AEROCOM BIOMASS BURNING EMISSIONS EXPERIMENT: UPDATES ON METHODS AND STATUS

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Objectives

- Inter-compare & quantify **model BB AOD accuracy and diversity**

- Propose **regional emission corrections** -- improve the widely used GFEDv3 emissions

- Test global model **smoke injection height – emission intensity relationships**

**We are offering:**

*Satellite-based smoke plume AOD and injection height climatologies*
1. Global dataset of fire cases with satellite-observed AOD 2004 (Alaska), 2006-2007

Background colors are Vegetation types from Global Land Cover (GLC) dataset

511 cases
Using snapshots of satellite-measured AOD to constrain biomass burning emissions in the GOCART model

Sample Case Russia
2006-07-20
GOCART ave AOD / MODIS ave AOD
GFED3d emission correction factors for GOCART
15,857 smoke plumes digitized for full 2008 (Contact: David Nelson, JPL)
Each plume is operator-processed using MISR INteractive eXplorer V3.0 (MINX), and QC’d
Raw, graphics and summary files, and documentation will be available on-line (we’ll let you know as soon as they are available)
MISR plume digitized with MINX

July 18, 2008
Canada
N. America plume injection height climatology


MODIS IGBP land cover map (1x1 Km res)

- Tropical Forest
- Temperate Forest
- Boreal Forest
- Boreal Shrubland
- Non-Boreal Shrubland
- Boreal Grassland
- Non-Boreal Grassland
- Cropland

Percent of plumes >0.5 km above BL, stratified by year and vegetation type

Val Martin et al. ACP 2010
Evaluation of a 1D plume-rise model: Towards a parameterization of smoke injection heights

To Constrain models:
Need to assess the Parameterizations actually used

1-D Plume-rise model heights vs. MISR-observed max. plume heights
-- Plume-rise calculations have lower dynamic range than observed, but very variable
Status of Aerocom BB experiment
Participating models

- CAM4-Oslo
- CAM5
- FMI_SALSA-EL
- GEOS-Chem
- GFDL
- GISS
- GOCART
- HadGEM3
- INCA
- MPI_HAM
- OsloCTM2
- SPRINTARS
BB experiment design

- 2 phases:
  - emission strength (BB0-BB4)
  - emission injection height

- PHASE 1. Emission strength (ongoing):
  - BB0 – no BB emissions
  - BB1 – GFED3 daily x 0.5
  - BB2 – GFED3d x 1
  - BB2 – GFED3d x 2
  - BB4 – GFED3d x 5

- PHASE 2. Emission injection height (will be announced in the following year):
  - BB5 – GFED3 (with provided plume heights)
  - BB6 – GFED3 x 5 (with provided plume heights)

- AeroCOM Wiki [https://wiki.met.no/aerocom/phase3-experiments](https://wiki.met.no/aerocom/phase3-experiments)
Requested output

- 1\textsuperscript{st} order: 550 nm total AOD at satellite time
- 2\textsuperscript{nd}: AAOD, wind speeds, PBL height,
- 3\textsuperscript{rd}: potential temperature

- Variables for each experiment are highlighted in the corresponding copy of HTAP2-AeroCOM3 master-table

- https://wiki.met.no/aerocom/phase3-experiments
Phase 1 Analysis: Source Strength

- Compare model and MODIS instantaneous AOD’s for a global set of BB cases
- Assess Model/MODIS AOD ratios for regional consistency for each model, and compare regionally representative ratios among models
- Propose, evaluate, and test with participating models major regional factors affecting emissions-AOD relationship (winds, topography, RH, atmospheric stability, model dispersivity etc)
Phase 2 Analysis: Injection Heights

- **Provide a** one-year, global **climatology of smoke vertical distribution at injection**, based on MISR stereo-derived plume heights

- **Identify** smoke plume evolution **differences** between nominal **assumed injection height** and MISR-constrained **injection height** model runs for each participating model

- **Propose** a plume **injection height parameterization** for future large-scale BB studies
1. Description of the accuracy and **diversity** of BB simulations in the **AeroCOM models** (paper).

2. Proposal of a **region-based GFED3 emission correction** scheme (is one for all models possible?, or describe customizable approach).

3. Proposal of a **plume injection height parameterization** for future large-scale BB studies.

4. **Summary for GFED developers** to aid in emission inventory development.
Concluding remarks

Thanks to all participants!

New tentative timeline (P1 P2 Overall):

- Continue accepting model output (CMOR software update currently in the works)
- Oct-Nov’14 Finalize database of 2008 fire cases
- 2nd half 2014 Develop a global map of vertical distribution of smoke based on the MISR plume height climatology
- Dec 2014 BB experiment update @ Fall AGU (based on analysis of available submitted output)
- 2015 Propose AeroCOM-BB runs with prescribed injection height
- 2015 Prepare manuscript on the source strength part