



The Community Emissions Data System (CEDDS) and SLCF Inventories

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Overview

- **CEDS intro and methodology**
- **CEDS products and software**
- **CEDS current and future work**
- **SLCF Context and considerations**

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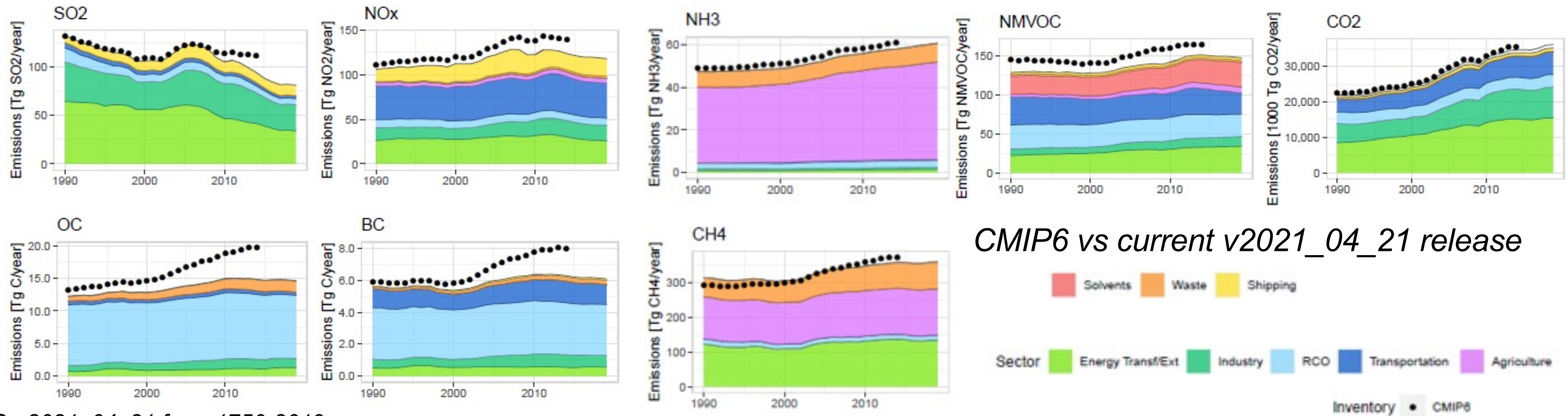
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CEDS Project Science Goals

Product: Global Emissions by Country, Sector, Fuel + gridded

- Annual estimates of anthropogenic emissions (not open burning) to latest full year.
- Seasonal cycle (monthly), speciated NMVOCs
- Gridded emissions (0.5°, also downscaled to 0.1°)
- Readily updated every year.
- *Uncertainty estimated at the same level (in progress)*



CMIP6 vs current v2021_04_21 release

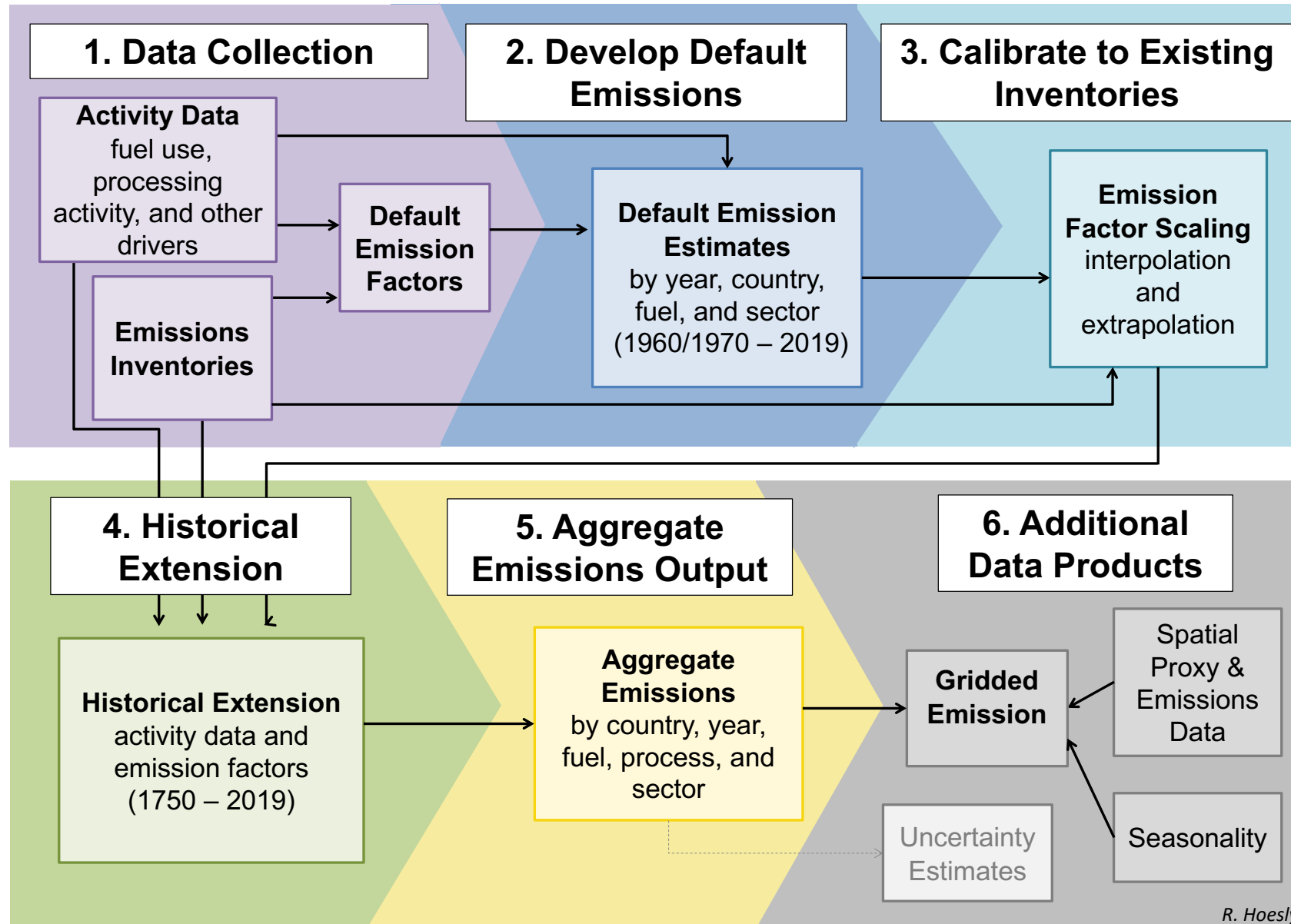


CEDS Methodology

Goals/Approach

- Consistent extrapolation over time (prevent spurious discontinuities)
- Community data review: aggregate (country, sector, ...) & gridded
- Release both data and data system
- Facilitate cross-country comparison (EF consistency, trends)
- Transparent emission results (assumptions -> emissions)

CEDS uses a “Tier 1/2 like” methodology for its default emissions estimate (adjusted where necessary to better match country data), which is then scaled to match country level data (which often uses higher tier methods).



CEDS Historical Emissions Data – Major Products

CMIP6 Data Release

- CEDA historical emissions data used for CMIP6 and follow-on research in the US and around the world
- CEDA emissions were the calibration/harmonized starting point for future scenarios used in CMIP6
- CEDA gridding routines were adapted to develop open-source software for CMIP6 future gridded emissions

Updated Data to 2019

- CEDA v_2021_04_21 aggregate (country, sector/country, fuel/country) and gridded emissions data
(Note: IEA energy consumption data is extended forward using BP energy statistics.)

CEDS Data System

- The CEDA data system is open source (e.g., used by McDuffie et al. 2020, to produce updated data with different sector/fuel resolution for use in Global Burden of Disease – GDB analysis)
 - Using the data system allows access to full fuel, sector, country data plus the ability to update any emissions assumptions. Most updates involve no or minimal coding.
- CEDA data system currently requires purchase of IEA energy statistics
 - We are exploring a fully open source option that uses UN energy statistics (1990 forward).

Would this be helpful for country-level inventory development?

CEDS Sectors

Non-combustion sectors largely follow EDGAR categories

1A1a_Electricity-public
 1A1a_Electricity-autoproducer
 1A1a_Heat-production
 1A1bc_Other-transformation
 1A2a_Ind-Comb-Iron-steel
 1A2b_Ind-Comb-Non-ferrous-metals
 1A2c_Ind-Comb-Chemicals
 1A2d_Ind-Comb-Pulp-paper
 1A2e_Ind-Comb-Food-tobacco
 1A2f_Ind-Comb-Non-metalic-minerals
 1A2g_Ind-Comb-Construction
 1A2g_Ind-Comb-machinery
 1A2g_Ind-Comb-mining-quarrying
 1A2g_Ind-Comb-other
 1A2g_Ind-Comb-textile-leather
 1A2g_Ind-Comb-transpequip
 1A2g_Ind-Comb-wood-products
 1A3ai_International-aviation
 1A3aii_Domestic-aviation
 1A3b_Road
 1A3c_Rail

1A3di_International-shipping
 1A3di_Oil_Tanker>Loading
 1A3dii_Domestic-navigation
 1A3eii_Other-transp
 1A4a_Commercial-institutional
 1A4b_Residential
 1A4c_Agriculture-forestry-fishing
 1A5_Other-unspecified
 1B1_Fugitive-solid-fuels
 1B2_Fugitive-petr
 1B2b_Fugitive-NG-distr
 1B2b_Fugitive-NG-prod
 1B2d_Fugitive-other-energy
 2A1_Cement-production
 2A2_Lime-production
 2A6_Other-minerals
 2B_Chemical-industry
 2B2_Chemicals-Nitric-acid
 2B3_Chemicals-Adipic-acid
 2C_Metal-production
 2D_Degreasing-Cleaning

2D_Paint-application
 2D3_Chemical-products-manufacture-processing
 2D3_Other-product-use
 2H_Pulp-and-paper-food-beverage-wood
 2L_Other-process-emissions
 3B_Manure-management
 3D_Rice-Cultivation
 3D_Soil-emissions
 3E_Enteric-fermentation
 3I_Agriculture-other
 5A_Solid-waste-disposal
 5C_Waste-incineration
 5D_Wastewater-handling
 5E_Other-waste-handling
 6A_Other-in-total
 7A_Fossil-fuel-fires
 7BC_Indirect-N2O-non-agricultural-N

Are adding more detail

Combustion sectors largely follow IEA categories

CEDS – Current Work

Add additional sectoral detail

- Breakout as explicit sectors: refineries, coke production, charcoal production, different types of metal smelting.

Add explicit point sources (more accurate gridded data with higher spatial resolution)

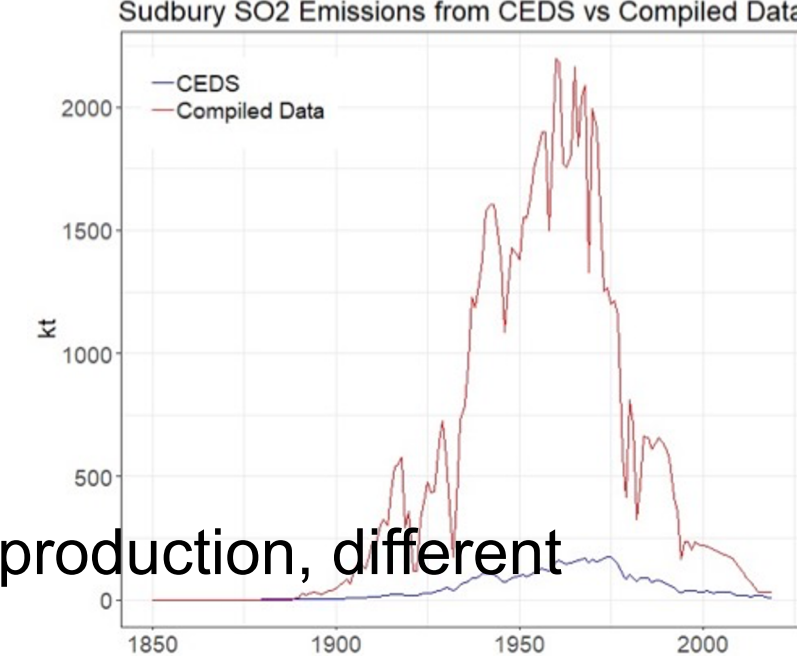
- Add point source emission time series w/ spatial location using satellite and other data (perhaps also alter spatial distribution for NO_x-related sectors)

Update time series to 2020

- 2020 emissions will reflect COVID-19-related changes in energy consumption
- Seasonal distribution of emissions will be different. Aim to incorporate this.
- Submit paper documenting new data releases

Produce uncertainty estimates

- Uncertainty ensembles focusing on SO₂, BC, OC
- Expand on analysis of uncertainty in the last few years of the estimate



Further Info

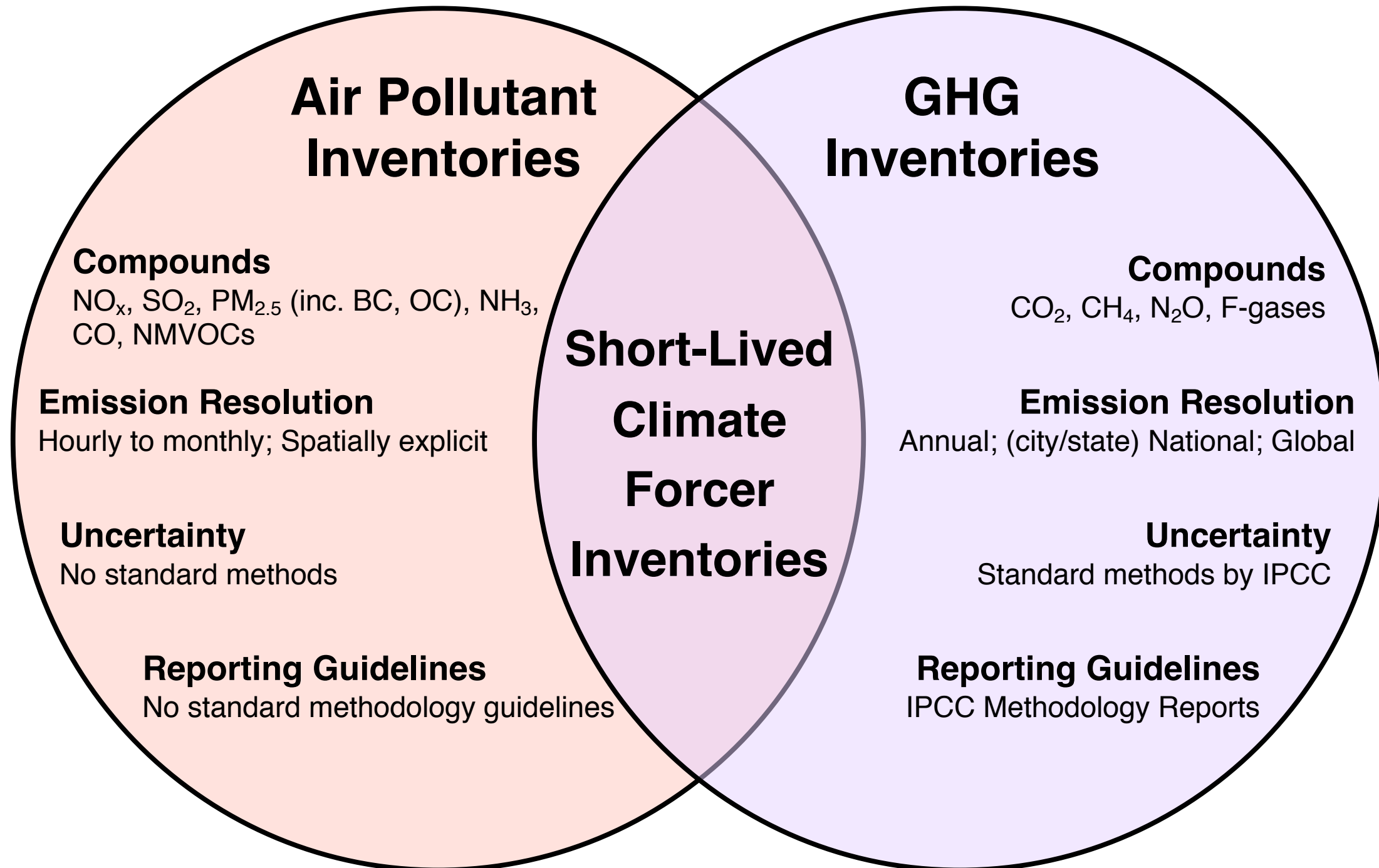
Collaboration welcome!

- Very much appreciate the collaboration of the GAINS and EDGAR teams
- Many aspects can be improved. We welcome additional data and co-authors. Sectoral or regional or country focus. New species could also be added.

Feedback and participation through several means

- GitHub: <https://github.com/JGCRI/CEDS> ([Links to new data releases here!](#))
- Zenodo CEDS Community: <https://zenodo.org/communities/ceds/>
- GMD CEDS article: <https://www.geosci-model-dev.net/11/369/2018/gmd-11-369-2018.html>
- *ERL energy data uncertainty article*: <https://doi.org/10.1088/1748-9326/aaebc3>
- CMIP6 gridded data download: <https://esgf-node.llnl.gov/search/input4mips/>
 - search by institution = PNNL-JGCRI
- General project page: <http://www.globalchange.umd.edu/CEDS/>
 - **Sign up for the listserv** - listserv@listserv.umd.edu

SLCF Context



All conventional air pollutants listed here are SLCFs.

Recommendations: Harmonizing air pollutant and GHG inventory production (in an SLCF context)

- Account for the different end uses of air pollutant and greenhouse gas emissions inventory data, while maintaining the useability of each (e.g., consider necessary sectoral, spatial, and temporal data resolutions).
- Align sectoral, chemical speciation, and emission definitions between air pollutant and greenhouse gas inventories.
- Enhance communication between AP and GHG inventory developer, research, and policy communities.
- Consider regional development priorities.
 - Understand the key sources across regions and compounds to prioritize development/reporting and data collection resources.
 - Develop flexible reporting protocols and methodologies that allow for accurate reporting but that are not overly burdensome. For example, the use of the IPCC tier approach, e.g., higher tiers needed for some emission species in a particular sector, but lower tiers might be acceptable for other species.
- Air pollutant SLCFs should not be reported in units of CO₂-equivalants.
- Draw on existing greenhouse gas inventory methodologies to provide more robust estimates of SLCF emission uncertainties

Final Thoughts

- Harmonizing sector categories is not always easy – there can be substantial differences between data sources
 - Example, US energy data (both EIA and IEA) use different sector definitions than US emission inventory data.
 - Some problematic sectors in general: construction, residential, commercial, agriculture, shipping/fishing
- Need data (not estimates) for traditional biomass fuel use in many countries
- Make sure incentive structures (including reporting requirements) do not direct effort into activities that detract from creating the data most needed for in-country use
 - For some countries, a fine-scale GHG inventory might be less useful than improved understanding of major drivers of air pollutant emissions (non-compliant vehicles, traditional biomass consumption, structure of informal industries, etc.)
- Existing scientific inventories that provide data at a country level (EDGAR, CEDS) can be used to compare against country efforts. (and GAINS at regional level land for some countries)
- Need better mechanisms for country-level data (from scientific literature, grey literature, or official inventories) to feed back into scientific inventories.
 - We do this for CEDS, but there is certainly additional information out there that could be incorporated to improve the quality of the inventory.