

AEROCOM BIOMASS BURNING EMISSIONS EXPERIMENT: UPDATES ON METHODS AND STATUS

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Objectives

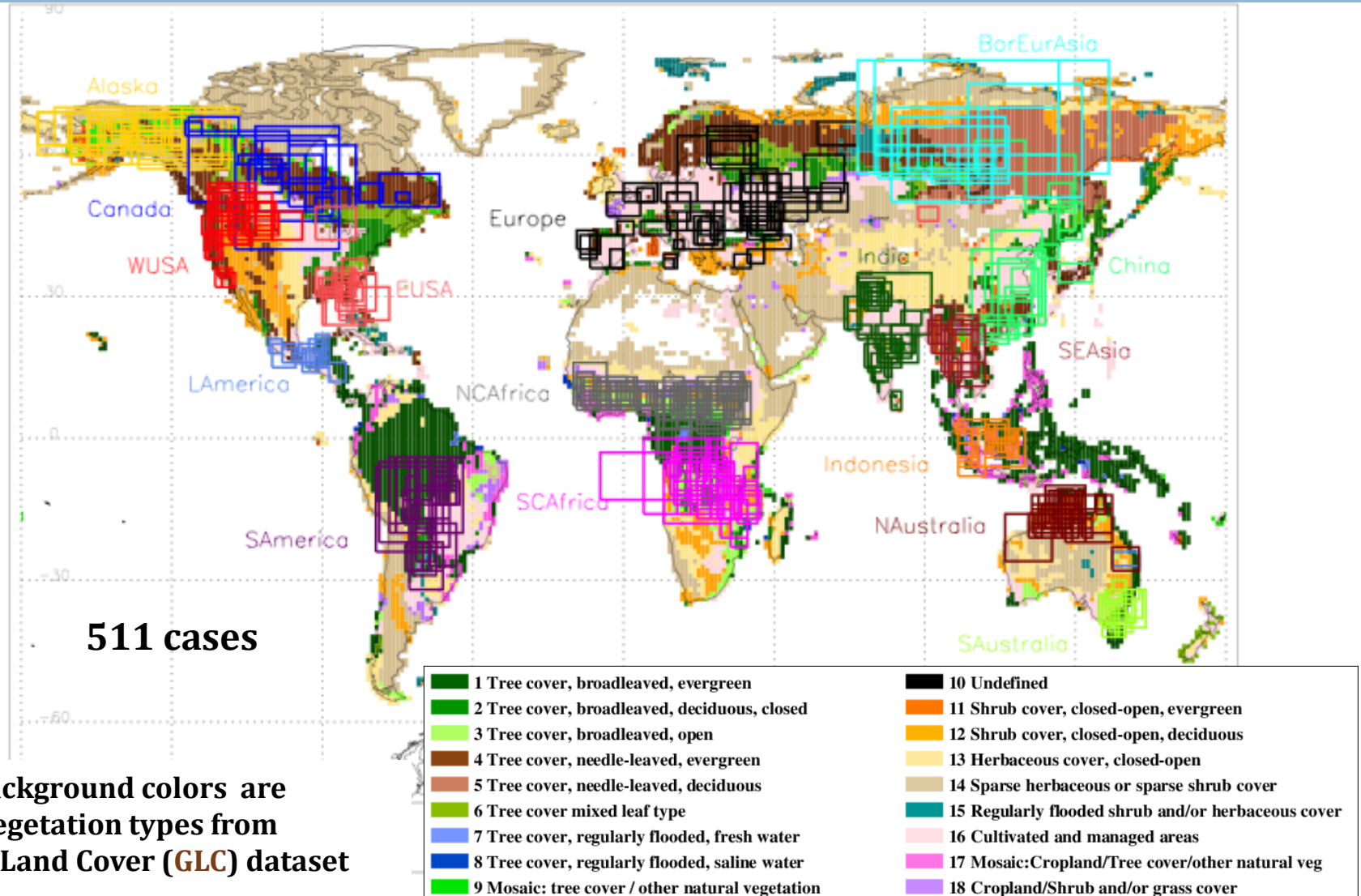
- Inter-compare & quantify **model BB AOD accuracy and diversity**
- Propose **regional emission corrections**
 - improve the widely used GFEDv3 emissions
- Test global model **smoke injection height – emission intensity relationships**

*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

3

GLC; 2004, 2006-2007 cases

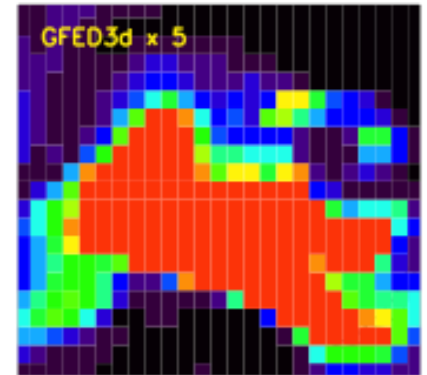
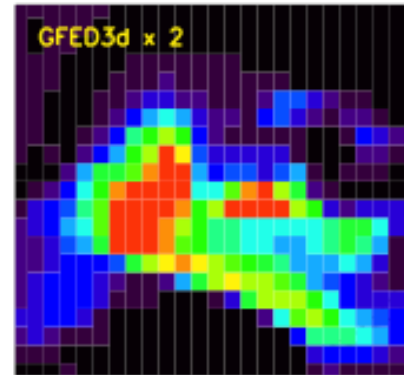
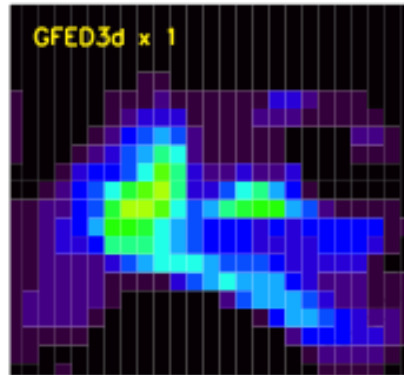
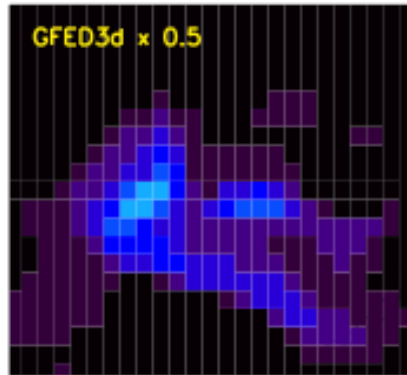
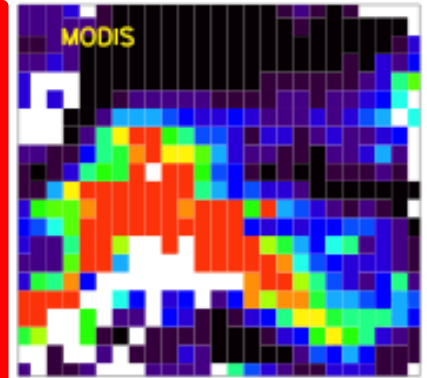
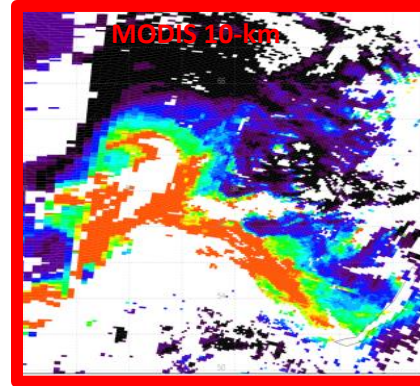
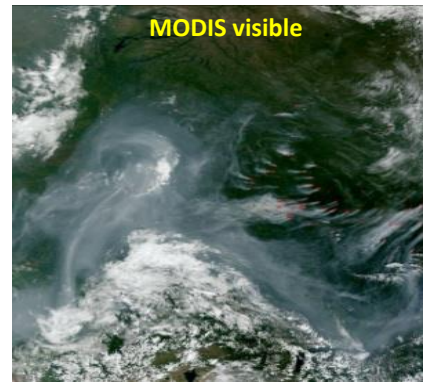


Background colors are
Vegetation types from
Global Land Cover (GLC) dataset

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

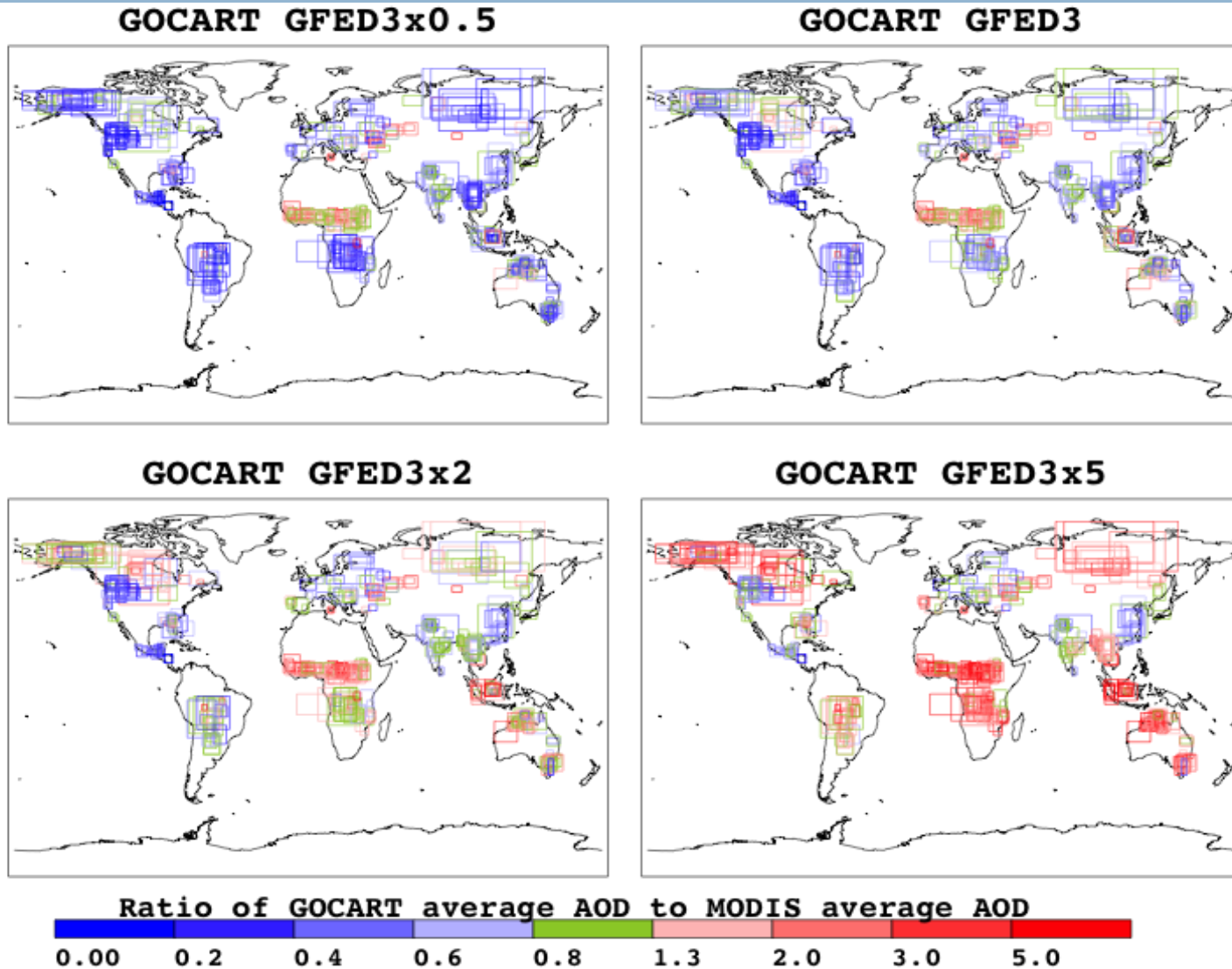
4

Sample Case Russia
2006-07-20

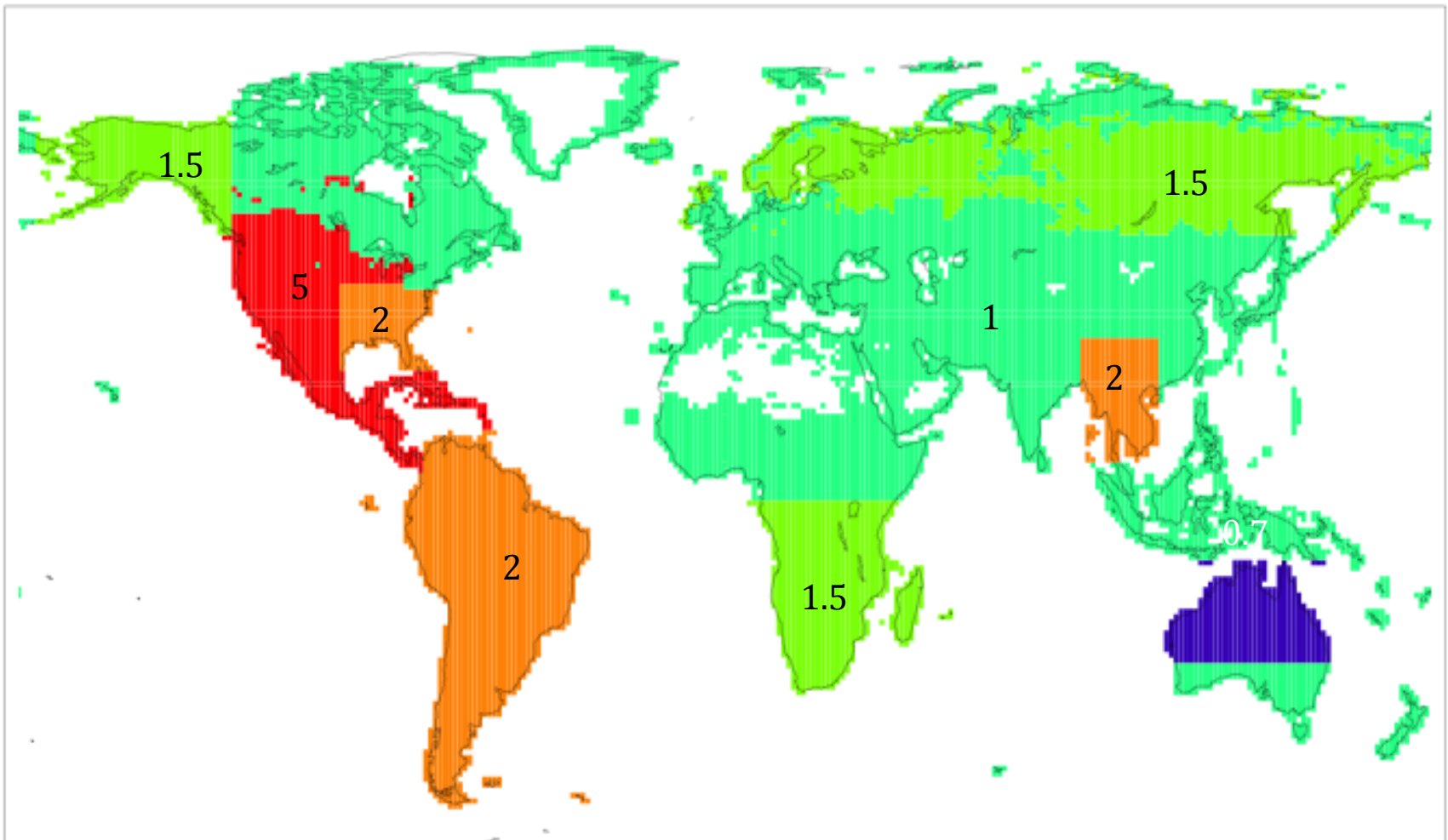


GOCART ave AOD /MODIS ave AOD

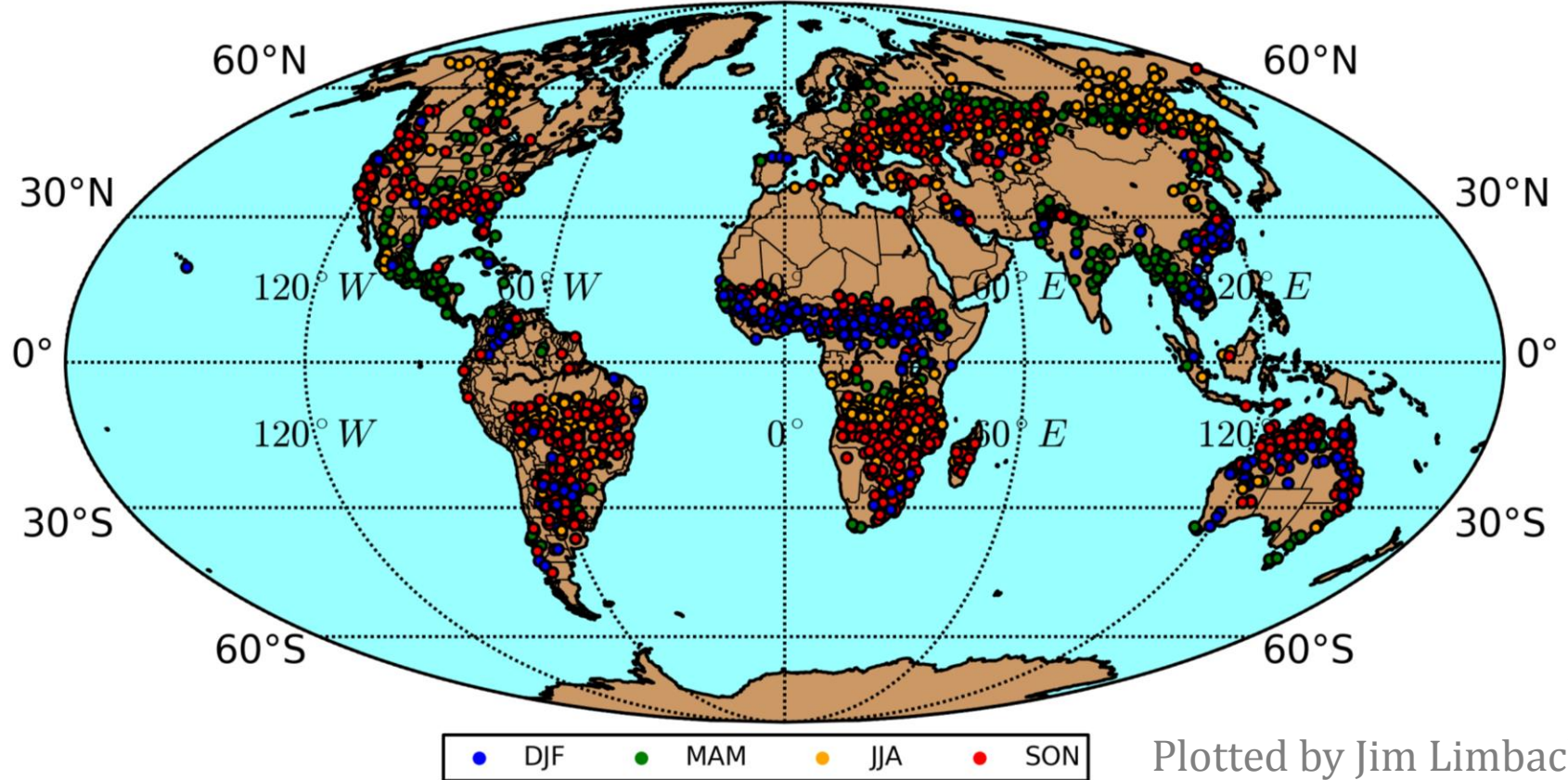
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GFED3d emission correction factors for GOCART



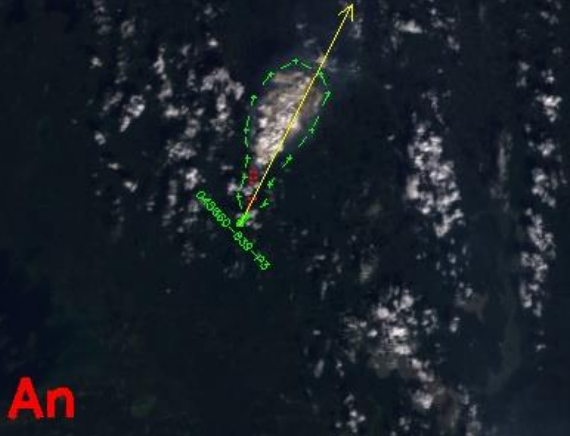
2. MISR stereo-derived plume heights dataset: 2008



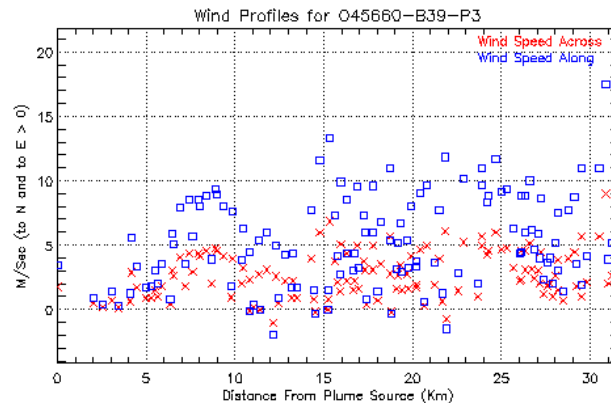
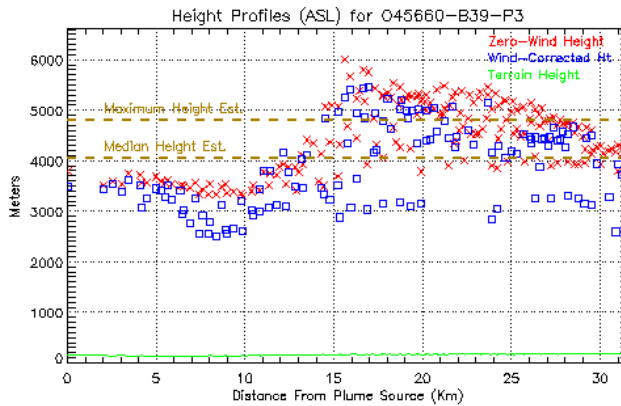
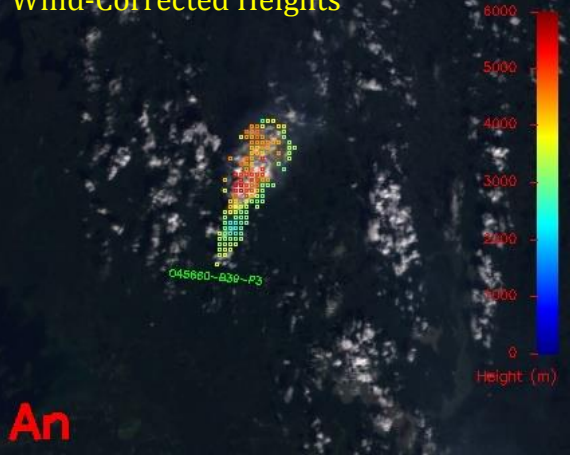
- 15,857 smoke plumes digitized for full 2008 (Contact: David Nelson, JPL)
- Each plume is operator-processed using MISR INteractive eXplorer V3.0 (MINX), and QC'd
- Raw, graphics and summary files, and documentation will be available online (we'll let you know as soon as they are available)

MISR plume digitized with MINX

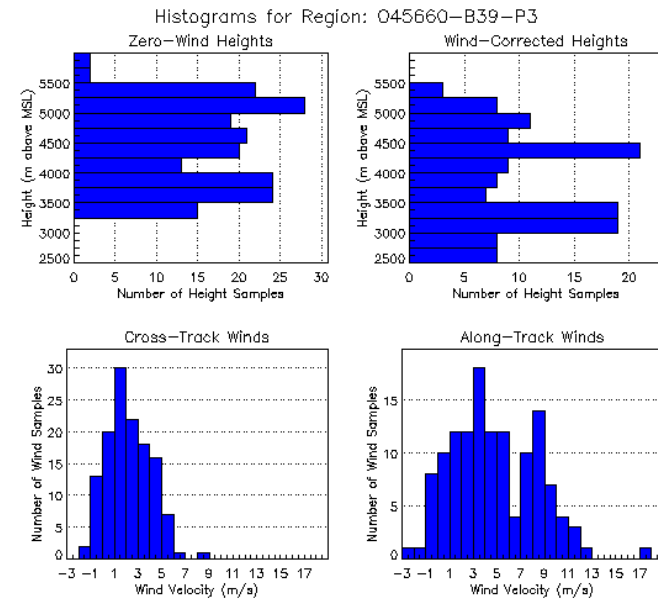
Nadir Image w/ digitized region outline (green: plumes; magenta: clouds), wind direction (yellow) and MODIS fire pixels (red)



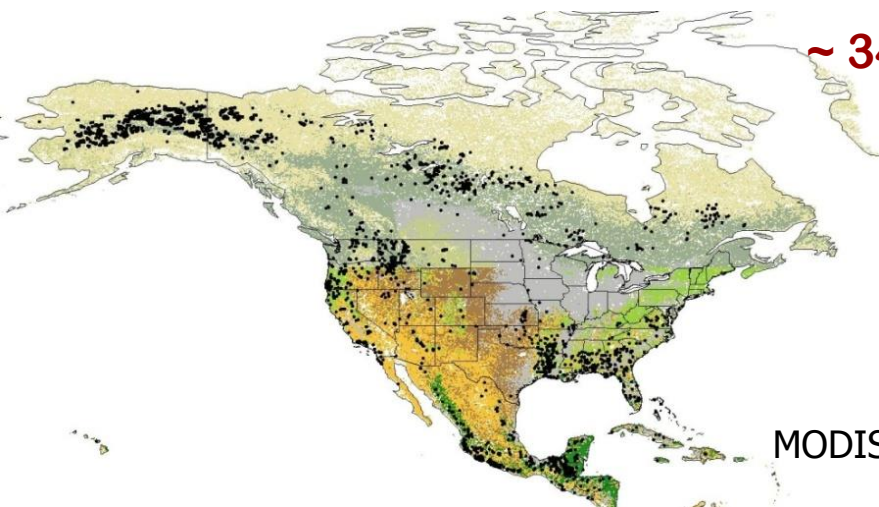
Nadir Image w/ Color-Coded, Wind-Corrected Heights



July 18, 2008
Canada



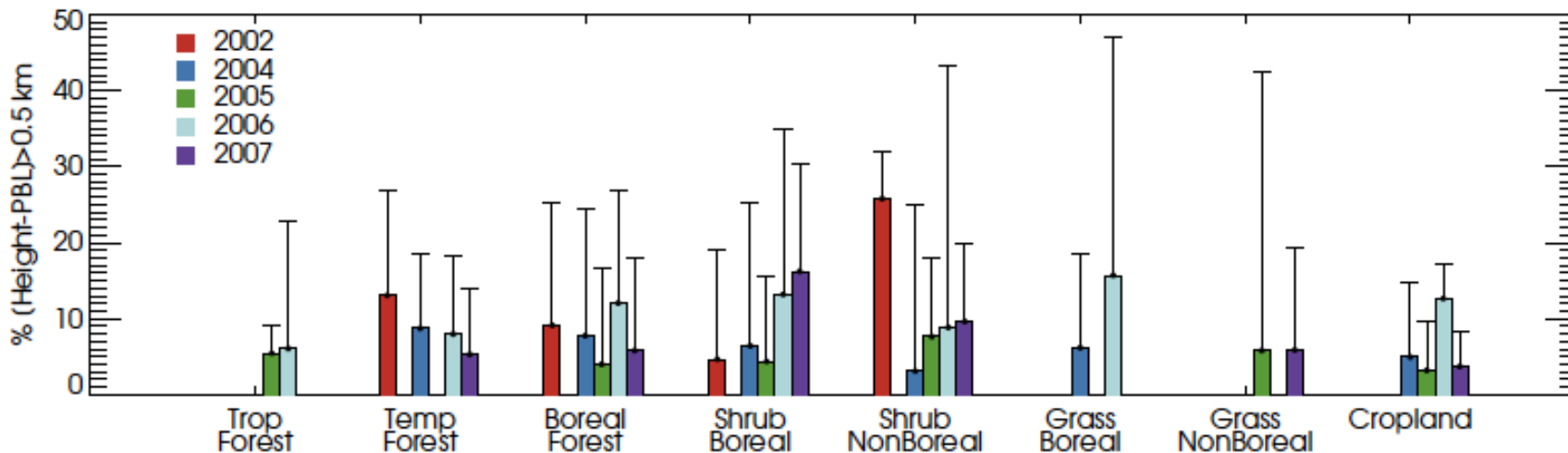
N. America plume injection height climatology



~ 3400 plumes digitized over North America for 2002, 2004-2007

MODIS IGBP land cover map (1x1 Km res)

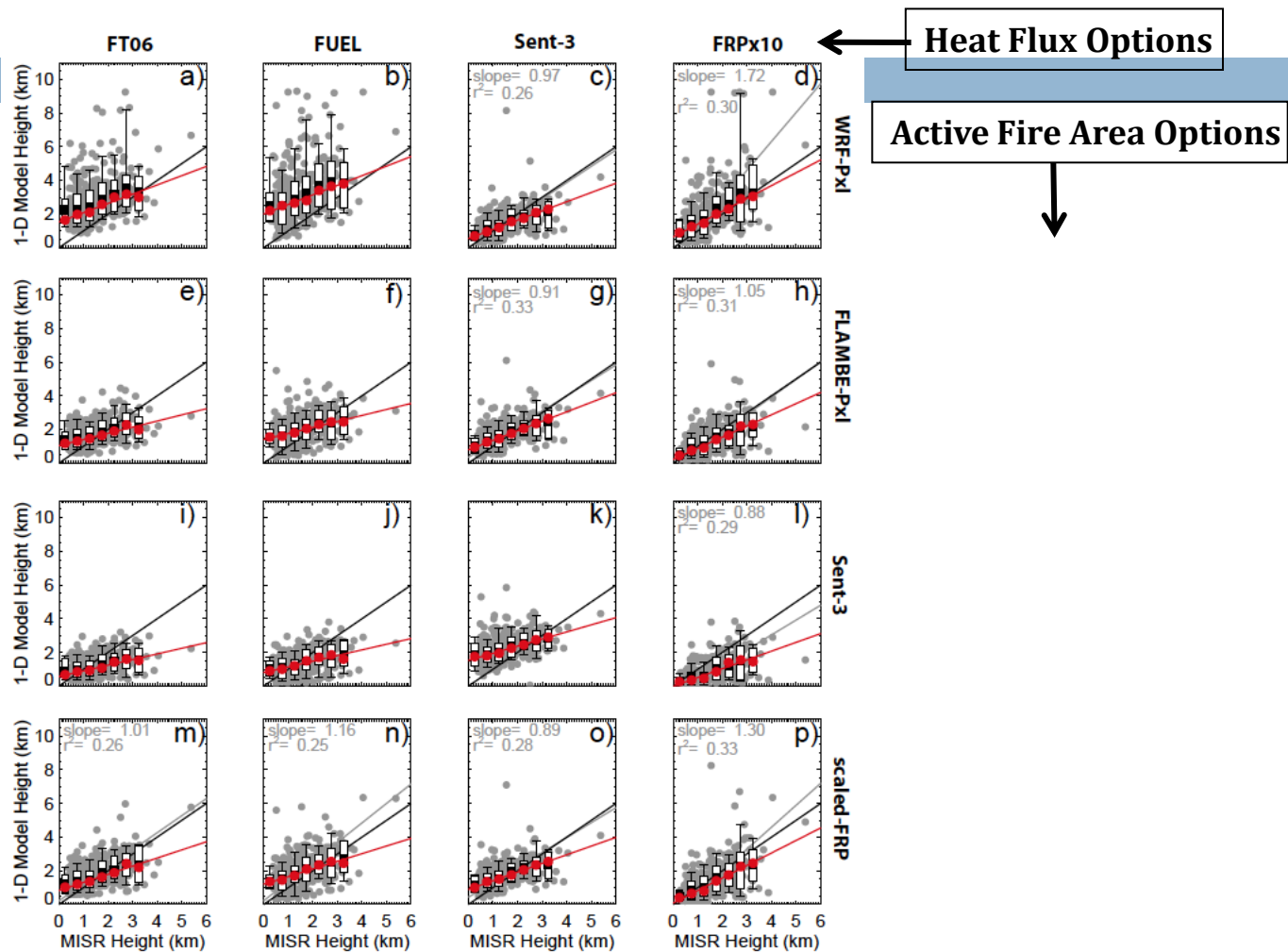
- Tropical Forest
- Temperate Forest
- Boreal Forest
- Boreal Shrubland
- Non-Boreal Shrubland
- Boreal Grassland
- Non-Boreal Grassland
- Cropland



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

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 Aeroacom 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>

Requested output

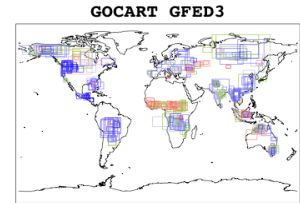
- 1st order: 550 nm total AOD at satellite time
- 2nd: AAOD, wind speeds, PBL height,
- 3rd: potential temperature

- 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

Expected Outcomes and Deliverables

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