

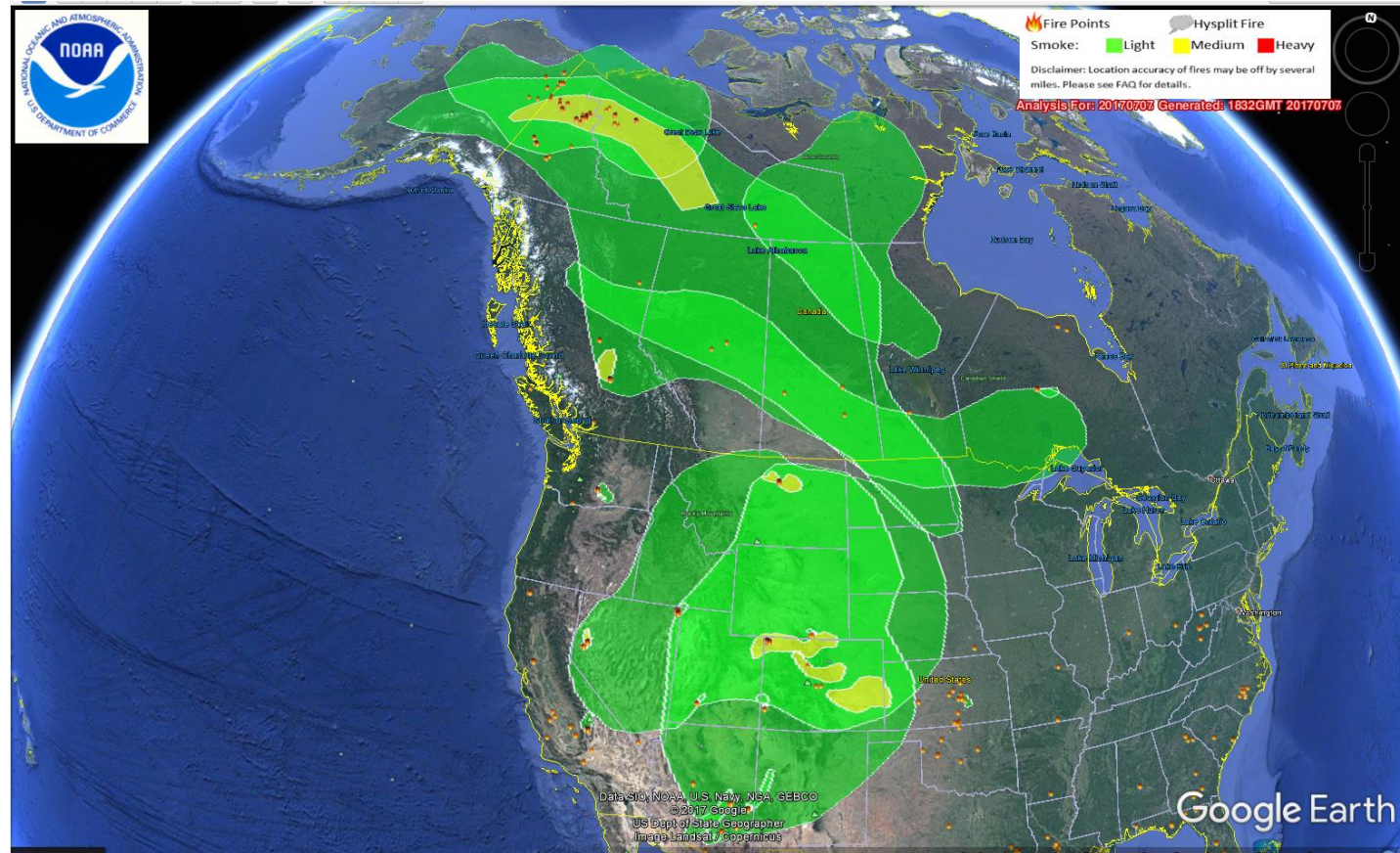
# Fire datasets, emissions, forecasting, land cover

Christine Wiedinmyer



# Overview

- Emissions from Fires
  - Available inventories
  - Creating your own emissions
    - Input datasets
- Fire Forecasting
  - What's available online data
- What else are you looking for?



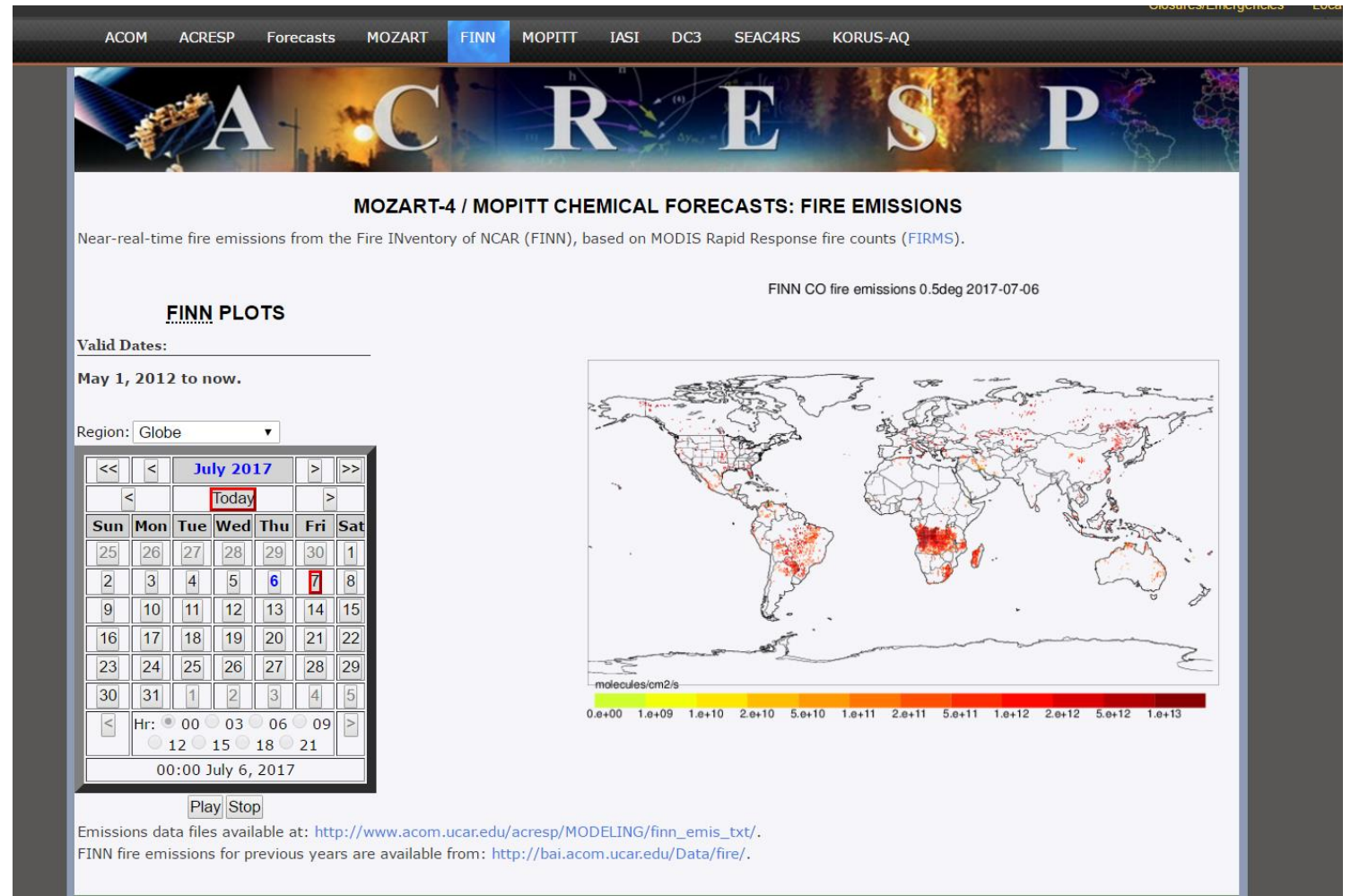
# Estimating emissions from open burning

- Fire-Specific Estimates
  - Biscuit Fire (Campbell et al., 2007)
  - Black Saturday Fires Australia (Murphy et al., 2012)
- Regional Models
  - FLAMBE (Reid et al., 2008)
  - North America (Wiedinmyer et al., *AE*, 2006)
  - Himalaya (Vadrevu et al., *AE*, 2011)
  - Western U.S. (Urbanski, *ACP*, 2012)
  - Asia (Song et al., *ERL*, 2010)
  - Western Africa (Lioussé et al., 2010)
- Global Models
  - GFED (van der Werf et al., *AC&P*, 2010 and others)
  - FINN (Wiedinmyer et al., *GMD*, 2011)
  - GFAS, (Kaiser et al. *Biogeosciences*, 2012)
  - QFED (Darmenov, A. S., and da Silva, A. 2015. *The Quick Fire Emissions Dataset (QFED): Documentation of versions 2.1, 2.2 and 2.4.* (R. D. Koster, Ed.) (Vol. 38). USA.)



# Where can I find these?

- FINN
  - Forecast emissions (version 1):  
<https://www.acom.ucar.edu/acresp/forecast/fire-emissions.shtml>



# Where can I find these?

- FINN
  - Forecast emissions (version 1):  
<https://www.acom.ucar.edu/acresp/forecast/fire-emissions.shtml>
  - Hindsight emissions (version 1.6):  
<http://bai.acom.ucar.edu/Data/fire/>
    - Comma-delimited files
    - Each fire a different entry
    - Developing tool to extract and develop gridded emissions

Home About Sections Observations Modeling Publications Events Opportunities People For Staff

NCAR UCAR National Center for Atmospheric Research Atmospheric Chemistry Observations & Modeling

**FIRE EMISSION FACTORS AND EMISSION INVENTORIES**

For any questions or comments about the downloads on this page, please contact [Christine Wiedinmyer](#).

Please submit your name and contact information:

- Name:
- Institution or Company:
- E-mail:
- How do you intend to use these files?

**1) Fire INventory from NCAR (FINN), Version 1.5**  
[Wiedinmyer et al., Geoscientific Model Development, 2011](#)

Please choose the time period and speciation desired:

- 2002 MOZART4  2002 SAPRC99  2002 GEOS-chem
- 2003 MOZART4  2003 SAPRC99  2003 GEOS-chem
- 2004 MOZART4  2004 SAPRC99  2004 GEOS-chem
- 2005 MOZART4  2005 SAPRC99  2005 GEOS-chem
- 2006 MOZART4  2006 SAPRC99  2006 GEOS-chem
- 2007 MOZART4  2007 SAPRC99  2007 GEOS-chem
- 2008 MOZART4  2008 SAPRC99  2008 GEOS-chem
- 2009 MOZART4  2009 SAPRC99  2009 GEOS-chem
- 2010 MOZART4  2010 SAPRC99  2010 GEOS-chem
- 2011 MOZART4  2011 SAPRC99  2011 GEOS-chem
- 2012 MOZART4  2012 SAPRC99  2012 GEOS-chem
- 2013 MOZART4  2013 SAPRC99  2013 GEOS-chem
- 2014 MOZART4  2014 SAPRC99  2014 GEOS-chem
- 2015 MOZART4  2015 SAPRC99  2015 GEOS-chem
- 2016 MOZART4  2016 SAPRC99  2016 GEOS-chem

**Notes:**

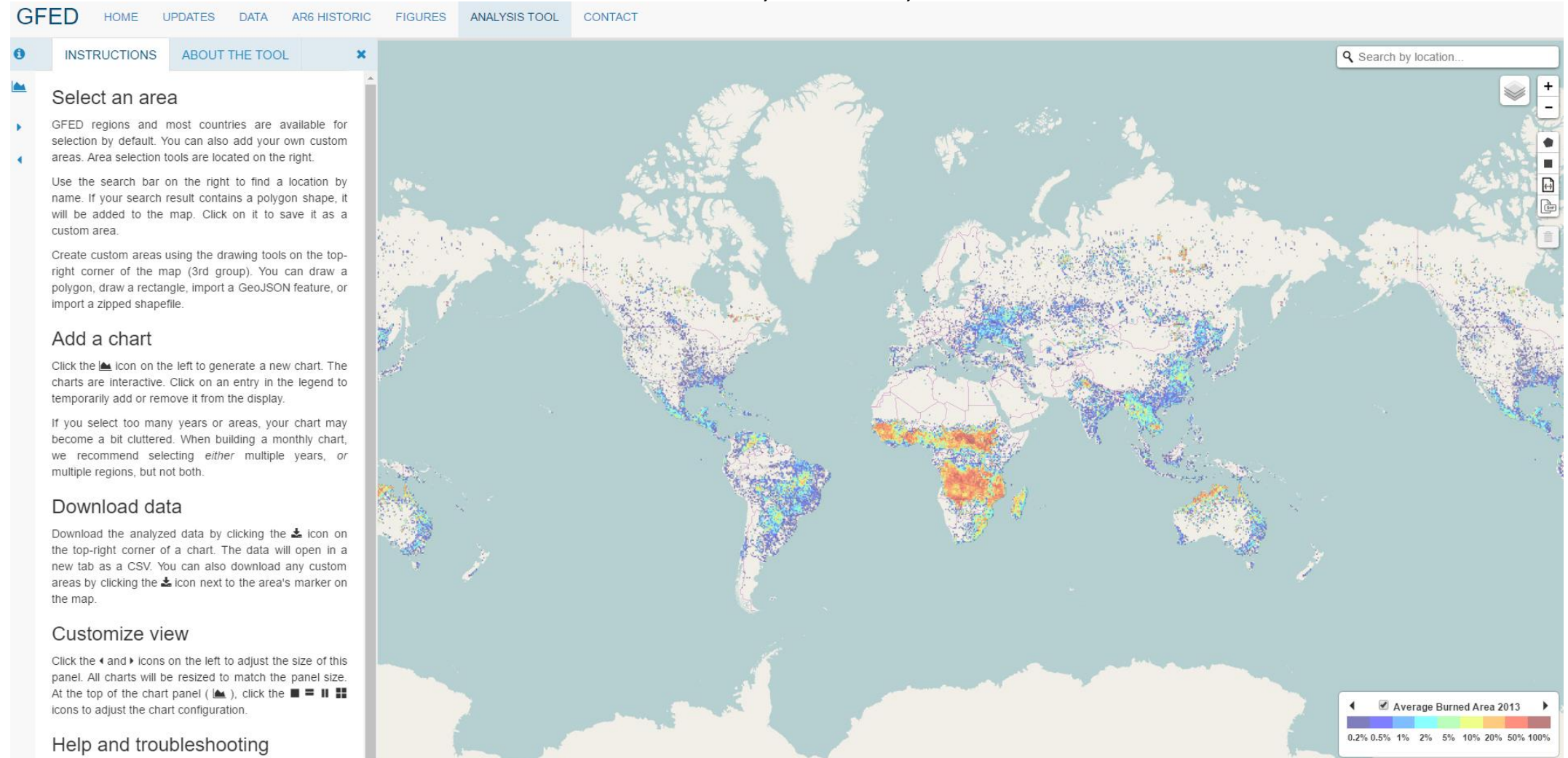
- Files are comma-delimited ASCII files. The format for the files are the same as the format of the version 1 files.
- For more information on MOZART4 and SAPRC99, please download this README file: [link](#).
- For more information on GEOS-chem, please download this README file: [link](#).

# Where can I find these?

- GFED

- <http://www.globalfiredata.org/>

van der Werf, G. R., Randerson, J. T., Giglio, L., van Leeuwen, T. T., Chen, Y., Rogers, B. M., Mu, M., van Marle, M. J. E., Morton, D. C., Collatz, G. J., Yokelson, R. J., and Kasibhatla, P. S.: Global fire emissions estimates during 1997–2015, Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2016-62>, in review, 2017.





















# Where can I find these?

- QFED

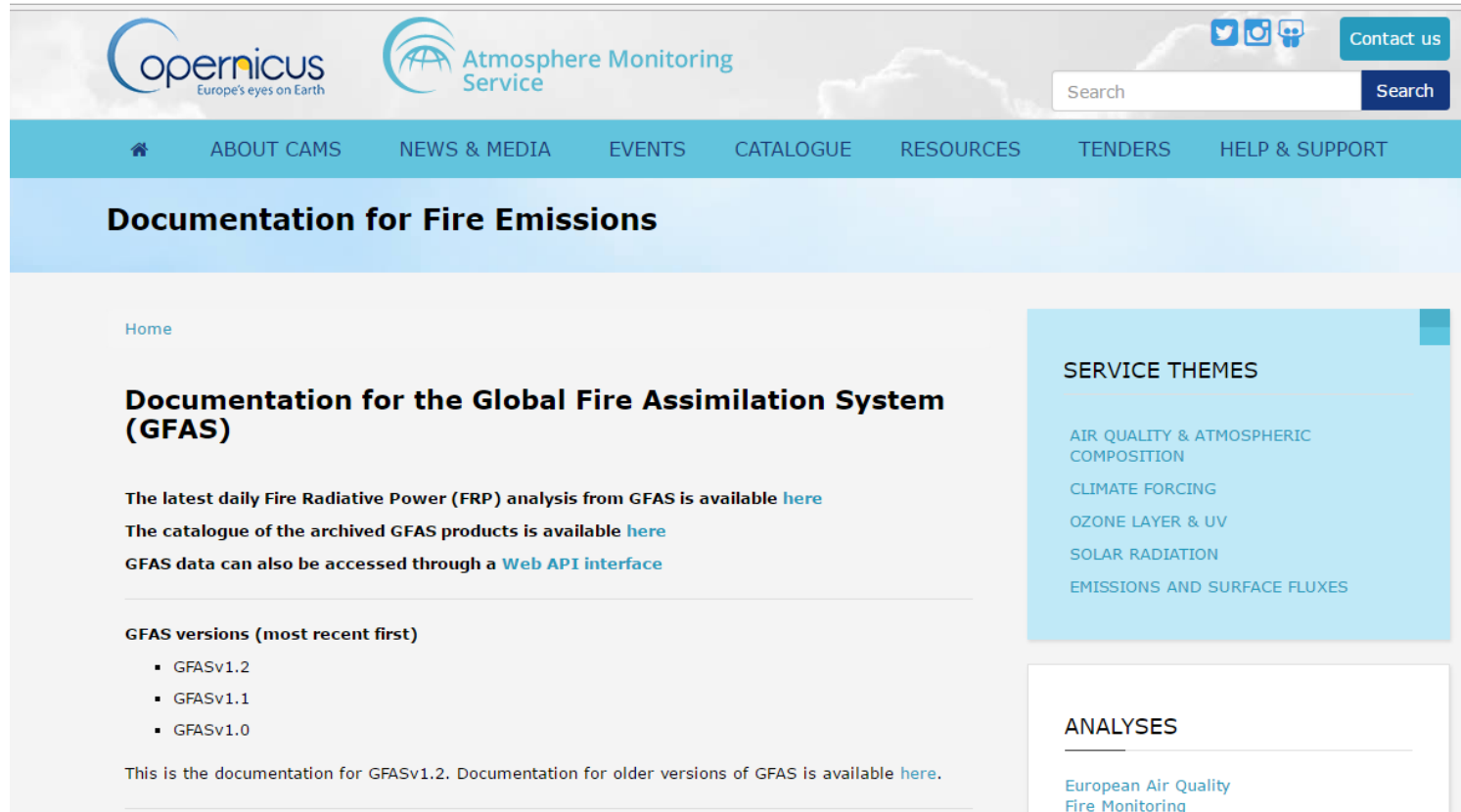
- Darmenov, A., and da Silva, A. M.: The Quick Fire Emissions Dataset (QFED) - Documentation of versions 2.1, 2.2 and 2.4, NASA TM-2013-104606, Vol. 32, (<http://gmao.gsfc.nasa.gov/pubs/tm/>), 183 pp, 2013.
- 0.1 degree gridded data, 2000- November 2016 available at:
  - <ftp://iesa@ftp.nccs.nasa.gov/aerosol/emissions/QFED/v2.4r6/0.1/>
  - Monthly files by compound in NetCDF file format

## Index of /aerosol/emissions/QFED/v2.4r6/0.1/Y2016/M11/

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 <a href="#">qfed2.emis_ch2o.005.20161101.nc4</a>	819 kB	11/9/16, 5:00:00 PM
 <a href="#">qfed2.emis_ch4.005.20161101.nc4</a>	819 kB	11/9/16, 5:00:00 PM
 <a href="#">qfed2.emis_co.005.20161101.nc4</a>	819 kB	11/9/16, 5:00:00 PM
 <a href="#">qfed2.emis_co2.005.20161101.nc4</a>	819 kB	11/9/16, 5:00:00 PM
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 <a href="#">qfed2.emis_pm25.005.20161101.nc4</a>	819 kB	11/9/16, 5:00:00 PM
 <a href="#">qfed2.emis_so2.005.20161101.nc4</a>	819 kB	11/9/16, 5:00:00 PM

# Where can I find these?

- GFAS
  - Kaiser et al, *Biogeosciences*, 2012
    - <http://www.biogeosciences.net/9/527/2012/bg-9-527-2012.pdf>
- <http://atmosphere.copernicus.eu/documentation-fire-emissions>



The screenshot shows the Copernicus Atmosphere Monitoring Service website. The header includes the Copernicus logo (Europe's eyes on Earth) and the Atmosphere Monitoring Service logo. There are social media icons for Twitter, Instagram, and Facebook, along with a 'Contact us' button and a search bar. The main navigation menu includes: Home, ABOUT CAMS, NEWS & MEDIA, EVENTS, CATALOGUE, RESOURCES, TENDERS, and HELP & SUPPORT. The page title is 'Documentation for Fire Emissions'. The main content area features a 'Home' link, a title 'Documentation for the Global Fire Assimilation System (GFAS)', and three links: 'The latest daily Fire Radiative Power (FRP) analysis from GFAS is available here', 'The catalogue of the archived GFAS products is available here', and 'GFAS data can also be accessed through a Web API interface'. Below this is a section for 'GFAS versions (most recent first)' with a list: GFASv1.2, GFASv1.1, and GFASv1.0. At the bottom, it states 'This is the documentation for GFASv1.2. Documentation for older versions of GFAS is available here.' On the right side, there is a 'SERVICE THEMES' section with links for: AIR QUALITY & ATMOSPHERIC COMPOSITION, CLIMATE FORCING, OZONE LAYER & UV, SOLAR RADIATION, and EMISSIONS AND SURFACE FLUXES. Below that is an 'ANALYSES' section with a link for 'European Air Quality Fire Monitoring'.



# Estimating emissions

$$Emissions_i = f(A(x,t), B(x,t), E_{fi})$$

**A(x,t):** Area burned

**B(x,t):** Biomass burned (biomass burned/area)

- type of vegetation (ecology)
- fuel characteristics:
  - amounts of woody biomass, leaf biomass, litter, ...
- fuel condition
  - moisture content

**E<sub>fi</sub>:** Emission factor (mass emission<sub>i</sub> /biomass burned)

- fuel characteristics
- fuel condition

# **Emission factors for open and domestic biomass burning for use in atmospheric models**

S. K. Akagi<sup>1</sup>, R. J. Yokelson<sup>1</sup>, C. Wiedinmyer<sup>2</sup>, M. J. Alvarado<sup>3</sup>, J. S. Reid<sup>4</sup>, T. Karl<sup>2</sup>, J. D. Crouse<sup>5</sup>, and P. O. Wennberg<sup>6</sup>

Atmos. Chem. Phys., 11, 4039–4072, 2011

[www.atmos-chem-phys.net/11/4039/2011/](http://www.atmos-chem-phys.net/11/4039/2011/)

[doi:10.5194/acp-11-4039-2011](https://doi.org/10.5194/acp-11-4039-2011)

Published 2011

2015 Update at:

<http://bai.acom.ucar.edu/Data/fire/>

<http://bai.acom.ucar.edu/Data/fire/finn-subset.shtml>

# Chemistry of Emissions

- Applications for models
- How explicit do we need the emissions?
  
- Temporal changes in emissions
- Controlling variables:
  - Fire conditions (i.e., temperature, flaming/smoldering)
  - Vegetation type, density
  - Vegetation conditions (i.e., drought stressed)



# Fire Locations

- <https://earthdata.nasa.gov/earth-observation-data/near-real-time/firms>

MODIS and VIIRS fire detections  
Current and Archived Data  
Text, KML, or GIS shapefiles

**Data**  
Disciplines:

**Related Content**

- [Tropical Storm Nanmadol in the western Pacific Ocean](#)
- [Tropical Storm Dora off the coast of Mexico](#)
- [EOSDIS Data News - 6/23/2017](#)
- [Wildfire in Portugal](#)
- [Webinar: Access and Visualize Model Data at the NASA GES DISC](#)

**More Resources**

- [Common Metadata Repository \(CMR\)](#)
- [Earthdata Search](#)
- [Global Imagery Browse Services \(GIBS\)](#)
- [LANCE: Land, Atmosphere Near Real-Time Capability for EOS](#)
- [Worldview](#)

## Active Fire Data

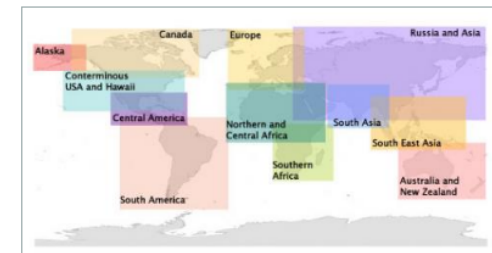


Download active fire products from the Moderate Resolution Imaging Spectroradiometer (MODIS) (MCD14DL) and the Visible Infrared Imaging Radiometer Suite (VIIRS) 375 m (VNP14IMGTDL\_NRT) for the last 24, 48 hours and 7 days in shapefile, KML, WMS or text file formats. The VIIRS 375 m active fire product is the latest product to be added to the Fire Information for Resource Management System (FIRMS). VIIRS data complement the MODIS fire detections but the improved spatial resolution of the 375 m data provides a greater response over fires of relatively small areas. [Read more about VIIRS...](#)

Data older than 7 days can be obtained from the [Archive Download Tool](#). Users intending to perform scientific analysis are advised to download the data.

Please note:

- MODIS C6 is available from November 2000 (for Terra) and from July 2002 (for Aqua) to the present.
- VIIRS 375 m near real-time (NRT) data is currently available from 8 January 2016 (NRT data are distinct from standard quality data).



- Shapefile
- KML
- TXT
- WMS
- Archive Download Tool
- Global Fire Maps

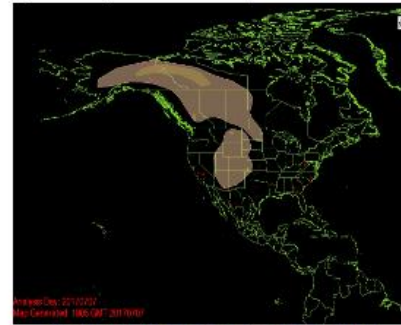
# Fire Locations

- NOAA Hazard Mapping System
  - <http://www.ospo.noaa.gov/Products/land/hms.html>

## Hazard Mapping System Fire and Smoke Product

### Current HMS Analysis

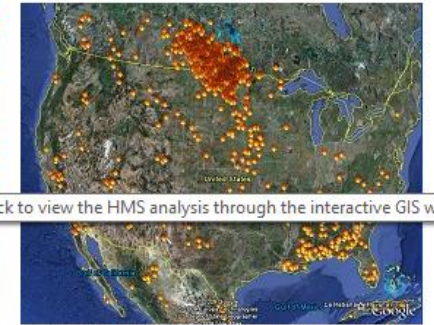
Analysis for day 7/7/2017 last updated at 7/7/2017 21:40:42 GMT



[Current HMS Fire and Smoke Analysis](#)



Download GIS files from  
<ftp://satepsanone.nesdis.noaa.gov/FIRE/HMS/GIS/>



[Click to view the HMS analysis through the interactive GIS webpage](#)

Google KML files: [Fire](#) | [Smoke](#) | [Hysplit](#)

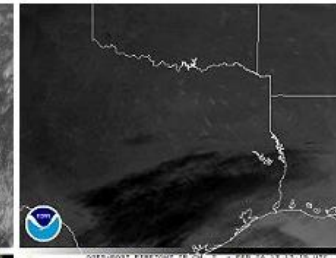
### Real-Time Satellite Imagery



[GOES West](#)



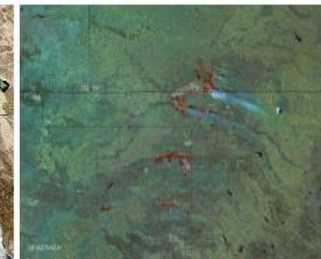
[GOES East](#)



[Active Fire Floater Imagery](#)



[NASA MODIS Rapid Response](#)




[VIIRS Remapped Projection](#)  
[VIIRS Orbital Projection](#)

# Fire Locations

- USFS RSAC
  - <https://fsapps.nwcg.gov/afm/>


- [Current Large Incidents \(Home\)](#)
- [New Large Incidents](#)
- [Fire Detection Maps](#)
- [MODIS Satellite Imagery](#)
- [VIIRS Satellite Imagery](#)
- [Fire Detection GIS Data](#)
- [Fire Data in Google Earth](#)
- [Fire Data Web Services](#)
- [Latest Detected Fire Activity](#)
- [Other MODIS Products](#)
- [Frequently Asked Questions](#)
- [About Active Fire Maps](#)



**Remote Sensing Applications Center**

2222 West 2300 South  
Salt Lake City, UT  
84119 - 2020

voice: (801) 975-3737  
fax: (801) 975-3478

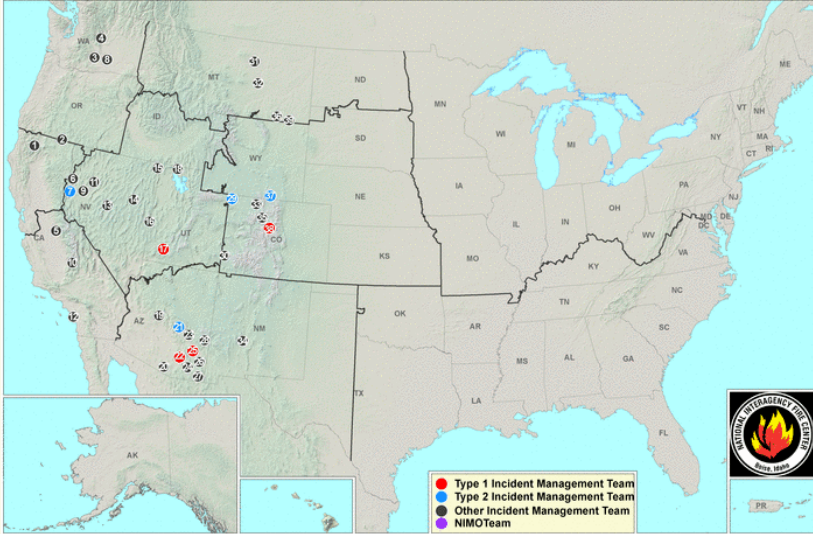


Fire locations are based on data provided by the National Interagency Coordination Center and are subject to change.

Large incident map currently updated on Fridays or as fire conditions warrant.

## Current Large Incidents

### July 07, 2017



① FAY	① LIMERICK	② HILLTOP	① JULY
② WILLOW	② CRISTIANITOS	② BURRO	② KELLY
② RATTLESNAKE HILLS	② TAR CREEK	② GIMME	② MILL CREEK
② MITCHELL	② HOBSON	② SWISHELMS	② TIFFANY
② SPRING	② DRY GULCH	② FRYE	② GUTZLER
② WINNEMUCCA RANCH	② HATCHERY	② SHEEP	② LEE CREEK
② EARTHSTONE	② BRIANHEAD	② SADDLE	② KEYSTONE
② SILVER DOLLAR	② CEDAR HILLS	② SH CREEK	② PEAK 2
② TRUCKEE	② GOODWIN	② PEEKABOO	② PLUM POWDER RIVER
② SCHAEFFER	② ELK HORN	② EAST RIM	

[View High Resolution Map](#)   
 [Definition of Map Terms](#)   
 [Download KMZ File](#)


**IMSR Summary**  
July 7th, 2017

**National Preparedness Level**

Level 3  
National Fire Activity  
Initial attack activity: Moderate (216) new fires  
New large incidents: 12  
Large fires contained: 7  
Uncontained large fires: 27  
Area Command Teams Committed: 0  
NIMOs committed: 0  
Type 1 IMTs committed: 4  
Type 2 IMTs committed: 8

Source:  
[Incident Management Situation Report](#)

**Active Fire Mapping News**  
May 15, 2017



**Website Accessibility Alert:** The Active Fire Mapping Program website, data, products and services will be unavailable starting **11AM MDT Wednesday May 17, 2017 until 8AM MDT Thursday May 18, 2017** due to data center maintenance issues.

[View map with Greater Sage-Grouse habitat layer.](#)



# Fire Locations

- USFS RSAC
  - <https://fsapps.nwcg.gov/afm/>
  - MODIS, VIIRS, AVHRR, GOES

**Current Large Incidents (Home)**

**New Large Incidents**

**Fire Detection Maps**

**MODIS Satellite Imagery**

**VIIRS Satellite Imagery**

**Fire Detection GIS Data**

**Fire Data in Google Earth**

**Fire Data Web Services**

**Latest Detected Fire Activity**

**Other MODIS Products**

**Frequently Asked Questions**

**About Active Fire Maps**

**RSAC**

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[View map with Greater Sage-Grouse habitat layer.](#)

**Legend:**

- Type 1 Incident Management Team
- Type 2 Incident Management Team
- Other Incident Management Team
- NIMOTeam

① FAY	① LIMERICK	① HILLTOP	① JULY
① WILLOW	① CRISTIANITOS	① BURRO	① KELLY
① RATTLESNAKE HILLS	① TAR CREEK	① GIMME	① MILL CREEK
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① SCHAEFFER	① ELK HORN	① EAST RIM	

[View High Resolution Map](#) [Definition of Map Terms](#) [Download KMZ File](#)

Select a Fire



# Other resources about fire locations, etc.

- Wildfire Automated Biomass Burning Algorithm (WFABBA)
  - <http://wfabba.ssec.wisc.edu/>
  - North and South America
- InciWeb
  - <https://inciweb.nwcg.gov/>
- NIFC
  - <https://www.nifc.gov/>
- NICC
  - <https://www.predictiveservices.nifc.gov/intelligence/intelligence.htm>

# Burned area data

- MODIS Burned Area Products
  - <http://modis-fire.umd.edu/pages/BurnedArea.php>
- USFS Burned Area Emergency Response (BAER)
  - <https://www.fs.fed.us/eng/rsac/baer/>
- Monitoring Trends in Burn Severity (MTBS)
  - <http://www.mtbs.gov/>

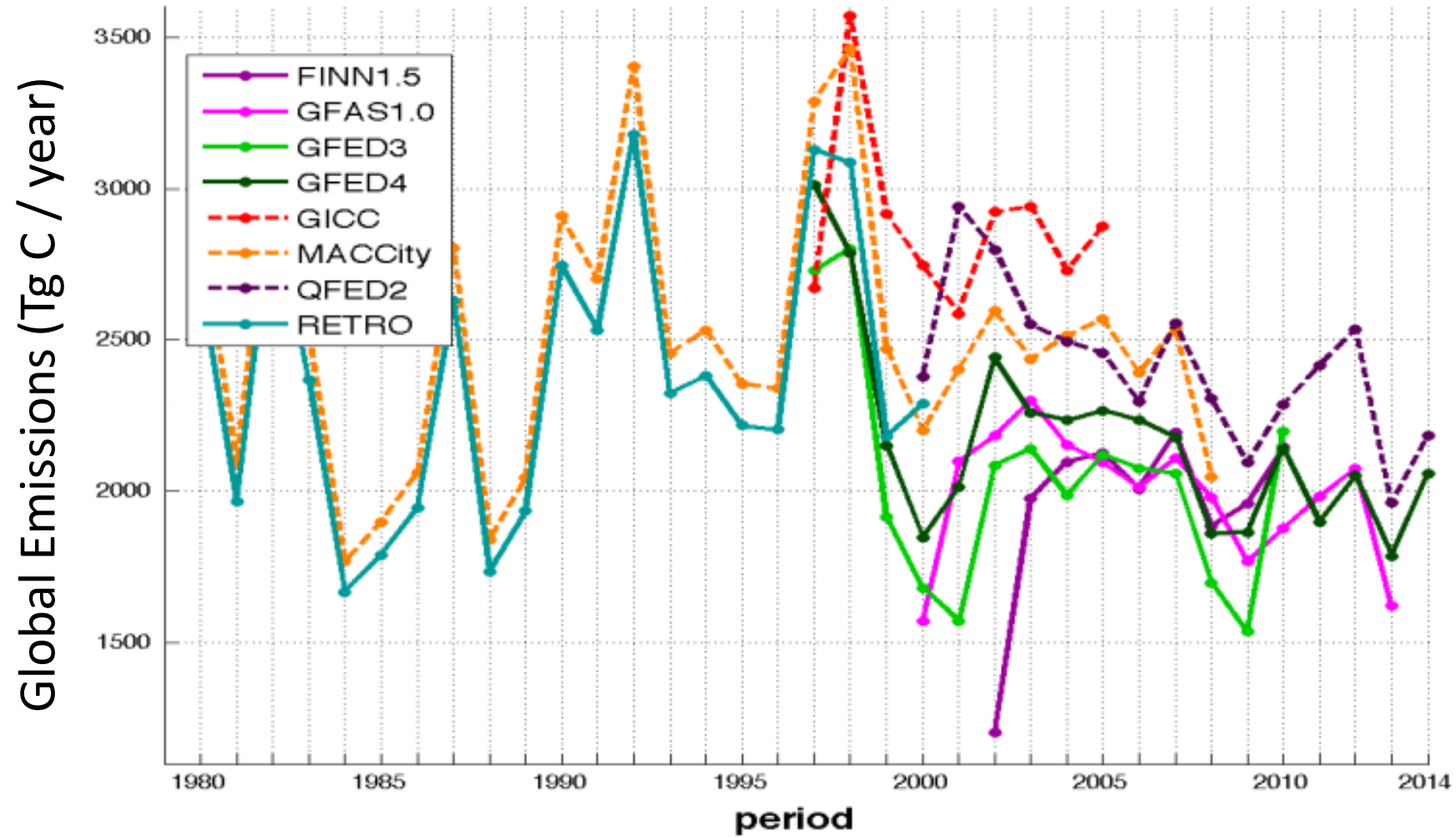
# Vegetation

- Global
  - MODIS Datasets Land Cover Type
    - Vegetation Continuous Fields
  - USGS 30m Land Cover
    - <https://landcover.usgs.gov/glc/>
    - Tree cover
  - Global Land Cover, <http://www.globallandcover.com/GLC30Download/index.aspx>
  - ESA 200m Annual Land Cover (1992-2015)
    - <https://www.esa-landcover-cci.org/?q=node/175>

# Uncertainties in Emission Estimates

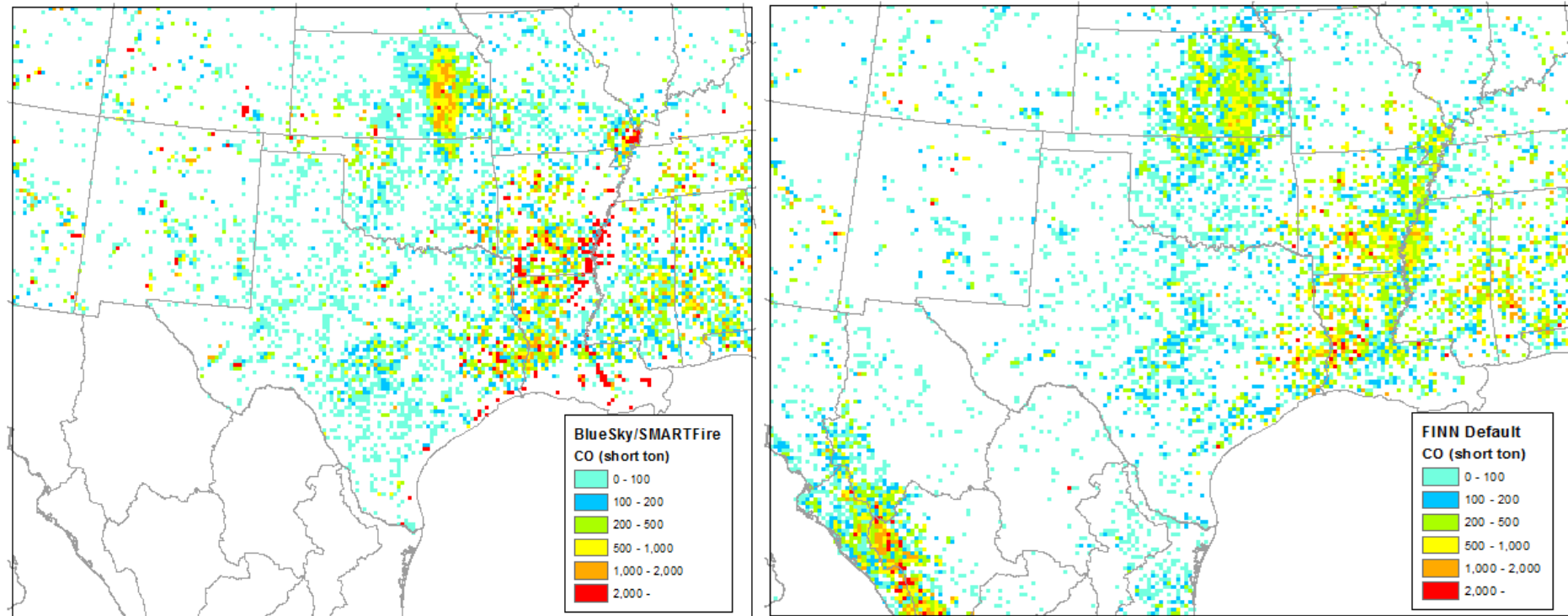


# Uncertainties in the emission models

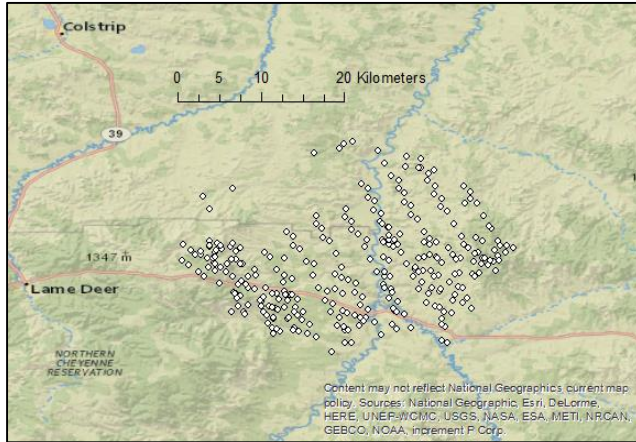


# Uncertainties in the emissions

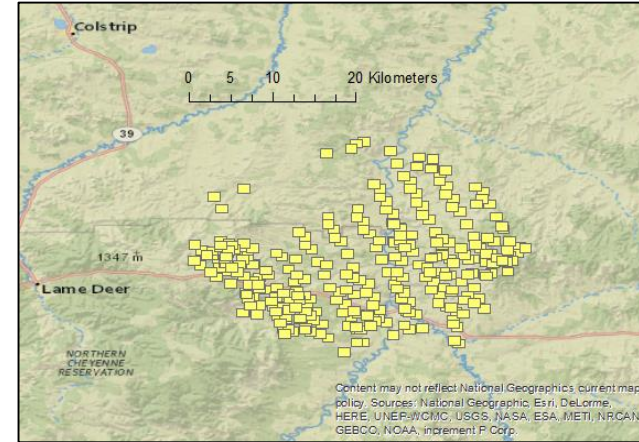
- Emission Factors
- Fire location/timing
- Fuel loadings
- Fuel Consumption



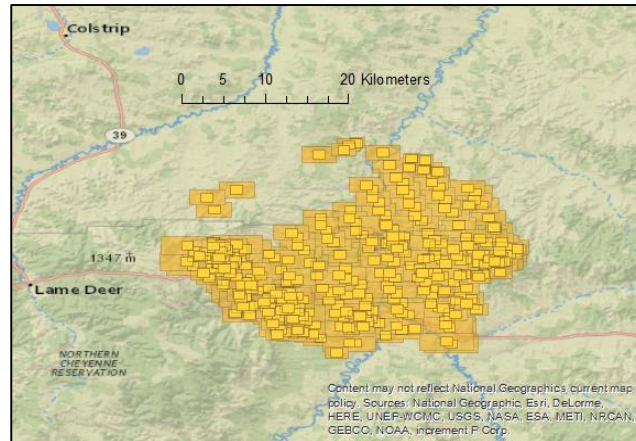
# FINNv2: Updates in Progress



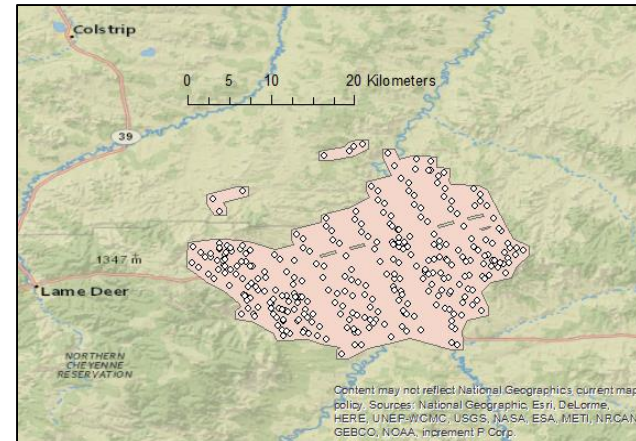
MODIS fire detections



1-km<sup>2</sup> area per detection



110% of easterly and northerly dimensions of satellite scan and track sizes identifies detection cluster.

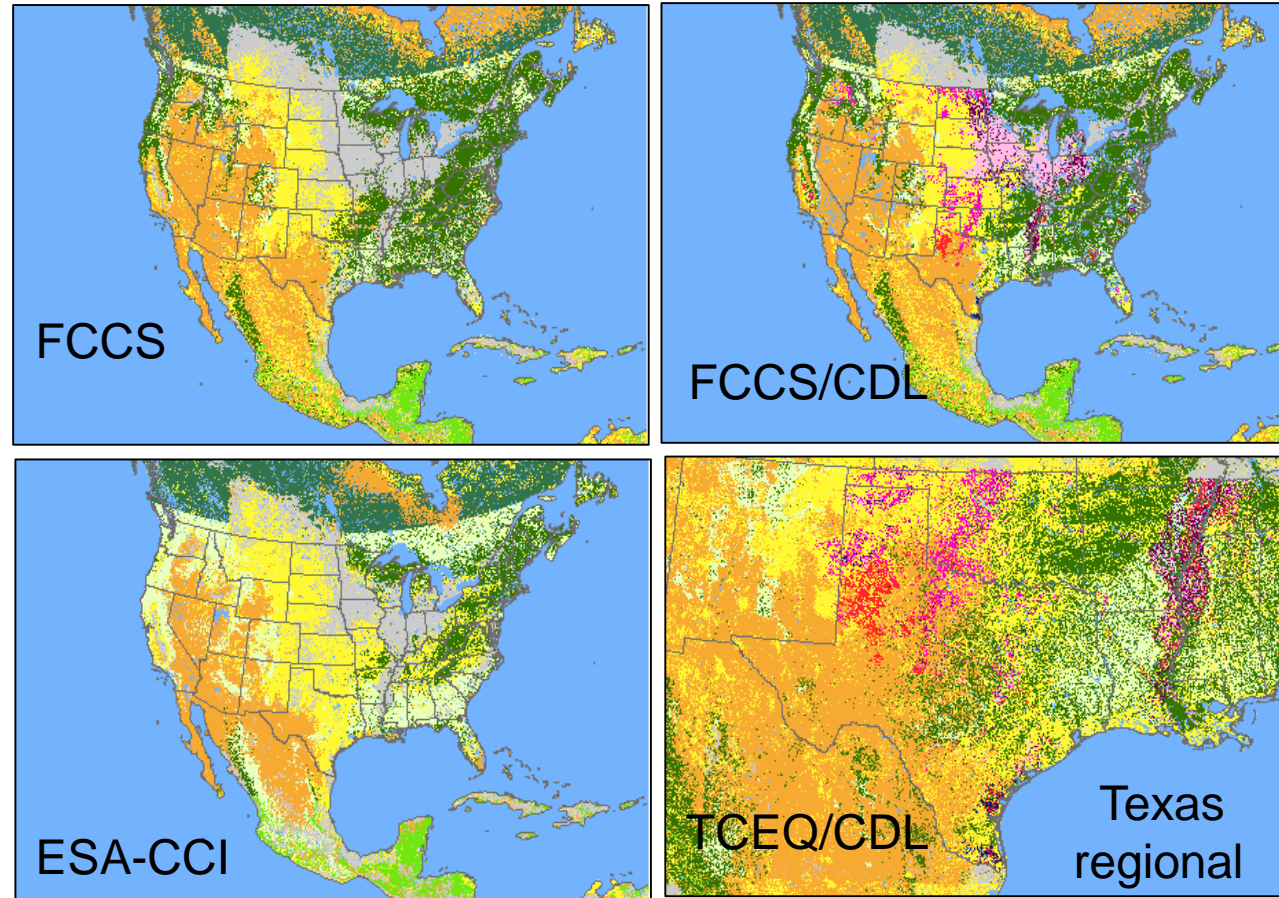


Polygon formed from convex hulls of clusters of detections for burned area.



# FINNv2: *Updates in Progress*

Comparing impacts from land cover inputs





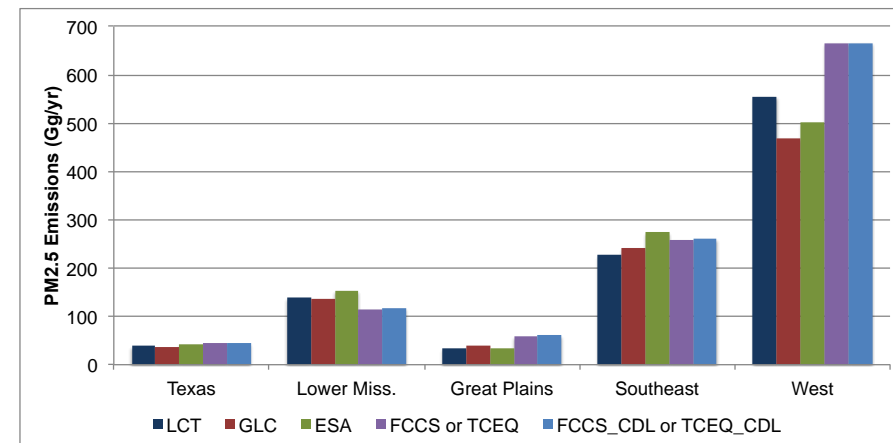
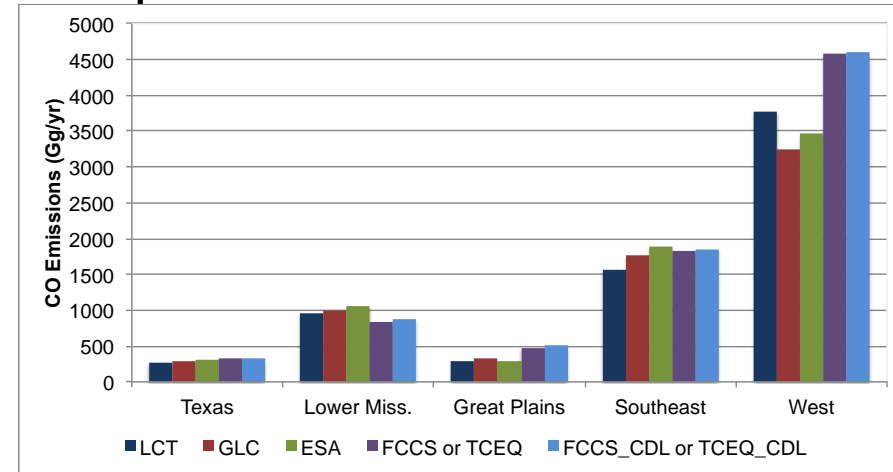
# FINNv2: Updates in Progress

- Comparing impacts from land cover inputs

Annual regional total CO and PM<sub>2.5</sub> emissions during 2012 from FINN v.2.1.

Land cover influences assignments of emission factors and fuel loadings.

Specification of crops captures seasonal activity but with little effect on total emissions



\*TCEQ regional land cover includes only Texas and the Lower Mississippi Valley (Louisiana, Mississippi, Arkansas). FCCS for CONUS and MODIS LCT applied elsewhere.

# What's needed for forecasting?

*Depends on...*

- What scales are you looking at?
- Where in the world are you looking?
- What do you want to know?

# Forecasting

- Fuels and Fire Danger in the US
  - [https://www.predictiveservices.nifc.gov/fuels\\_fire-danger/fuels\\_fire-danger.htm](https://www.predictiveservices.nifc.gov/fuels_fire-danger/fuels_fire-danger.htm)
- NOAA Hazard Mapping System
  - <http://www.ospo.noaa.gov/Products/land/hms.html>
- Naval Research Laboratory
  - <https://www.nrlmry.navy.mil/aerosol/>
  - Includes FLAMBE emissions and forecasts
- GEOMAC
  - <https://www.geomac.gov/viewer/viewer.shtml>

