Development of RCP Historical Emissions Lessons Learned

A Coordinated US Initiative on Emissions Research

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RCP Emissions

While the RCP scenarios are defined by radiative forcing, a full suite of GHG and pollutant emissions are included.

The RCPs will provide: regional emissions of GHGs and pollutant substances, globally gridded emissions (at 0.5°) of short-lived compounds, and GHG concentration pathways.

➢ GHG Emissions: CO_2, CH_4, N_2O, Fluorinated Gases
➢ Pollutant Emissions: NO_x, CO, NMVOCs, SO_2, BC, OC, NH_3

Regional and gridded emissions are provided in 12 source sectors in order to allow for later spatial/temporal desegregation and NMVOC speciation.

Air Transportation	*Industry (combustion and process emissions)*
International Shipping	*Buildings (Residential and Commercial)*
Ground transportation	*Ag. waste burning on fields*
Electric power plants, energy conversion, extraction and distribution	*Agriculture (agricultural soils, other agriculture)*
Solvents	*Grassland burning*
Waste (landfills, waste water, non-energy incineration)	*Forest burning (Deforestation & Forest Fires)*

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Pollutant Gas Harmonization

In order to provide a consistent starting point for all four scenarios, emissions will be harmonized to a consistent, year 2000 grid.

> This means that the product will be regional and gridded emissions pathways that match a common set of base-year data. This does not necessarily mean that the native output from each model matches this grid, but that at least a procedure is applied (by each IAM group) to produce harmonized emissions output.

The first step in this process was the selection/construction of a regional consensus year 2000 inventory for all pollutant emissions.

- ➢ UNFCC Submissions (NO_x, CO, NMVOCs, SO_2, CH_4(?))
- ➢ NO_x, CO, NMVOCs — (JRC, John.van-Aardenne)
- ➢ SO_2 — (JGCRI, Steve Smith)
- ➢ NH_3 (Ag sources) — (PBL Lex Bouwman)
- ➢ BC & OC (energy) — (Tami Bond and Cathy Liousse)
- ➢ Biomass Burning — (GFED, GICC, & RETRO, Martin Schultz)
- ➢ International Shipping — (ATTICA assessment, Veronika Eyring)
- ➢ Aircraft — (DLR and QUANTIFY, David Lee)

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Pollutant Gas Harmonization
(pt 2)

Data from a number of additional inventories and short-term projections has been collected for comparison.

> ➤ EDGAR FT — (used in consensus reactives)
>
> ➤ REAS (emissions from Asia)
>
> ➤ Zheng et al.
>
> ➤ IIASA-GAINS (Ag sources only)
>
> ➤ Other country/regional estimates (USA, Canada, EMEP)

In addition, gridded emissions estimates were developed from 1850-2000 for all reactive gas and aerosol emissions.

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Lessons Learned – Historical Pollutant Emissions (I)

➢ This was a difficult endeavor!

  • The last year for which comprehensive data were available was 2000. We could not calibrate IAMs to common 2005 data.

    IAMs could better calibrate to emissions by sector and fuel.

  • Emissions were compiled from a variety of sources. Some inconsistencies were inevitable.

  • Many improvements possible: changing grids over time (*RCP: were constant or by population*), consistency with country inventories (*varies*), inter-annual variability (*not examined overall*), and extrapolation methods (*consistent for BC, OC, and SO$_2$. Others stitched together from different sources*).

  • **Uncertainty needs to be assessed**.

➢ Only one effort currently strives to construct and maintain consistent global GHG and pollutant emissions estimates (EDGAR).

  • Its not reasonable to expect this one effort to supply global emissions inventory needs.

  • Due in part to copyright issues, data released only in a fairly aggregate form.

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Lessons Learned – Historical Pollutant Emissions (II)

➢ Changing emissions in developing countries are not well tracked.

  • Examples: China, South Korea, Taiwan

➢ Historical data is increasingly available, but needs to be assessed, collated, and made available.

  • Most of the inventory efforts use varying interpretations of one data source for historical fossil-fuel consumption.

➢ Diurnal and seasonal cycles not well constrained.

  • Diurnal and seasonal cycles largely non-existent in global inventories.
  • Importance of emission height needs to be better established.
  • RCP historical emissions are provided by sector and can serve as starting points for explorations of these topics.

➢ Emissions data is lagging observations.

  • Surface, satellite, and other observations are available in near real time. The emissions inventories needed for modeling studies lag by many years!

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Inventory Needs

A sustained effort to develop and update global emissions inventories is needed instead of the scattershot approach taken at present.

➢ Global inventories should be available on an on-going basis, not just every 5-10 years.

➢ Latest consistent country estimates are available via UNFCC.

- For 2007. Should build on this. These are absolutely necessary where emissions controls are in place.

- Well constructed country-level inventories are often the best source of data. But not all are well constructed or complete! Uncertainty is generally not assessed. Sectoral data is one key here.

- Research needs to be conducted to compare inventory assumptions, quantify uncertainty, and examine fundamental data (drivers, emissions factors, technology characterizations).

➢ Will need to prioritize improvements

- What makes a difference in simulations at different scales?

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