The incorporation of the US national emission inventory into version 2 of the Hemispheric Transport of Air Pollutants inventory

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Abstract EPA's 2008 National Emission Inventory has been incorporated into version 2 of the Hemispheric Transport of Air Pollutants Inventory. This work involves the creation of a detailed mapping of EPA Source Classification Codes (SCC) to the International Nomenclature for Reporting System (NFR). The mapping of SCC codes to the NFR system allows for comparison of USA emission inventories with other national inventories on a consistent basis. We summarize the emission estimates for 2008 and 2010 and provide a useful reference for linking USA inventories to Global inventories for use in regional and global chemical transport models.

Keywords emission inventory, global transport

1. Introduction

The Task Force on Hemispheric Transport of Air Pollution (TF-HTAP) is an international scientific cooperative effort to improve the understanding of the intercontinental transport of air pollution across the North Hemisphere. It was organized in 2005 under the auspices of the UNENC Convention on Long-range Transboundary Air Pollution (LRTAP) and is open to all interested experts. In 2010, TF- HTAP produced the first comprehensive assessment of the intercontinental transport of air pollution in the Northern Hemisphere. In 2012, TF-HTAP launched a new phase of cooperative experiments and analysis that is intended to inform the LRTAP Convention and other multi-lateral cooperative efforts, as well as national actions to decrease air pollution and its impacts. The first objective in this new phase is to provide a single global annual dataset that draws from the "best available " inventories developed on a regional basis and filled in with glob-

al inventories. This new dataset is called HTAP_V2 and consists of 0.1° by 0.1° grid maps of CO, SO_2, NO_x, NMVOC, NH_3, PM_{10}, $PM_{2.5}$, BC and OC for the years 2008 and 2010. HTAP_V2 uses nationally reported emissions combined with regional scientific inventories in the format of sector-specific grid maps. The grid maps are complemented with EDGARv4.3 data for those regions where data are absent. The global grid maps are a joint effort from US-EPA, the MICS-Asia group, EMEP/TNO, the REAS and the EDGAR group to serve in the first place the scientific community for hemispheric transport of air pollution. This work describes the incorporation of EPA's National Emision Inventory into HTAP_V2.

2. 2008 EPA NEI

An Emission Modeling Platform (EMP) includes annual emission inventories, emission processing tools and methods, and a collection of ancillary files detailing temporal allocation, spatial allocation, speciation, and other parameters. The 2008 EMP (http://www.epa.gov/ttn/chief/emch/index.html#2008) was the starting point for the emissions used in HTAP_V2. The software used to complete the processing includes the following: Sparse Matrix Operator Kernel Emissions (SMOKE) model version 3.1 (http://www.smoke-model.org/index.cfm) processed with the US EPA Emissions Modeling Framework (EMF) version 2.5; Multimedia Integrated Modeling System (MIMS) Spatial Allocator version 3.6 (http://www.ie.unc.edu/cempd/projects/mims/spatial/) ; Python version 2.6 for generation of onroad inventories by SCC based on EPA's Office of Transportation and Air Quality (OTAQ) MOtor Vehicle Emission Simulator (MOVES) MOVES2010b activity data (http://www.epa.gov/otaq/models/moves/index.htm). The annual county level emissions from all sources, except mobile sources, were speciated into 25 non-methane VOC aggregation groups based on the Global Emissions InitiAtive (GEIA). However, for the purpose of summarizing the emissions in this paper, we will report the sum of the non-methane VOC emissions rather than each of the 25 groups. Mobile Source emission estimates were based on MOVES emission factors with 2007 meteorology processed with the SMOKE/MOVES system. A fleet year of 2007 was assumed for the mobile sources in the MOVES system. Surrogates were calculated with the spatial allocator version 3.6 and were based on the same inputs as in the 2008 modeling platform but revised for the 0.1° resolution of a global domain on latitude-longitude grid which includes the entire 50 states and Puerto Rico.

3. Summary of Emission Estimates

We summarize the emission estimates provided for version 2 of the HTAP inventory for the United States in the following tables. Table 1 contains a description of

each sector and a corresponding number used in subsequent tables. Table 1 contains emission estimates for all criteria pollutants for the continental US plus Alaska and Hawaii for 2008. We have used a more detailed grouping of emissions by source category than actually implemented in the version 2 of the HTAP inventory. In addition, some sources, which were not used by the HTAP inventory, are included for completeness.

Table 1 Description of Emission Sectors and Numerical Code

Sector Description	**Number**
Aviation	1
Shipping except international waters	2
Energy point sources	3
Industry except dust	4
Ground transport except dust	5
Building heating, cooling, and equipment	6
Solvents	7
Crop Cultivation	8
Agricultural Waste	9
Waste Disposal	10
Dust from industrial sources	4.5
Dust from ground transport	5.5
International shipping	2.5
Energy area sources	3.5

Table 2 US 2008 Emission Estimates in Tg/year by sector codes

Sector Number	**CO**	**NO_x**	**VOC**	**EC**	**OC**	**PM_{10}**	**NH_3**	**SO_2**	**Non-carbon $PM_{2.5}$**
1	920	116	59	5	1	19	0	13	0
2	2360	514	826	13	11	29	0	34	3
3	679	3,077	53	14	15	384	25	8,202	263
4	4,431	3,187	4,425	78	71	641	85	1,666	313
5	35,246	7,164	4,189	43	2	279	136	152	95
6	12,174	769	1,152	33	233	435	58	279	155
7	5	5	3,632	0	1	4	0	0	2
8	541	477	189	35	10	75	3,262	30	8
9	346	16	32	5	17	45	0	3	23
10	1,192	86	211	19	67	213	62	19	95
4.5	0	0	0	0	5	1,283	0	0	138
5.5	0	0	0	1	30	3,940	0	0	430
2.5	178	1,927	83	2	2	177	0	1,329	160
3.5	352	568	3,368	3	6	39	3	151	19

Table 3 US 2010 Emission Estimates in Tg/year by sector codes

Sector Number	CO	NO_x	VOC	EC	OC	PM_{10}	NH_3	SO_2	Non-carbon $PM_{2.5}$
1	920	116	59	5	1	19	0	13	0
2	1,873	532	709	13	9	25	0	32	3
3	679	3,077	53	14	15	384	25	8,202	263
4	3,987	3,006	4,379	73	69	634	85	1,622	312
5	27,229	6111	3,379	143	73	275	112	41	43
6	11,340	791	1,095	33	236	439	58	273	156
7	5	5	3,632	0	1	4	0	0	2
8	437	416	173	28	9	67	3,262	4	8
9	346	16	32	5	17	45	0	3	23
10	1,192	86	211	19	67	213	62	19	95
4.5	0	0	0	0	5	1,283	0	0	138
5.5	0	0	0	1	30	3,940	0	0	430
2.5	178	1,927	83	2	2	177	0	1,329	160
3.5	352	568	3,368	3	6	39	3	151	19

4. Further Information

Documentation and additional details are available at http://edgar.jrc.europa.eu/htap_v2/index.php?SECURE=123. The final data sets used for the HTAP_V2 inventory will be posted at http://www.geicenter.org and http://eccad.sedoo.fr.

Disclaimer: *Although this paper has been reviewed by EPA and approved for publication, it does not necessarily reflect EPA's policies or views.*

5. Questions and Answers

Paul Makar: "You mentioned that no temporal allocation is being done (at this stage). Will HTAP impose (a) temporal allocation(s) on the emissions prior to the use of the merged inventory? Temporal allocation can have a very big impact on model results."

Answer: The HTAP_V2 inventories are being created as annual estimates. However, we have created monthly temporal allocation factors for each of the emission sectors which could be used at least for the US. Temporal allocation for other parts of the world remains a challenge.