

Results from a Survey of Global Natural Gas Flaring from Visible Infrared Imaging Radiometer Suite Data



Chris Elvidge

Earth Observation Group

NOAA National Centers for Environmental Information

Boulder, Colorado

chris.elvidge@noaa.gov

Mikhail Zhizhin, Kimberly Baugh, Feng-Chi Hsu

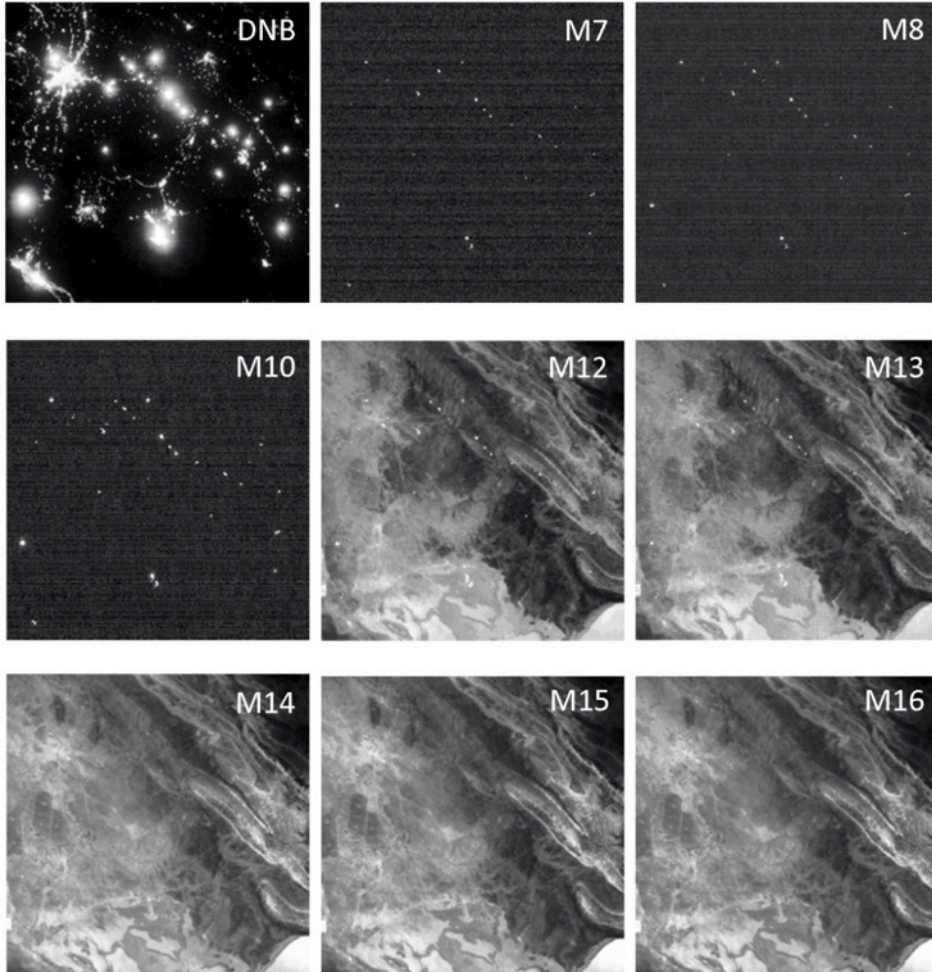
CIRES

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Why monitor global flaring

- MRV (monitoring, reporting and verification) of national carbon emission reductions under the recently signed Paris Agreement.
- Tracking progress towards “Zero routine flaring by 2030” initiative of WB and UN.
- Calculating fossil fuel carbon intensities for Low Carbon Fuel Standards.
- As a tool for exploration for waste natural gas for capture / utilization.
- As an input to carbon emission spatial databases.

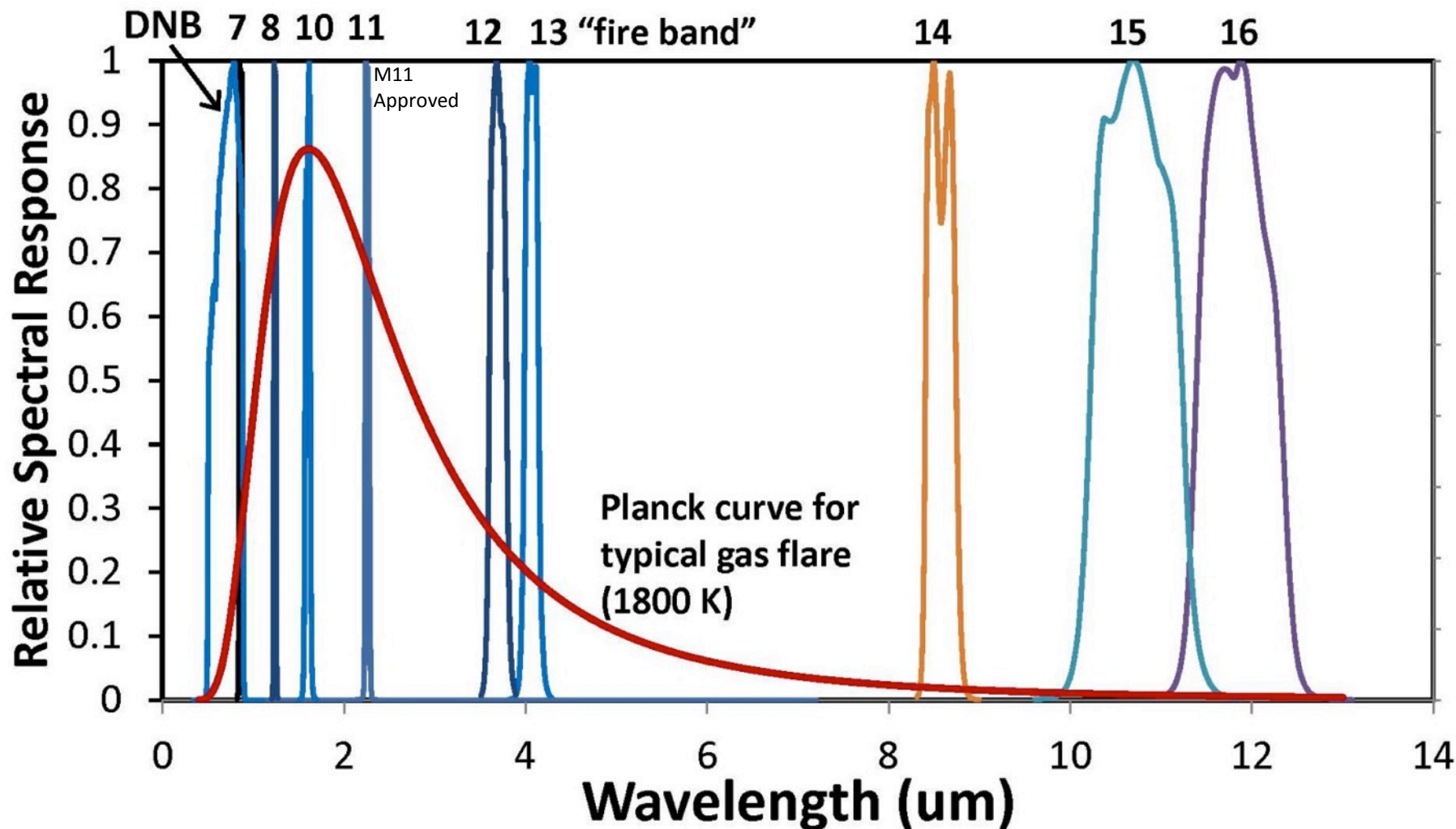
Basra Gas Flares, Iraq - July 17, 2012



Gas flares are readily detected in the VIIRS M10 spectral band

VIIRS Nightfire (VNF): A global multispectral fire product

Nine channels of data are collected at night



Nighttime collection of channel 11 is expected to start in 2016

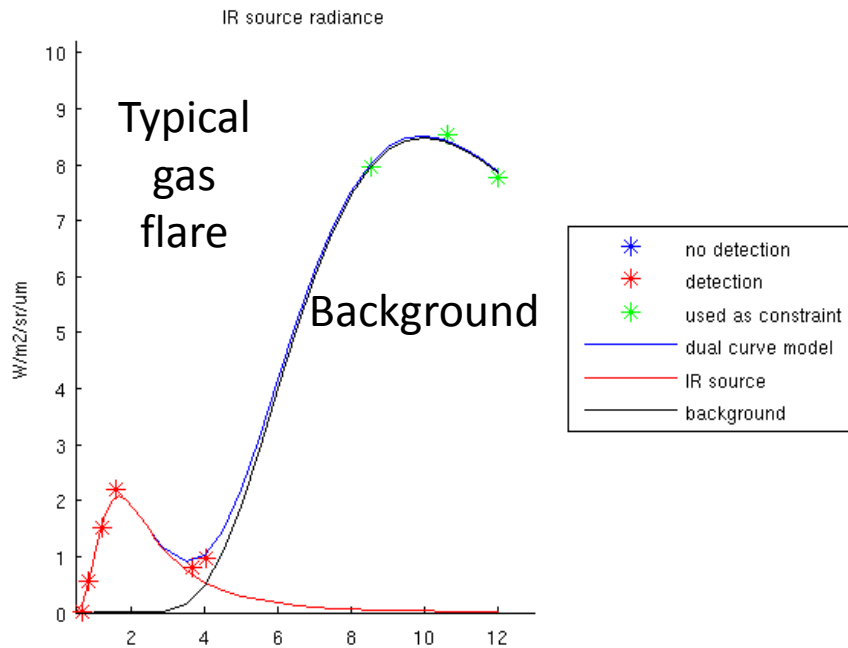
VIIRS Nightfire (VNF)

- A multispectral “fire product” developed by the NOAA Earth Observation Group.
- Makes use of two near infrared (NIR), a short-wave infrared (SWIR), and two mid-wave infrared spectral bands.
- The NIR and SWIR bands were designed for daytime imaging of reflected sunlight. IR emitters can be readily identified at night in these spectral bands.
- Daily files are in csv and kmz formats available at:
http://ngdc.noaa.gov/eog/viirs/download_viirs_fire.html
- Publications: <http://www.mdpi.com/2072-4292/5/9/4423>
<http://www.mdpi.com/1996-1073/9/1/14>

Why Multispectral?

Combustion parameters:

ID=VNF_npp_d20140426_t0800568_e0806372_b12924_x0922946W_y196042N_l2716_s2045_v21
Lat=19.604204 Lon=-92.294624 deg. Time=2014/04/26 08:06:32
Temperature source=1730 deg. K Temperature background=291 deg. K
Radiant heat intensity=16.63 W/m2 Radiant heat=13.18 MW
Source footprint=25.96 m2
Methane equivalent=0.356 m3/s CO2 equivalent=651.983 g/s
Cloud state=clear Atmosphere corrected=no

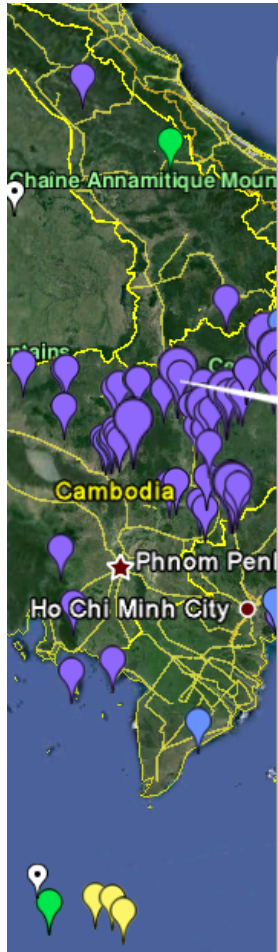


To get at
the Planck
curves!

These are used
to calculate
temperature,
source size and
radiant heat.

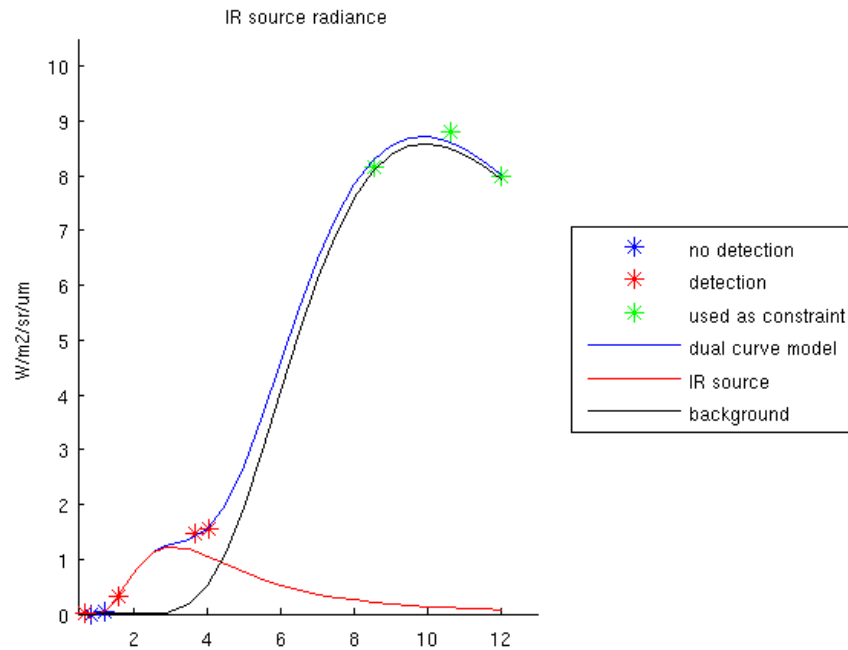
Daily files are in csv and kmz formats

Typical Biomass Burning Detection



Combustion parameters:

ID=VNF_npp_d20140426_t1815286_e1821090_b12930_x1060700E_y138260N_l0804_s1065_v21
Lat=13.825994 Lon=106.070045 deg. Time=2014/04/26 18:17:32
Temperature source=942 deg. K Temperature background=291 deg. K
Radiant heat intensity=17.98 W/m2 Radiant heat=16.68 MW
Source footprint=373.71 m2
Cloud state=clear Atmosphere corrected=no



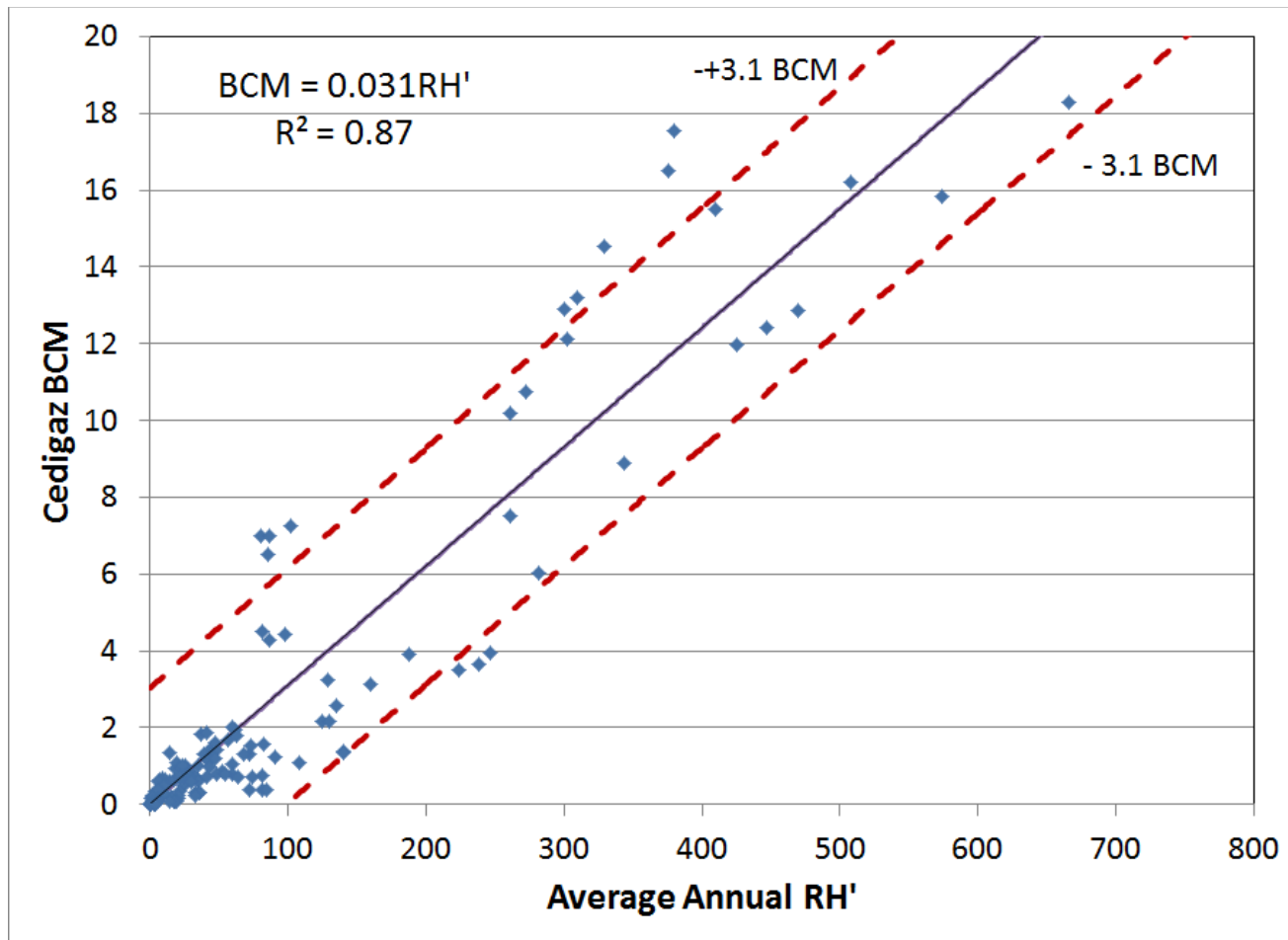
Lower temperature than gas flaring. Often these have larger source size than gas flares.

Global Atlas of Gas Flaring

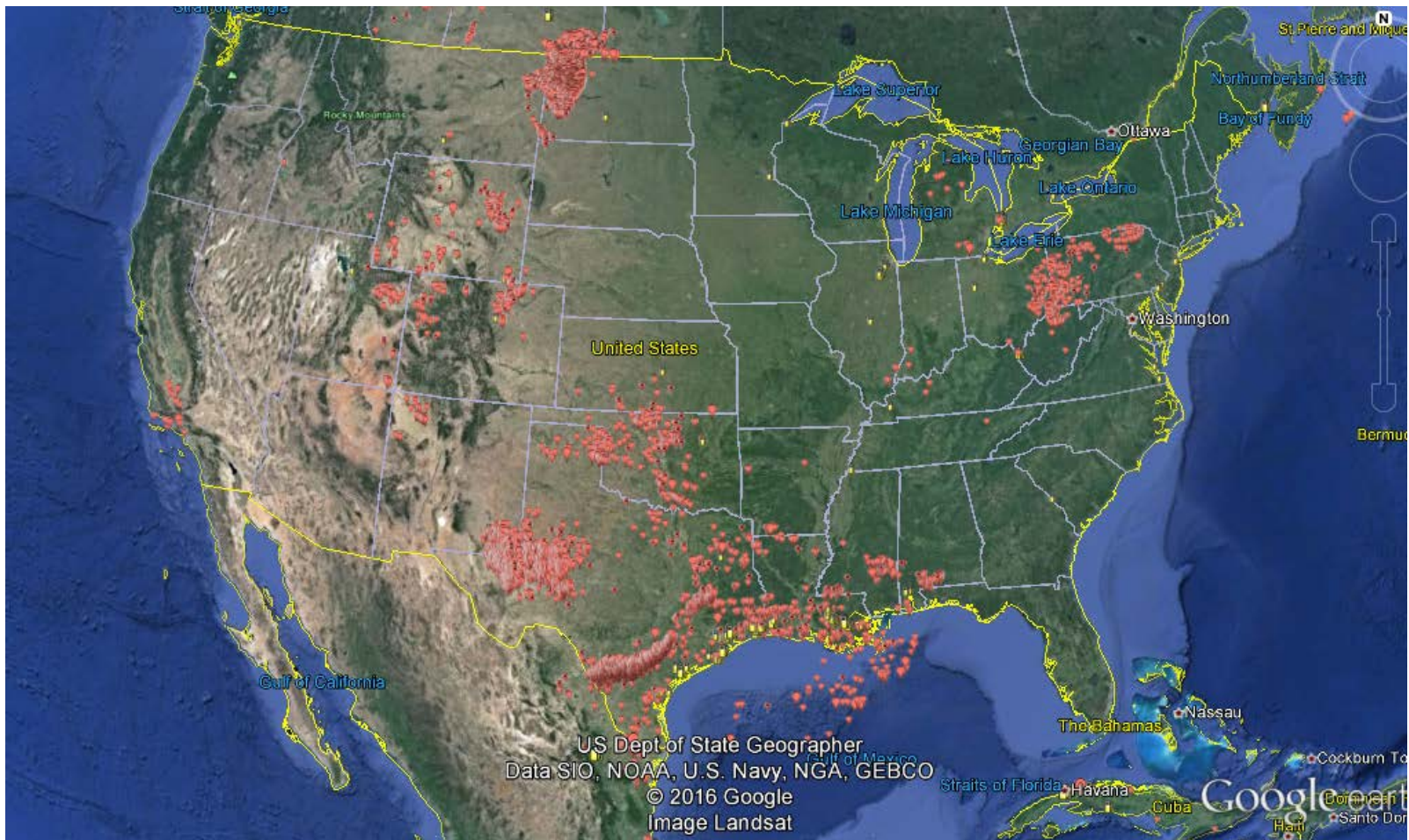
http://ngdc.noaa.gov/eog/viirs/download_global_flare.html

- 2012-2014
- Flaring sites identified based on temperature and persistence.
- Flared gas volume calibration developed based Cedigaz national level data.
- 17K flaring sites identified.
- Russia leads in flared gas volume.
- USA leads in the number of flaring sites.
- The largest flare is in Venezuela.

Calibration with Cedigaz data



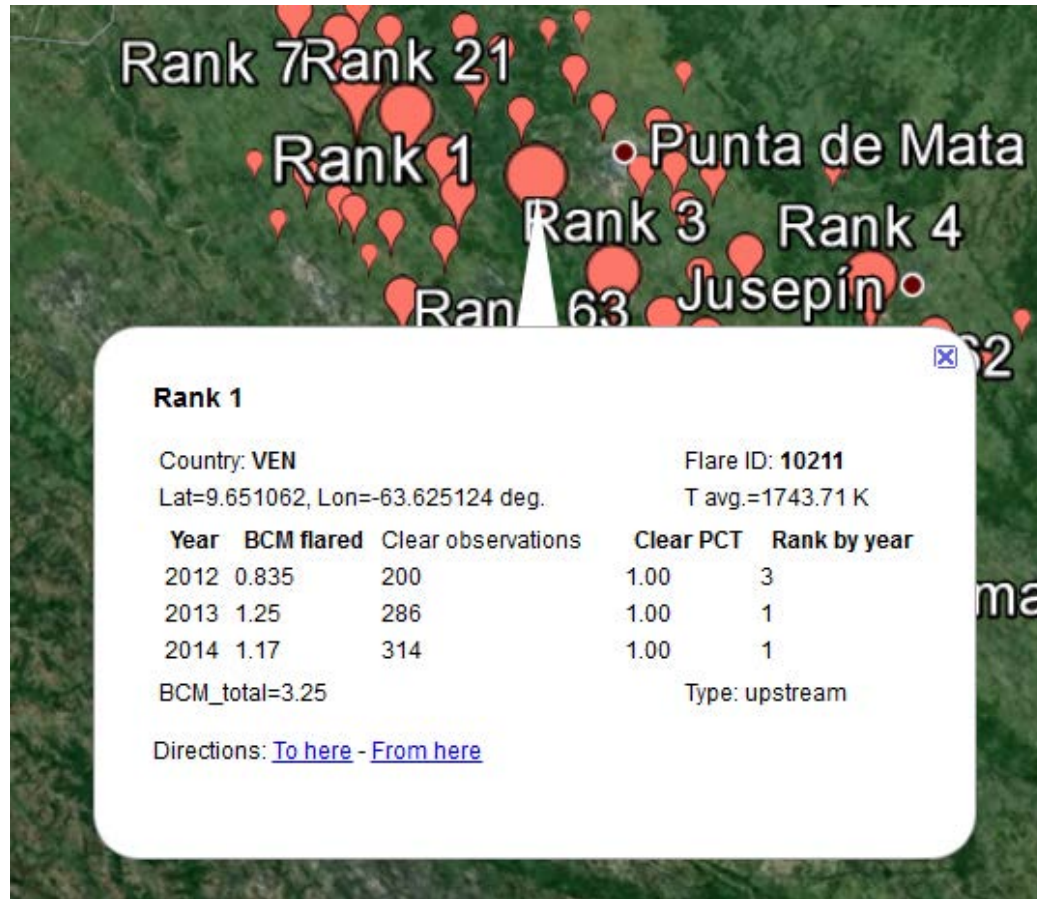
USA Flaring

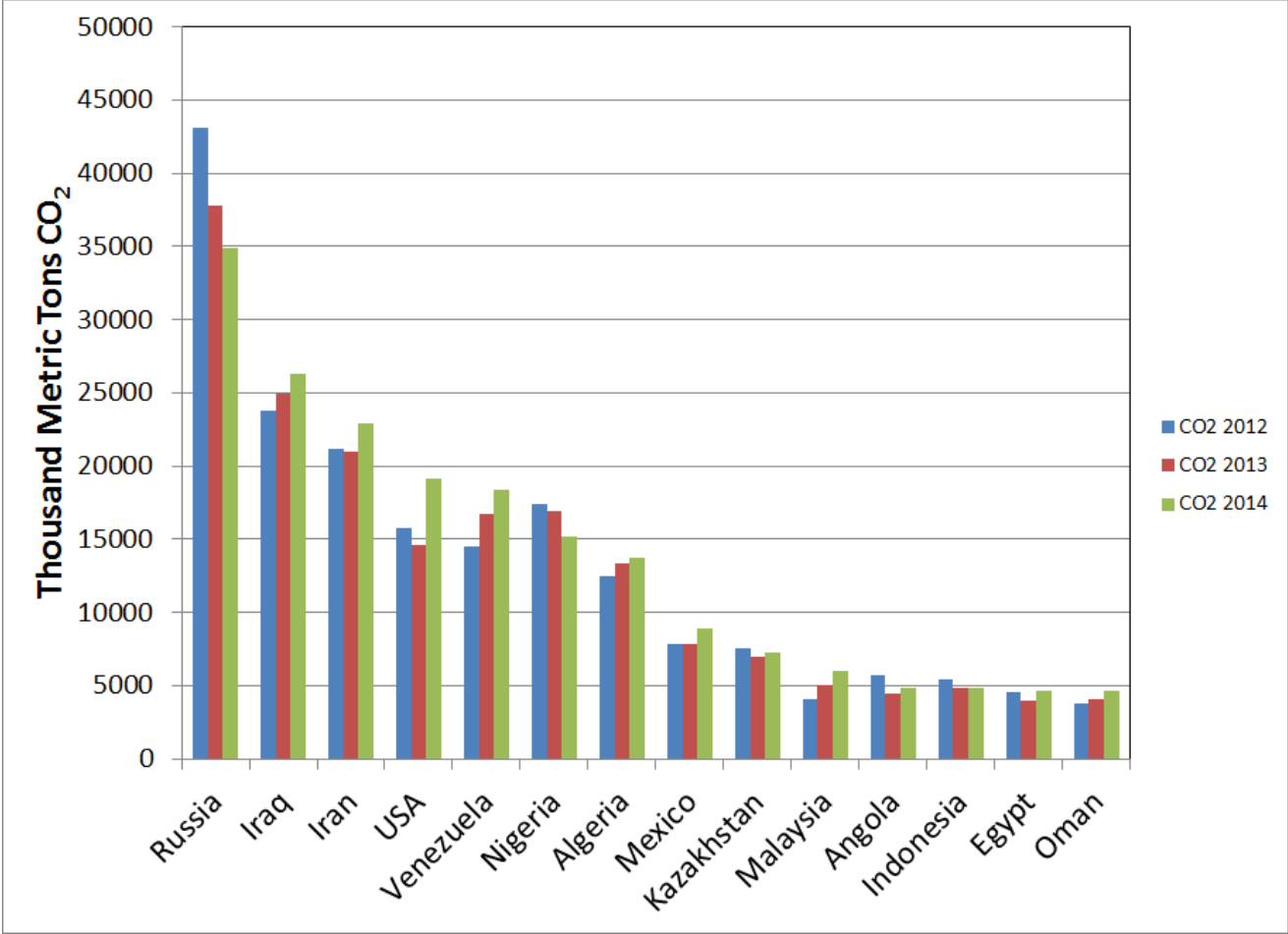


Russia Flaring



Largest Flare





Summary

- A new atlas of global gas flaring is now available.
 - 17K flaring sites identified.
 - Russia leads in flared gas volume.
 - USA leads in the number of flaring sites.
 - The largest flare is in Venezuela.
- Error bars on flared gas volume estimates are high, probably due to untraceable errors in the Cedigaz data. The calibration could be improved using a test flare facility.
- The project is currently on hold due to funding hiatus.