Introducing the Oil Climate Index: Applying NASA's Satellite Data to Fill Gaps in Resource Decision-making

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About the Carnegie Endowment

- The Carnegie Endowment for International Peace is a global network of NGO policy research centers in Russia, China, Europe, the Middle East, India, and the United States, founded by Andrew Carnegie in 1910

- Mission: Advance peace through analysis and development of fresh policy ideas and direct engagement and collaboration with decision-makers in government, business, and civil society

Sample Global Oils

About the Oil Climate Index

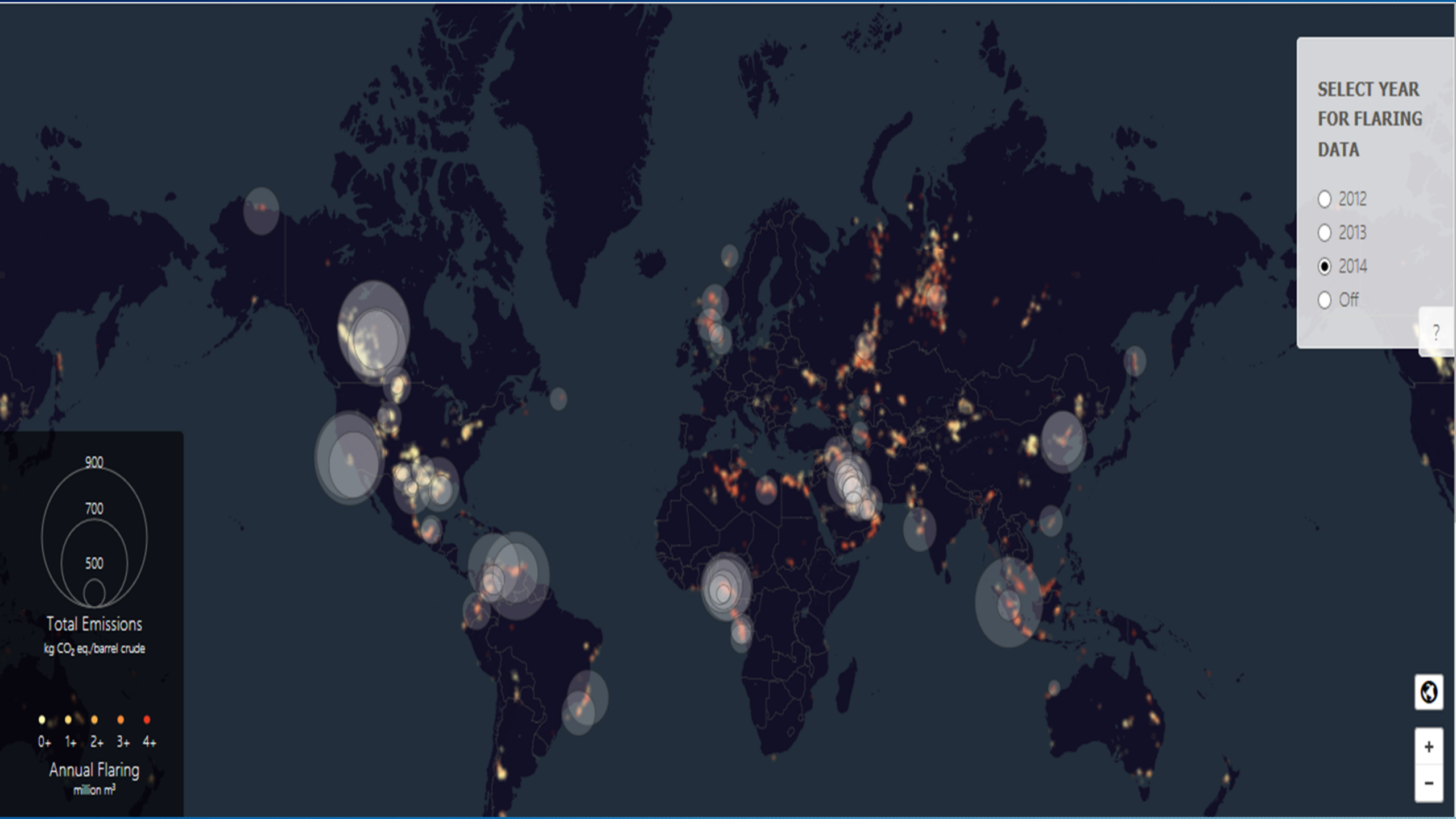
- The OCI is an open-source tool to evaluate the life-cycle GHG emissions of global oil resources
- Goal: Alert stakeholders about the GHGs in the oil supply chain with an eye toward informing investment, development, operations, and governance
- History: Gordon initiated the OCI project in 2013 in collaboration with researchers from Stanford University and the University of Calgary
- The OCI and its underlying models have undergone extensive peer review that are published in major journals (e.g., *Science* August 2018)

OCI Model and Phases of Development

Three process engineering models comprise the OCI:

OPGEE (production); PRELIM (refining); OPEM (transport and end use)

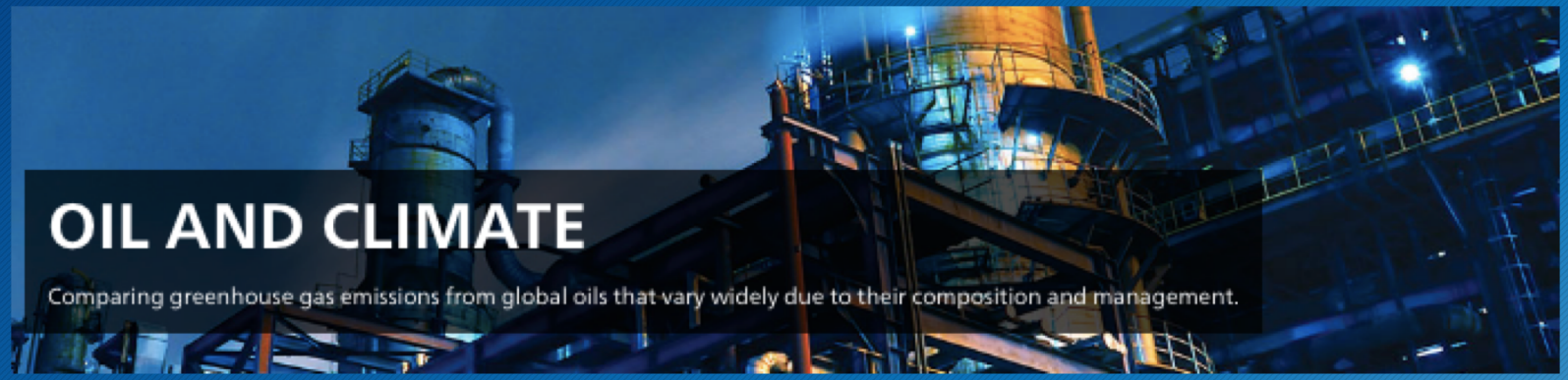
- Phase 1.0 (2015) – Model 30 global oils (5% total production); Find major variance between different oils' lifecycle GHGs and identify where in the supply chain emissions occur
- Phase 2.0 (2016) – Model 75 global oils (30% total production); Confirm Phase 1.0 finding that a major variance in oil sector climate footprints
- Phase 2.5 (2018) – Currently updating oil data and adding IEA *World Energy Outlook 2017* country-level methane emission estimates
- Phase 3.0 (2019) – In process to add ~40 global gases to the OCI and compare and contrast petroleum sector lifecycle GHGs


SELECT YEAR FOR FLARING DATA
2012
2013
2014
Off
?
900
700
500
Total Emissions
kg CO_2 eq./barrel crude
0+ 1+ 2+ 3+ 4+
Annual Flaring
million m^3
+
−

Carbon Monitoring System data in the OCI

- CMS data we've used
  - VIIRS global flaring data through 2014
- Interests for the near future
  - Updating the VIIRS satellite data (2018?)
  - Identifying and incorporating global methane data
  - Utilizing real-time satellite data in the OCI
- Thinking long-term
  - Air pollutants
  - Land use

OCI 2.0 Analytics and Visualizations



OCI 2.0 web tool URL: http://oci.carnegieendowment.org/

Near-future interest: methane data

Aim: to obtain global methane data to overlay on maps of oil and natural gas fields

SCIAMACHY detection of San Juan Basin leak

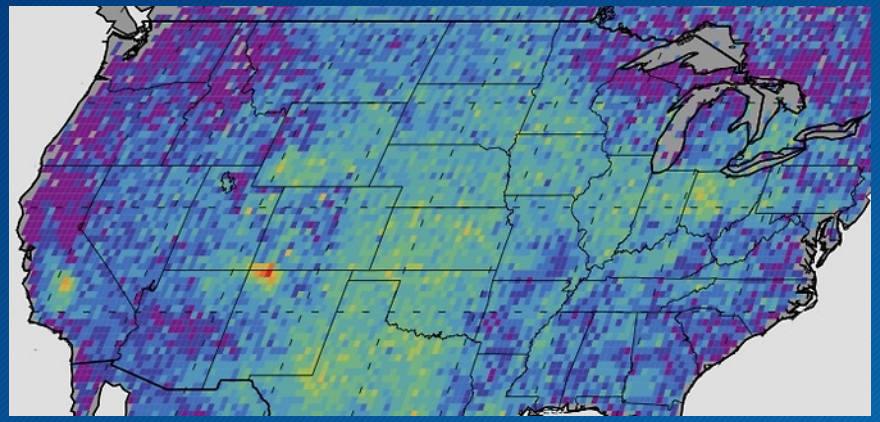
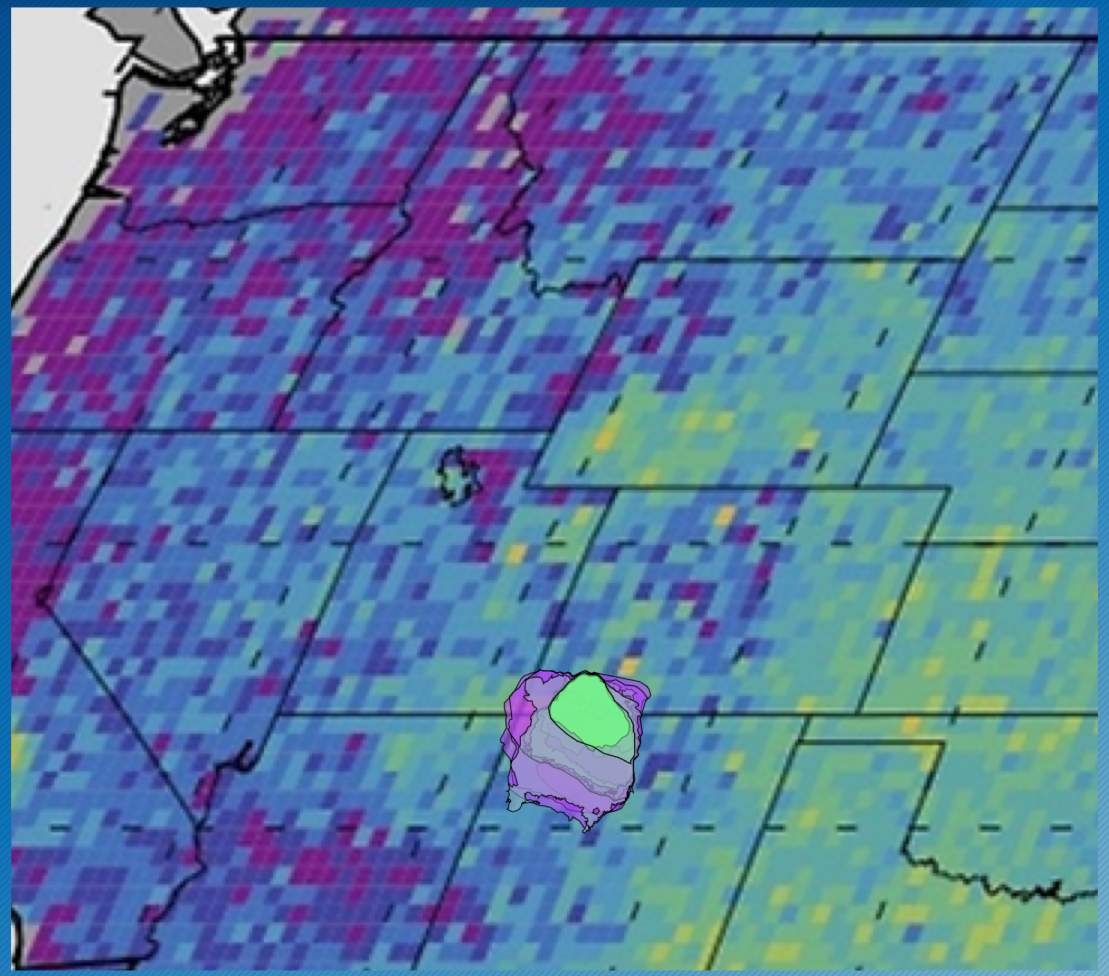


Image Credit: NASA/JPL-Caltech/University of Michigan



Near-future interest: methane data

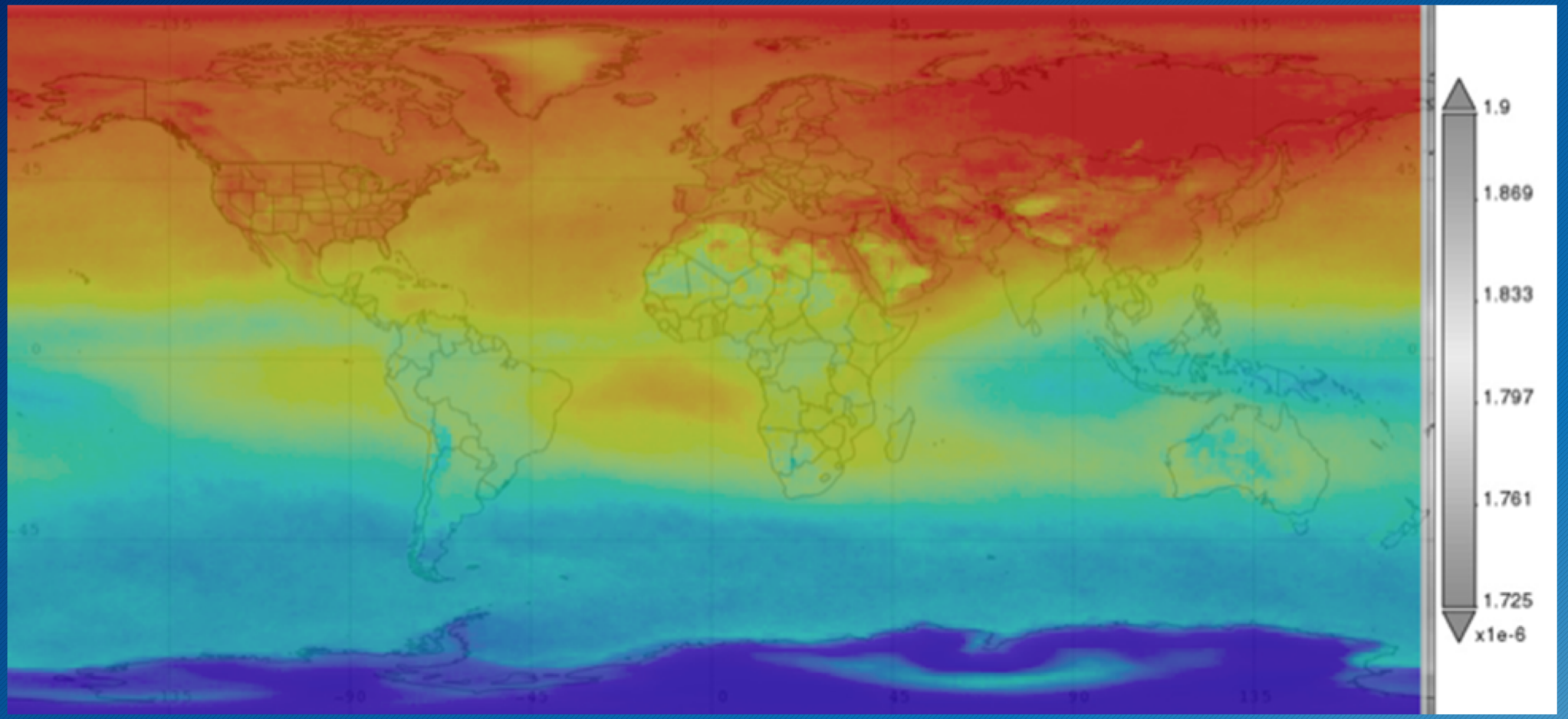
Satellite data requirements for OCI 3.0:

- Global spatial coverage
- Most recent temporal coverage available; ultimate goal to capture real-time data
- Measurements from appropriate altitude (surface level or near-surface level)
- L3 data (ideal); L2 data (visually workable?)

OCI roadblocks to date using NASA data

Instruments:

- AIRS on Aqua



Raster showing 2016 average global methane concentration. Methane concentration measured at this height does not allow us to translate this into useful insights about oil and gas operations at ground level.

Questions on usability of AIRS & TES data

NASA Instruments:

- AIRS on Aqua
  - *Giovanni shows methane at 1000 hPa, but we're told observations at this level are sparse and not reliable*
  - *Has this data product improved sensitivity at 1000 hPa?*
  - *Are there models that convert high-altitude measurements to estimates for near-surface level emissions? GEOS-Chem (Harvard)?*
- TES on Aura
  - *What is the temporal coverage? (We're only finding data through 2012)*
  - *Would data from 681.2 hPa be relevant to near ground level?*

Other institutions' products and topics for discussion

- TANSO on GOSAT (Japanese Space Agency) – high ~400 hPa
- TROPOMI (European Space Agency) – will data be OCI-ready?
  - launched in 2017; CH4 data available fall 2018
  - L2 product
- EDGAR (European Commission) – not useful for OCI?
  - Bottom-up calculations for activity emissions mapped by NASA/others
- MethaneSAT (Environmental Defense Fund) – 2021 launch
- Siberian methane craters and any other venting "pingos" - is anyone at NASA analyzing and mapping?

Potential OCI Inputs from CMS Data

- Near Term
  - Updating the VIIRS satellite data (2017 or 2018?)
  - Identifying and incorporating global methane data like SCIAMCHY did for ground-level methane detection
- Long Term
  - Black Carbon
  - Ethane
  - Criteria Air Pollutants
  - Land use Disruption and Carbon Release
  - Other opportunities?