

Overview of Sources and Surface Uptake Working Group



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Working Group Related Science Questions

- **Emissions**
 - **Anthropogenic & Natural**
 - **Bottom-up inventory**
 - **Top-down constraint**

- **Dry deposition**
 - **Parameterization**
 - **Top-down estimate**

On-going Projects – Please Add/Remove/Revise

Current Projects (please add yours!)

User Group	Description	Contact Person	Date Added
Birmingham, UK/NCAR	Inefficient combustion emissions in Africa	Eloise Marais ✉	12 April 2017
Harvard	Methane sources in the Arctic	Christopher Pickett-Heaps ✉	
Harvard	Mechanistic Lightning Parameterization	Lee Murray ✉	
JPL	Comparison of adjoint and mass balance for NO _x emissions	Changsub Shim ✉	
U. East Anglia	COS Emissions	Parvadha Suntharalingam ✉	
U. Edinburgh	Biogenic VOC emissions from tropical ecosystems	Michael Barkley ✉	
U. Edinburgh	Regional methane sources using surface in situ and GOSAT and IASI satellite observations and an ensemble Kalman filter	Annemarie Fraser ✉	
U. Edinburgh	Quantifying the impact of boreal biomass burning emissions on tropospheric oxidant chemistry	Mark Parrington ✉	
U. Eindhoven	Constraining ship emissions using OMI NO ₂ observations / Soil NO _x emissions	Geert Vinken ✉	21 June 2012
U. Toronto / Env Canada	CO ₂ sources and sinks (fossil fuels including shipping/aviation, biosphere, ocean, etc.)	Ray Nassar ✉	
U. Toronto	Adjoint analysis of CO sources from MOPITT	Zhe Jiang ✉	
Peking University	Top-down constraints on Asia VOCs	May Fu ✉	
Peking University	Air-sea exchange and top-down constraints on global acetone	May Fu ✉	29 April 2011
CSU	IASI constraints on NH _x	Colette Heald ✉	
Tsinghua University	Bottom-up/top-down anthropogenic inventory over East Asia	Qiang Zhang ✉	
CU Boulder	Top-down constraints on NH ₃	Juliet Zhu ✉	
US EPA	Top-down constraints on NO ₂	Havala Pye ✉	
U. Nebraska Lincoln	Top-down constraints on aerosols over Asia using MODIS	Richard Zu ✉	
Peking University	Natural sources (soil, lightning, bb) of NO _x over China: top-down vs bottom-up	Jintai Lin ✉	01 Nov 2010
UW	Snow NO _x source in Greenland and Antarctica	Becky Alexander ✉	07 May 2015

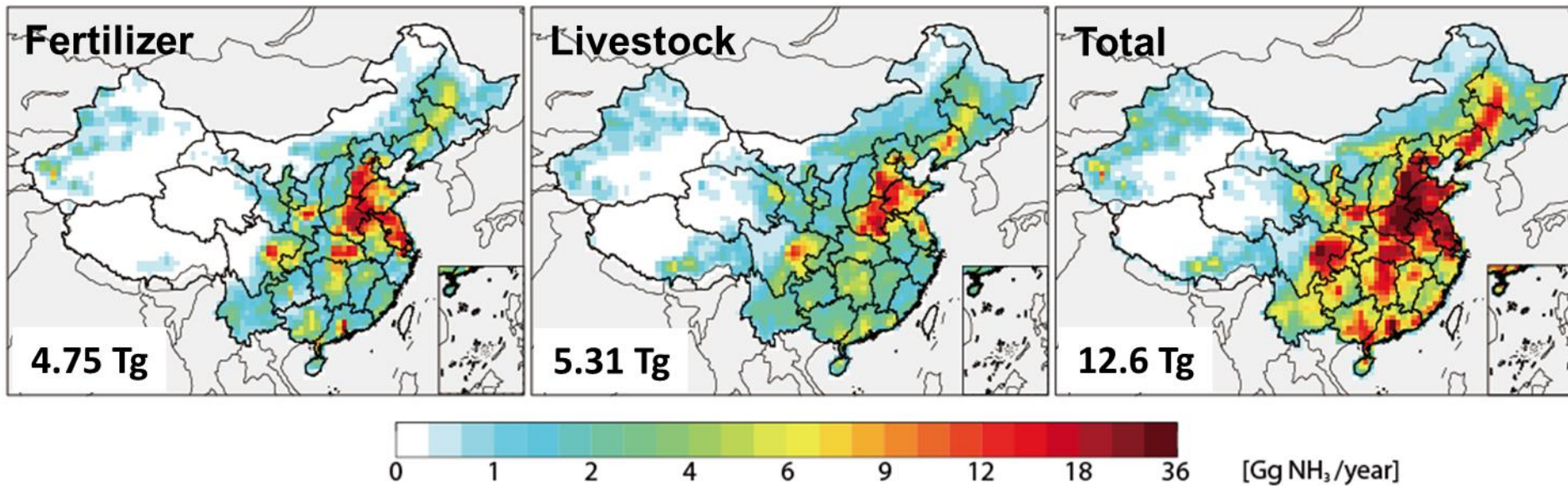
Updates in Public Release Since IGC7

Version	Released	Description	Contact
v11-01	Jan 2017	Update HEMCO to version 2.0.003	Christoph Keller (NASA GSFC)
v11-01	Jan 2017	0.1° x 0.1° CAC emissions	Aaron van Donkelaar (Dalhousie)
v11-01	Jan 2017	Replace RETRO C3H8 emissions with emissions from Xiao et al. (2008)	Emily Fischer (CSU) Zitely Tzomba (CSU)
v11-01	Jan 2017	Add option for QFED & FINN emissions in the Hg simulations	Jenny Fisher (Wollongong)
v11-01	Jan 2017	CO2 direct effect on isoprene emissions	Amos Tai (CUHK)
v11-01	Jan 2017	Update biomass burning emissions to GFED4.1, includes: <ul style="list-style-type: none"> Daily and diurnal factors 	Prasad Kasibhatla (Duke) Christoph Keller (Harvard)
v10-01	Jun 2015	The HEMCO emissions component now handles all GEOS-Chem emissions.	Christoph Keller (Harvard) GCST
v10-01	Jun 2015	Daily anthropogenic emissions broken down by sector from the EPA NEI2008 inventory (via HEMCO)	Katie Travis (Harvard)
v10-01	Jun 2015	FINNv1 biomass burning emissions (via HEMCO)	Jenny Fisher (Wollongong) Min Huang (JPL)
v10-01	Jun 2015	MEGAN v2.1 plus Guenther 2012 biogenic emissions (via HEMCO)	Dylan Millet (Minnesota)
V11-01	Dec 2016	Lightning updates based on Travis et al. (2016) and Zhang et al. (2014)	Katie Travis (Harvard)
All versions	Continuous	Bug fixes	

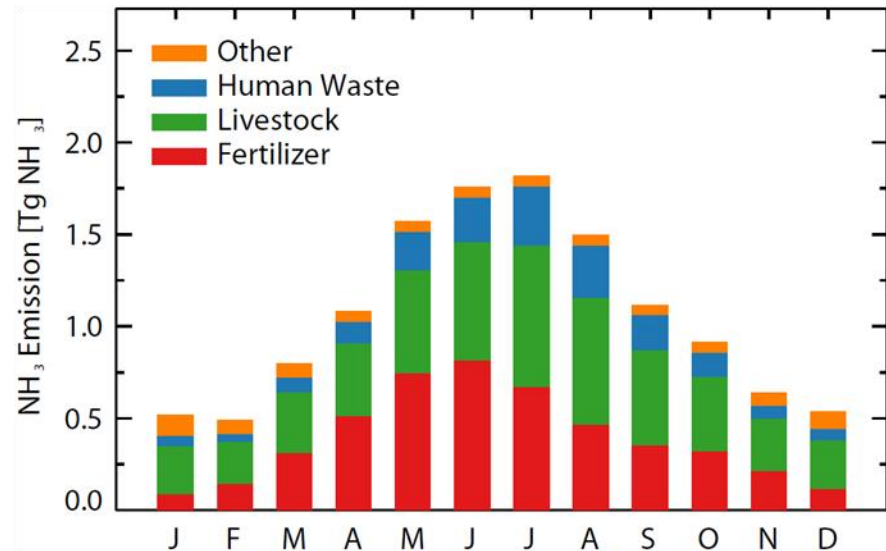
Updates to be Implemented – Discussion in Day 3

Development	Author (institution)	Reference
<u>Currently slated for 11-02</u>		
EDGAR v4.3 emissions	Chi Li (Dalhousie)	
EPA BC/OA emissions over US (1990-2012)	David Ridley (MIT)	
Historical CAC emissions	Chi Li (Dalhousie)	
Default US emissions to NEI after 2011	Dalhousie group	
Arctic seabird ammonia emissions	Betty Croft (Dalhousie)	Croft et al., Nat. Commun., doi:10.1038/ncomms13444,
Ocean ammonia emission inventory	Fabien Paulot (GFDL)	
NOx source from deep snowpack	Zatko, Alexander (UW)	
Non-ag NH3 source for MASAGE	Amos Tai (CUHK)	
<u>Not yet prioritized - need to revisit</u>		
Sea salt emission from sea ice	Jiayue Huang (UW)	
SST dependence of sea salt emissions	Jiayue Huang (UW)	
<u>New items to prioritize</u>		
Inefficient combustion emissions in Africa (DICE-Africa)	Eloise Marais (U. Birmingham)	Marais and Wiedinmyer, ES&T, doi:10.1021/acs.est.6b01000
Trash burning emissions	Christine Wiedinmyer (NCAR)	Wiedinmyer et al., ES&T, doi:10.1021/es502250z, 2014
FINN version 1.5 (extended record; updated emissions)	Christine Wiedinmyer (NCAR)	NCAR website URL: http://bai.acom.ucar.edu/Data/fire
<u>Listed as 'over the horizon' (6-12 months) - update priority/status as needed</u>		
Dust emissions at nested-grid resolution	Yuxuan Wang (TA&M), Jun Wang (UI)	
Improved lightning emission scheme	Lee Murray (NASA GISS/LDEO)	
Injection height for fire emissions	Emily Fischer (CSU)	
Injection scheme for dust: subgrid wind variation	David Ridley (MIT)	
Bidirectional NH3 emissions	Juliet Zhu (CSU), Lin Zhang (PKU)	
Country-based weekday/weekend variability for EDGAR	Lee Murray (NASA GISS/LDEO), Christoph Keller (Harvard)	
Resolution-independent lightning NOx scaling	Lee Murray (NASA GISS/LDEO)	
EPA NEI v ek (better oil and gas emissions)	Emily Fischer (CSU)	
<u>Listed as 'on hold indefinitely' - need to update status or delete</u>		
TNO emissions over Europe at 7km	Greece team	
Biogenic emissions of ethane, propane	Zietely Tzompa (CSU)	

Ammonia Emissions from Agriculture in China (2008)



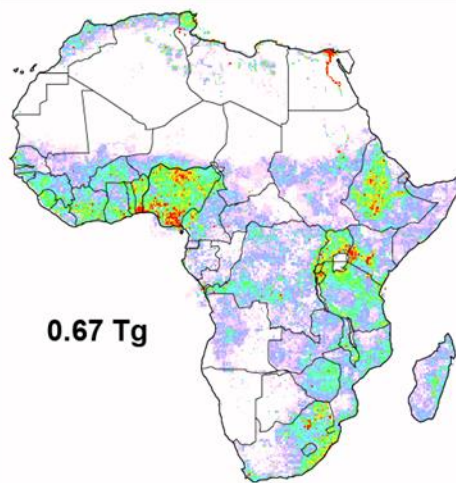
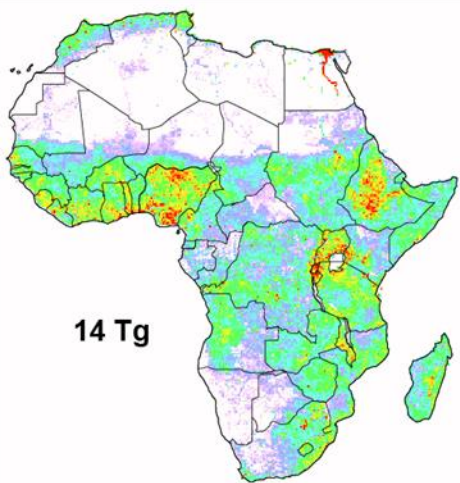
- Improved estimates on the fertilizer application timing and magnitude over 18 different agricultural crops in China.
- Annually 12.6 Tg NH₃ emitted over China in 2008, with a distinct seasonality.



Diffuse and Inefficient Combustion Emissions in Africa (DICE-Africa) [Marais & Wiedinmyer, ES&T, 2016]

Includes: 2006 and 2013 pollution from residential fuelwood and charcoal use, kerosene use, charcoal production, artisanal oil refining, gas flares, cars and motorcycles

NMVOCs and BC emissions in 2006



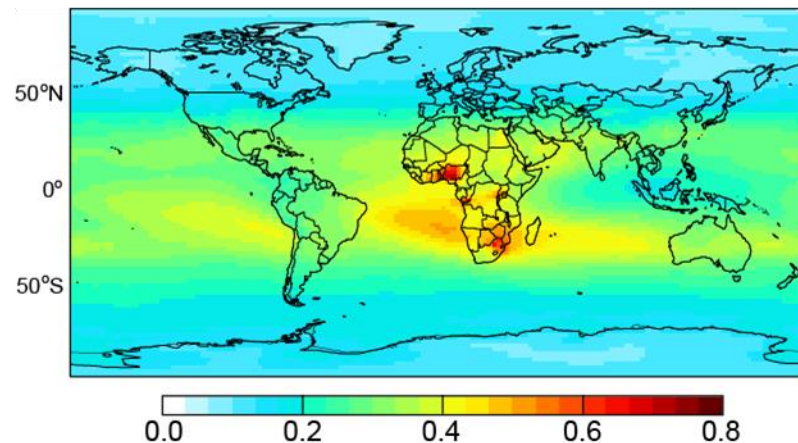
NMVOCs
0.001 0.01 0.1 1.0 10 [g m⁻² a⁻¹]

BC
0.0005 0.005 0.05 0.5 [g C m⁻² a⁻¹]

BC and NMVOCs emissions similar in magnitude to biomass burning in Africa

Impacts air quality (health and food security) and global tropospheric ozone (climate)

Impact on global tropospheric ozone according to GEOS-Chem [DU] (1 DU = 2.69d16 molec/cm²):



Future Challenges

- **Regionally harmonized, sectorally detailed, temporally varying high-resolution anthropogenic emission inventory**
- **Injection heights of anthropogenic, biomass burning and lightning emissions**
- **Robust high-resolution top-down estimates**
- **Integration of top-down and bottom-up**
- **Deposition**

Working Group Name and Chair Changes

- **New Name: Emissions and Deposition**
- **Step down: Q. Zhang**
- **New Chair: Emily Fischer (from Organics WG)**
- **New Chair: Eloise Marias**
- **New Chair: Dylan Millet (from Organics WG)**