



# Community Emissions Data System (CEDS) - New Historical Emissions for Aerosol and Chemistry Research

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*This effort grew out of experience producing historical emissions for the RCP/CMIP5 process several years ago.*

## Steering Committee

Laura Dawidowski (NAEC, Buenos Aires)  
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## Collaborators

Liu Liang, Tami Bond (U Illinois), Bob Andres (ORNL), Others

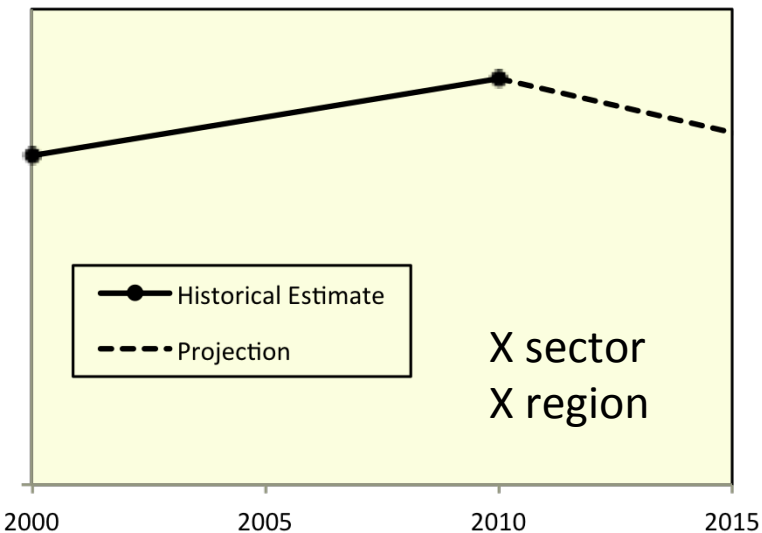
## ***CEDS Goals:***

***Emissions with the same standards of timeliness, openness, and uncertainty quantification as other key model inputs.***

Timely “research” estimates for emissions of aerosol (BC, OC) and aerosol precursor compounds (SO<sub>2</sub>, NO<sub>x</sub>, NH<sub>3</sub>, CH<sub>4</sub>, CO, NMVOC) are key inputs for aerosol research and Earth System Models

*Needed for historical and future simulations, validation/comparisons with observations, historical attribution, uncertainty quantification, IAM calibration and validation, and economic/policy analysis.*

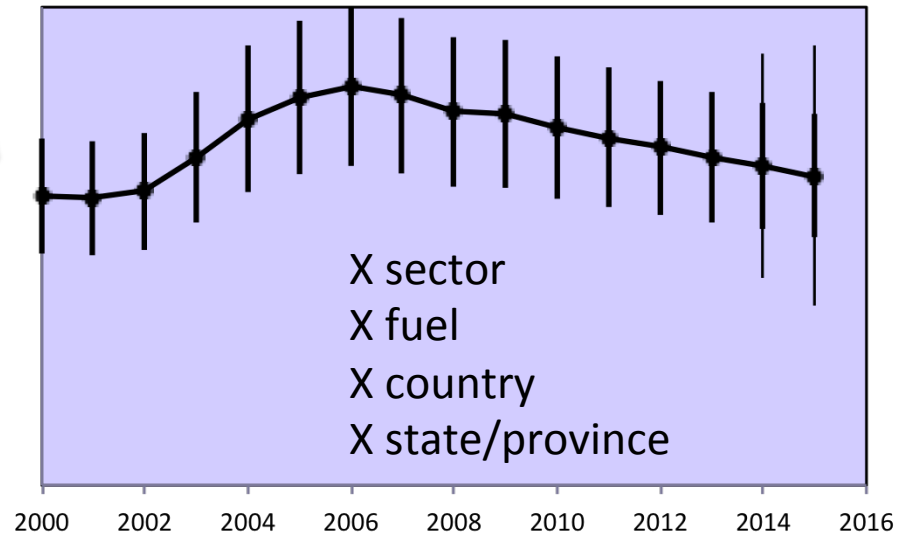
## Instead of this



Produced using an open-source data system to increase data transparency and facilitate research advancements.

## Produce

*Uncertainty essential for estimates of more recent years.*



## Approach: Hybrid of bottom-up emissions & inventory

- Develop a default dataset (GAINS emission factors, EDGAR, etc.)
- Calibrate to country-level inventories at the sectoral level where available and reliable (e.g., most policy-relevant). Similar to approach for RCP/CMIP5 data and EDGAR-HTAP.
- Most of the effort is in gathering input data
  - Driver data (historical energy, agricultural output, other sectors)
  - Default emissions factors. Sectoral emissions for calibration.
- Methodologies similar to Smith et al. (2011) & Klimont et al. (2013)

## Produce “a” best estimate, not a fully independent estimate

- In most OECD countries much effort goes into estimating emissions, so use those. Important when control levels are changing over time.
- Emissions factors are changing less rapidly in many developing countries (but are less well known in many cases).
- Some countries (e.g. China, SE Asia) – changes are also rapid –are also more uncertain. Challenging. Wider community involvement can improve results.

## Phase I: 2015

Community input and review in both phases.

- Build emissions data system
- Updated dataset for CMIP6 focusing on recent decades (Winter 2015)

## Phase II: 2016 – 2017

- Consistently estimate uncertainty over time and region
- Expand sub-regional detail for large countries and extend emissions estimates over entire industrial era
- Improve gridding, add seasonality and other characteristics

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## Implementation

- Modular, data-driven system, in the **R open-source platform**
- Flexible, automated system
- Consistent with country-level inventories (where desired/appropriate)
- Open source code and input data (where possible)
- Tool for emissions research more broadly

Interim emissions data product that updates the Lamarque et al. (2010) dataset in time for CMIP6.

- Recent emissions consistent with country inventory data over approximately ~1970 – 2014
- Early Winter 2015 Data: SO<sub>2</sub>, NO<sub>x</sub>, CO, NMVOC, NH<sub>3</sub>, CH<sub>4</sub>, BC, OC, CO<sub>2</sub>
- EDGAR 4.3 (0.1°) basis for gridding and default emissions
- Extrapolate to earlier years using RCP data (e.g. HYDE)
- Future scenario will be harmonized to depart from this starting point
- Additional features will be added in Phase II

## Calculation Status (Oct 1, 2015)

### Emission Data Used

Gains (Default EF)  
US Emission Trends  
Canada Emission Trends  
UNFCCC Reporting  
EDGAR, REAS, AdI Results  
Asia, US NEI, EMEP



**Emissions of SO<sub>2</sub> by  
Country, Sector, Fuel  
(1960/1971 – 2014)**

## Uncertainty For Most Recent Years (Phase I)

*It is critical that emissions for recent years are coupled with uncertainty estimates*

- The additional uncertainty in the most recent years can be rigorously assessed by applying the extension methodologies to past data

*Although “past uncertainty does not guarantee future uncertainty”*

## Comprehensive Uncertainty Estimates (Phase II)

*All bottom-up emission uncertainty estimates contain a substantial element of expert judgment*

- Guide assumptions with literature, comparisons between inventories, and comparisons between within CEDS
- Reduce dimensionality by a “tiered” approach to group assumptions  
*Otherwise: ~40 sectors X 200+ countries X 5 fuels X ~10 emissions*
- Consider correlations across sectors and countries (spatially)
- Result: consistent uncertainty estimates across species and regions

## Your input is encouraged

- [ssmith@pnnl.gov](mailto:ssmith@pnnl.gov)
- We have a web site
  - <http://www.globalchange.umd.edu/CEDS/>
- And a listserv for updates
  - Send an email to [listserv@listserv.umd.edu](mailto:listserv@listserv.umd.edu) with the email body: “subscribe cedsinfo”. (You will get a return e-mail asking you to verify your subscription.)

## The data system and input data will be released as open source software

- Including capability of producing gridded emission datasets  
*You will have to purchase a license for the IEA energy data*

## DEMO session Thursday 17:45

- *Learn about system structure and operation*





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**END**