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

May 18, 2016
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.
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
Why Multispectral?

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

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 on 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

\[ BCM = 0.031RH' \]

\[ R^2 = 0.87 \]
USA Flaring
Russia Flaring
Largest Flare

![Map of Largest Flare Locations](image)

### Rank 1
- **Country:** VEN
- **Flare ID:** 10211
- **T. avg.:** 1743.71 K

<table>
<thead>
<tr>
<th>Year</th>
<th>BCM flared</th>
<th>Clear observations</th>
<th>Clear PCT</th>
<th>Rank by year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.835</td>
<td>200</td>
<td>1.00</td>
<td>3</td>
</tr>
<tr>
<td>2013</td>
<td>1.25</td>
<td>286</td>
<td>1.00</td>
<td>1</td>
</tr>
<tr>
<td>2014</td>
<td>1.17</td>
<td>314</td>
<td>1.00</td>
<td>1</td>
</tr>
</tbody>
</table>

**BCM total:** 3.25

**Type:** upstream

**Directions:** To here - From here
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.