projects: Climate Model Intercomparison Project Phase 6 (CMIP6), IGAC/SPARC Chemistry-Climate Model Initiative (CCMI) and other IGAC projects, Monitoring Atmospheric Composition and Climate Project (MACC), etc.
- Support Earth System Models, Chemistry-Climate Models, and Air Quality Models
- Consider same chemical compounds as ACCMIP dataset, plus long-lived climate forcers (CO₂, CFCs, N₂O), short-lived climate forcers (O₃, CH₄, aerosols), and halogenated compounds
- Hamburg workshop (20-21 November 2013): Discussed process for developing inventory products, formed several working groups, and identified potential leaders and participants for each of these groups

Previous Historical Emissions Efforts

ACCMIP (developed as part of CMIP5)

- International group of experts defined monthly sectoral anthropogenic and biomass burning non-CO₂ emissions for year 2000 = anchor point for historical and future emissions
- Generate emissions every decade + 2005
- Provide VOC speciation
- Provide concentration & nitrogen deposition fields

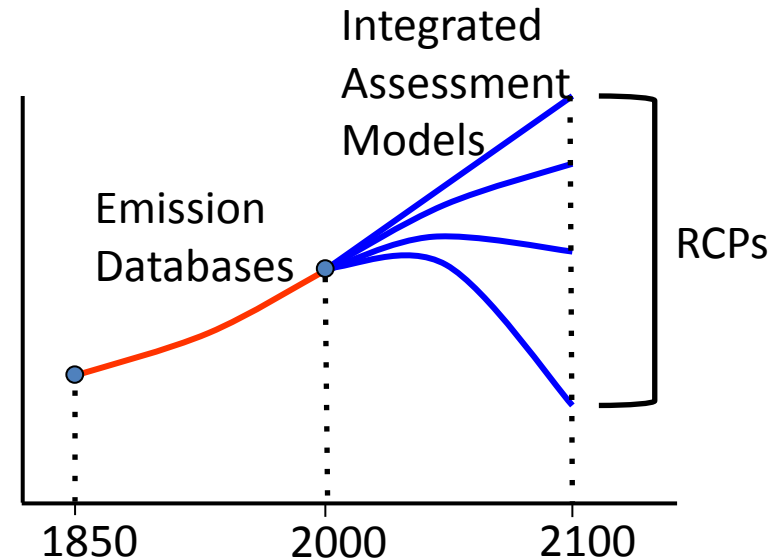
MACCcity (developed for MACC and CityZen projects):

- Emissions each year from 1960 to 2010
- Use RCP 8.5 future scenario for 2005 and 2010
- Interpolate ACCMIP emissions for different sectors

Limitations

- First time, tight schedule – no testing
- Disconnect with CO₂ emissions
- Constant gridding and VOC speciation
- Data held in multiple data locations (later centralized at IIASA)
- Only provided central/best estimate every decade
- Disconnects: harmonization period (2000) + simulations (2010) + LLGHGs (2005)
- No mechanism for corrections

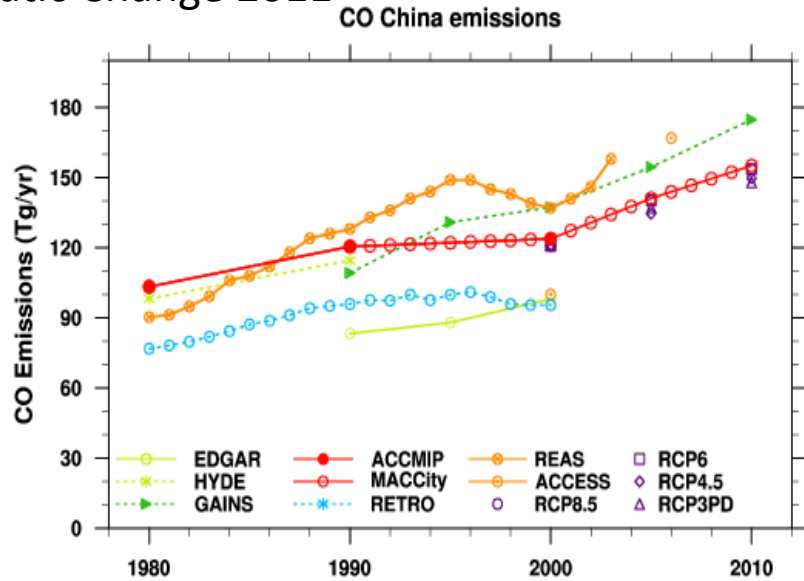
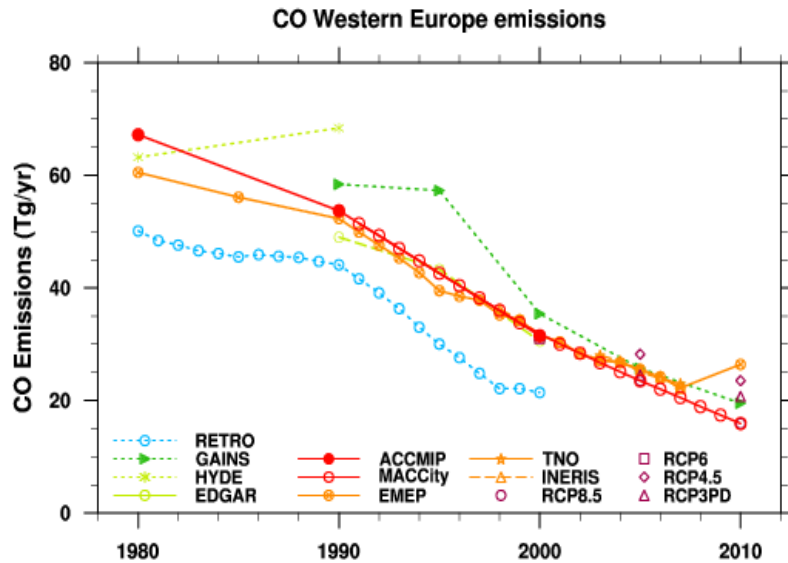
Best Estimate CMIP5 Emissions



Lamarque et al., ACP, 2010

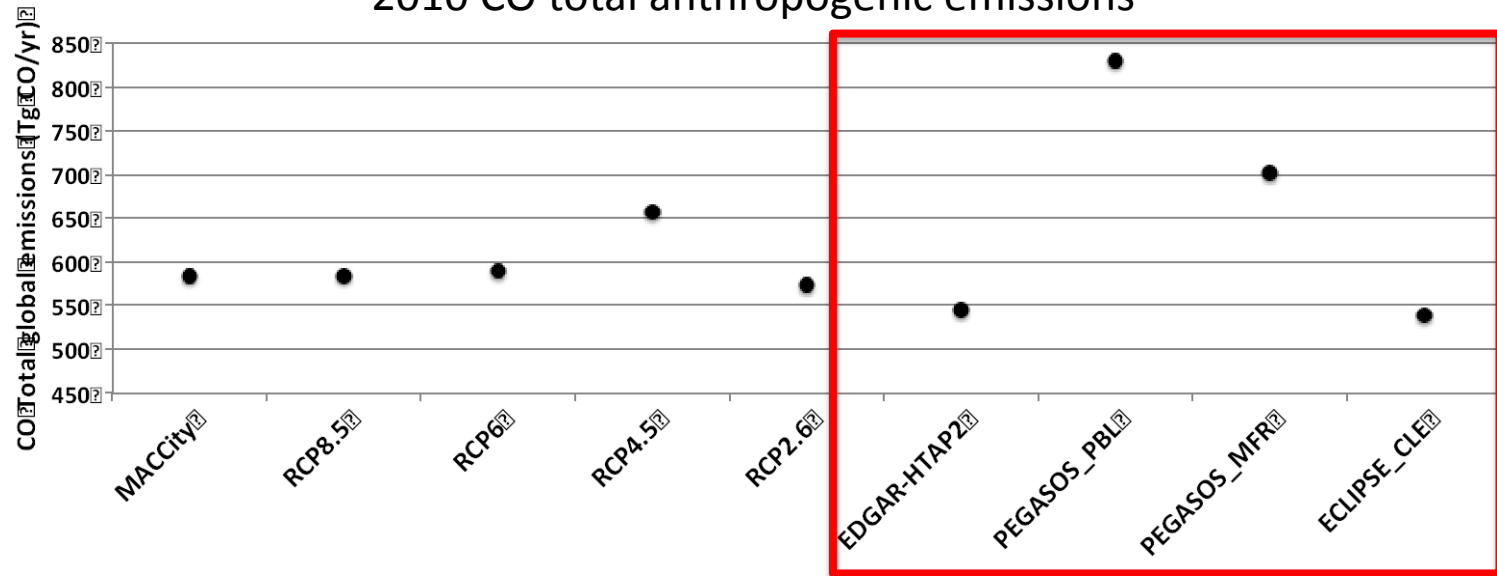
Comparisons of Global Emissions Inventories

Granier et al., Climatic Change 2011



Update of
Granier et al.
including
recent
inventories
→ To be
published!

2010 CO total anthropogenic emissions



Community Historical Emissions: Process

- Work will be done by different topic or production groups
- Priorities need to be defined; could depend on user communities
- Process followed within each group
 - Assess previous work
 - Evaluate datasets
 - Propose new activities
 - Write objectives, so that other groups know about them
 - Define papers, reports, proposals to be written
 - Identify new participants
 - Inform to full group via web forum
 - Propose abstracts/papers to workshops/conferences

Community Historical Emissions: Topics

One Atmosphere = greenhouse gases + reactive gases + aerosols

- Evaluation and testing: multi-model/model-measurement comparisons, inverse modeling
- VOCs speciation
- Consistency of air pollutants with CO₂
- Seasonal variations using observations
- Agricultural and biogenic emissions
- Energy development (e.g., oil/natural gas, flaring)
- Leverage developments of wildfire emissions community (e.g., IBBI)
- Shipping and aircraft emissions
- Process for regular updates
- Include efforts of other working groups (e.g., GEIA China)
- Other topics under study can be included in process

Community Historical Emissions: Outcomes

- GEIA web site: virtual workspace, information storage, forums
- Next meeting: Possibly GEIA Conference, June 2014, Boulder
- Document in papers: ESSD (dataset); JGR, ACP, etc (analysis)
- Inventory product timeline
 - **2015**: Emissions up to 2010 (2012?) for CMIP6, CCMI phase 2, UNEP WMO Ozone report
 - **2015**: Deliver historical emissions up to 2014 to integrated assessment groups for scenario trend analysis
 - **2016**: Estimated history up to 2014 + future projections harmonized to 2015 (handshake completed)
- **Want to join this effort?** Contact Greg, Claire or Jean-François