

# **Data Quality Tools for AIS Data to Enhance Accuracy of Emissions Inventories: BOEM 2011/2014/2017 Gulfwide Emission Inventories**

Richard Billings, Heather M. Perez, Roger Chang, and Jennifer Sellers  
Eastern Research Group, Inc.

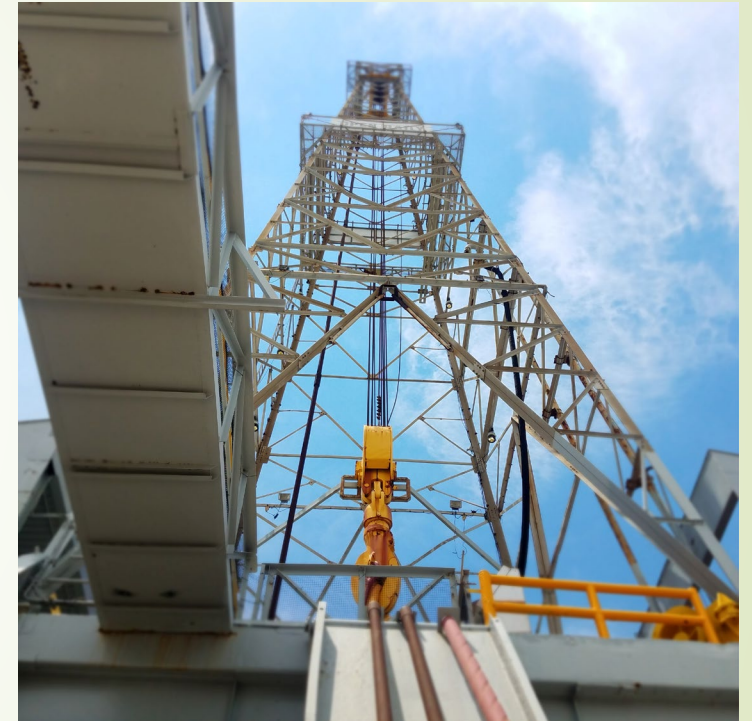
Holli Ensz

Bureau of Ocean Energy Management

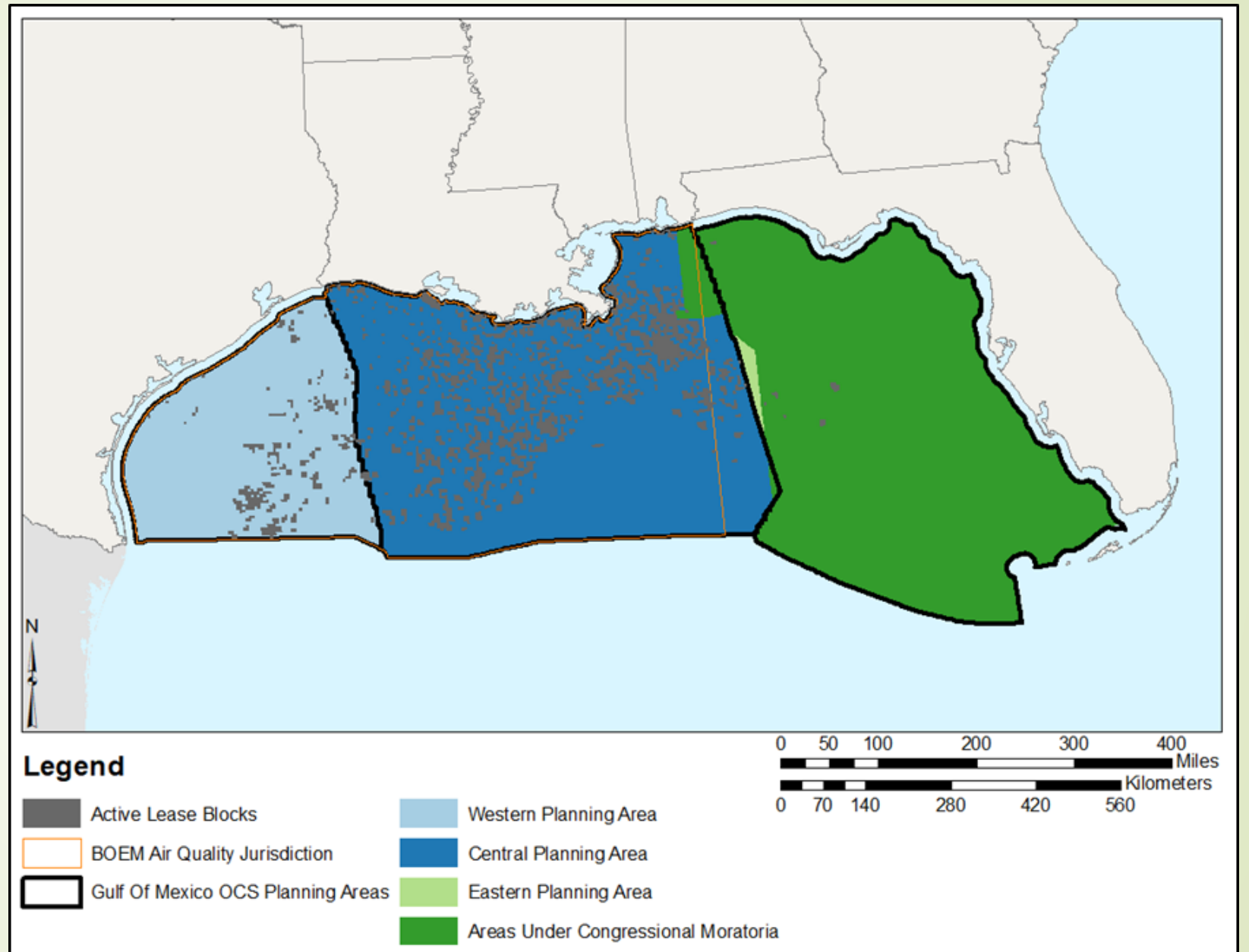
2019 International Emission Inventory Conference  
Collaborative Partnerships to Advance Science and Policy  
Dallas, Texas  
July 30-August 2, 2019

# BOEM Gulf of Mexico Air Emissions Inventory

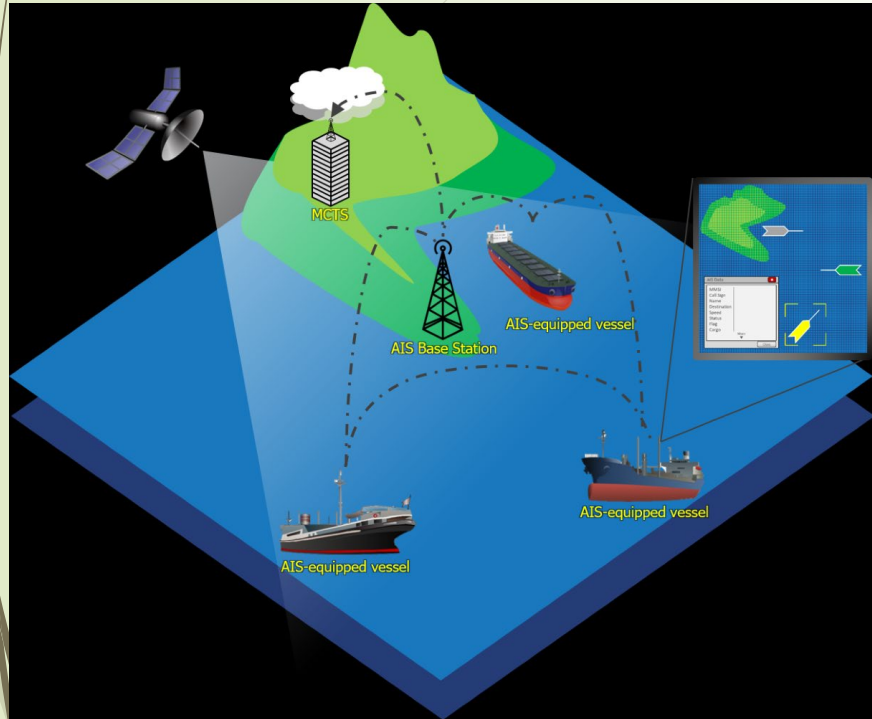
- All platform and non-platform sources
  - Commercial cargo vessels & cruise ships
  - Commercial and recreational fishing
  - US Coast Guard ships
  - **Seismic survey vessels**
  - **Mobile drilling rigs**
  - **Pipelaying vessels**
  - **Support vessels (e.g. crew boats, supply boats, tugs, and stimulation vessels)**
  - **Floating Production Storage and Offloading (FPSO) vessels**



# BOEM GOM Study Area



# Automatic Identification System (AIS) data



- Oceaneering's PortVision preprocessed AIS data
- **Hourly** observations
- Consolidated **stationary** vessel records
- **25 million** observations
- **17.9 Billion** kw-hrs
- **9,000** (2014) to **11,196** (2017) unique vessels

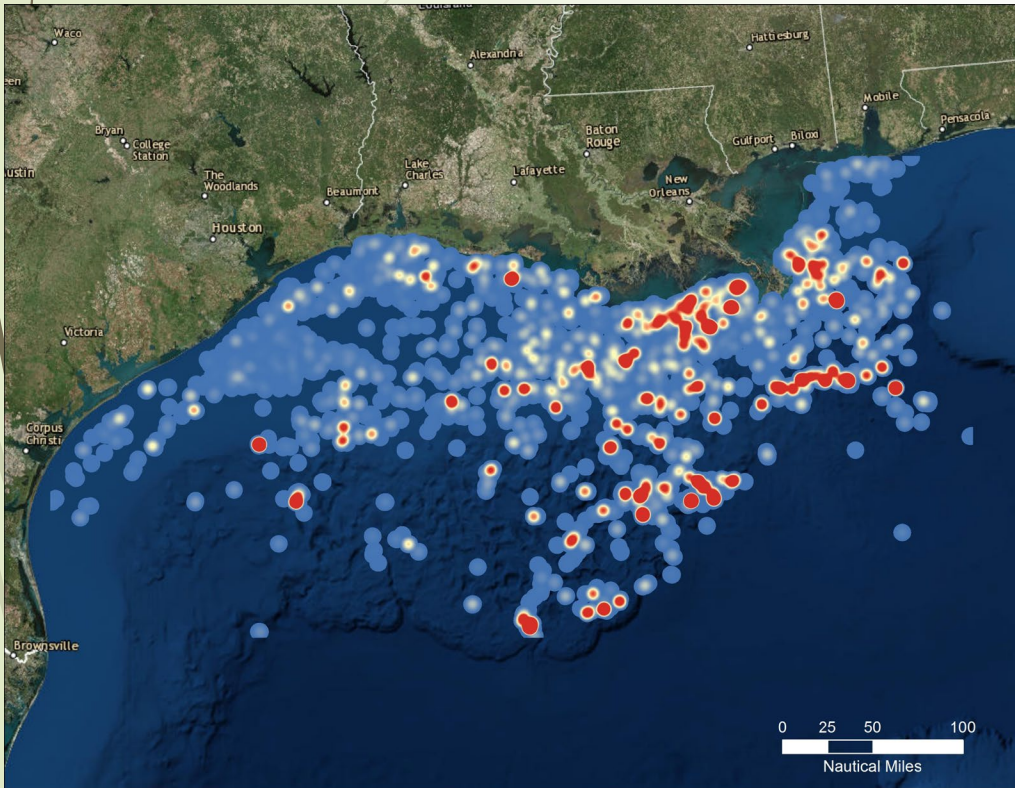


# Specialty vessels





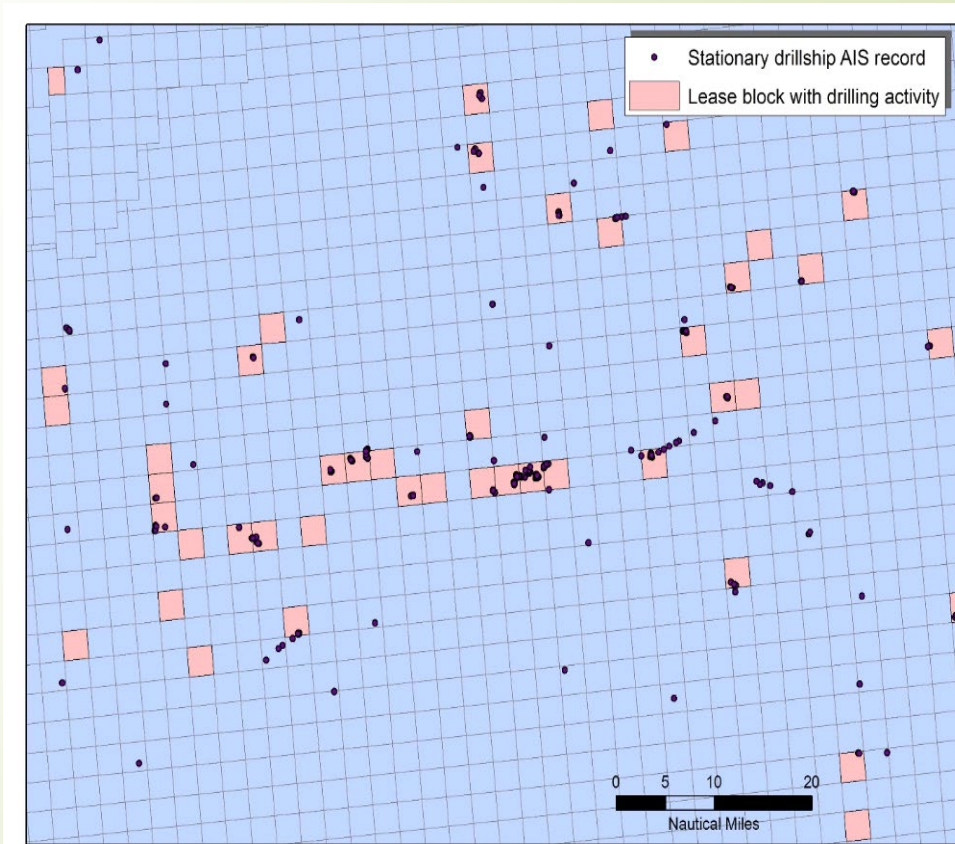
# Support vessels



- More complete capture of support vessel population
- Particularly smaller vessels
- Better assessment of operations based on vessel speed.

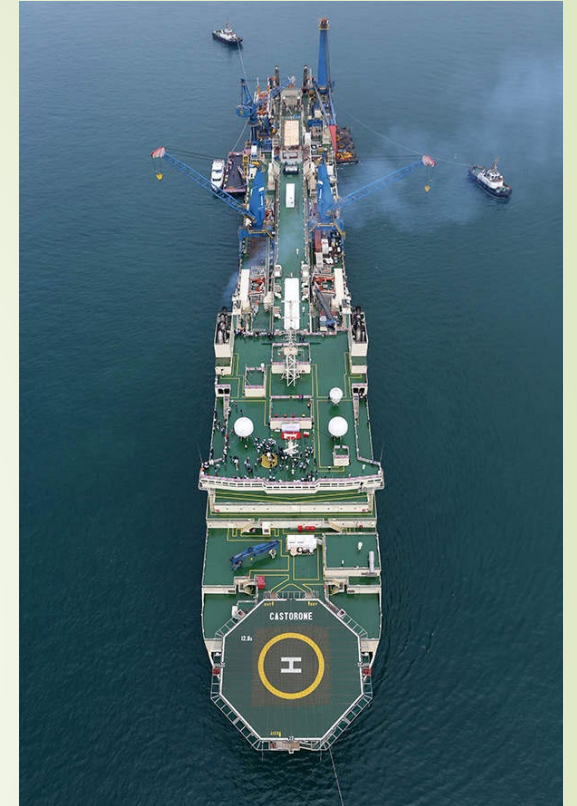
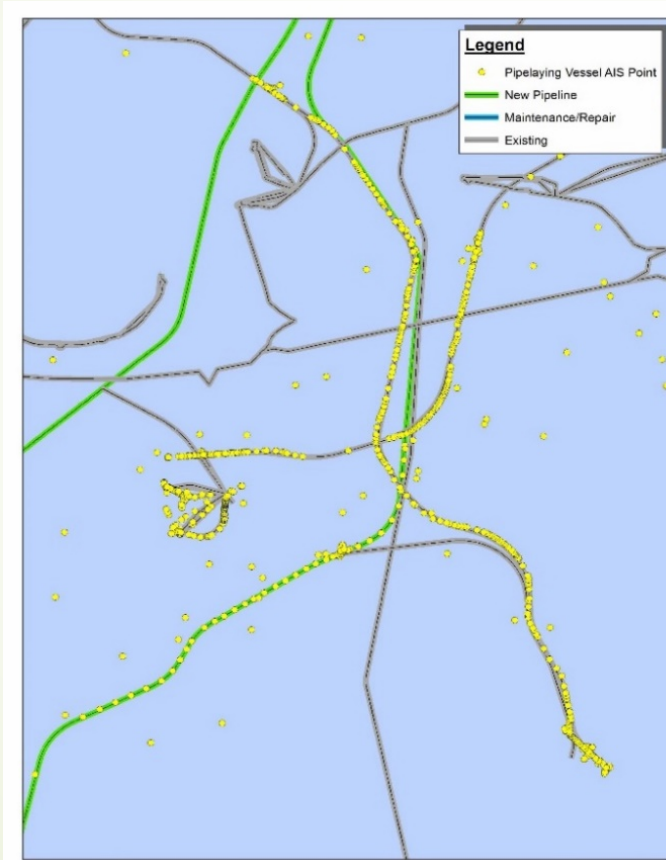
# Mobile drilling rigs

- **83%** of lease blocks that BOEM reported drilling activities had AIS drill rig activity
- AIS does not always include **non-self propelled** drill ships
  - Drilling platforms
  - Jackups
  - Submersible and
  - Some semi-submersibles
- Removed drilling operations that **overlapped** with stationary production platforms





# Pipeline maintenance and construction

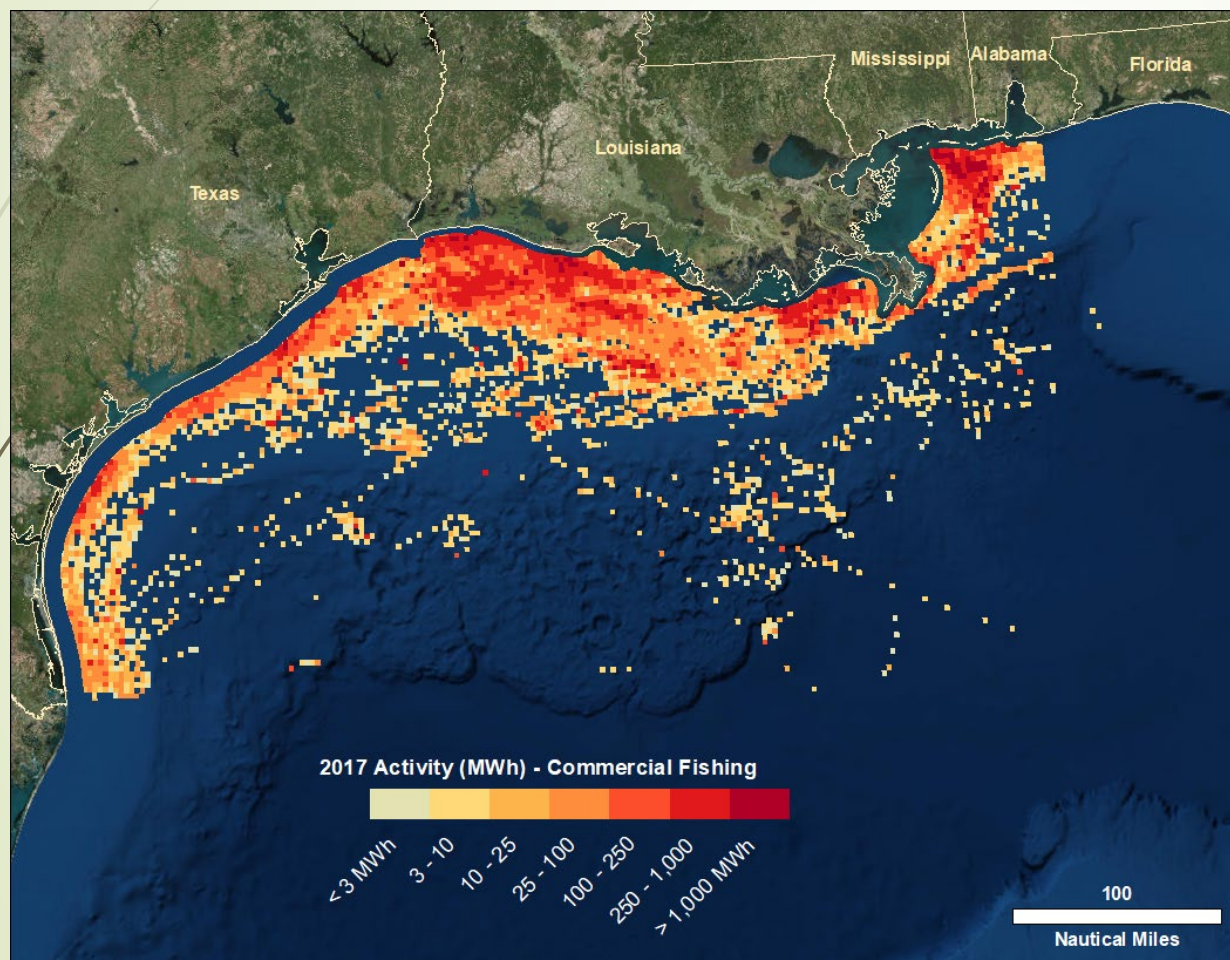


- BOEM shapefile of offshore pipelines
- AIS pipelaying vessel locations



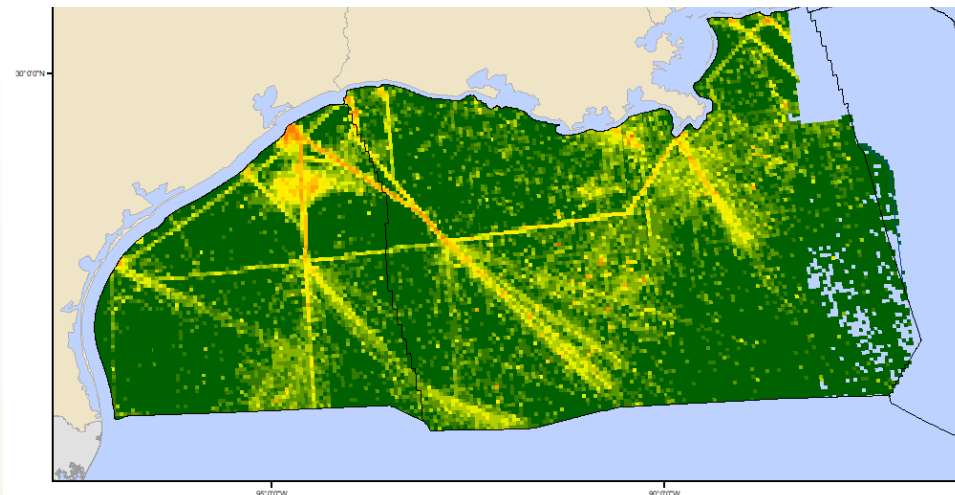
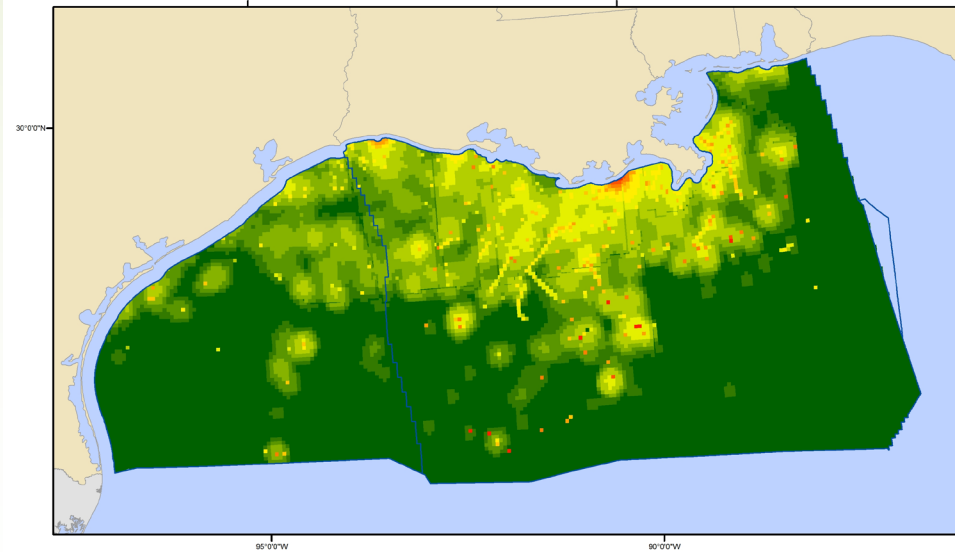
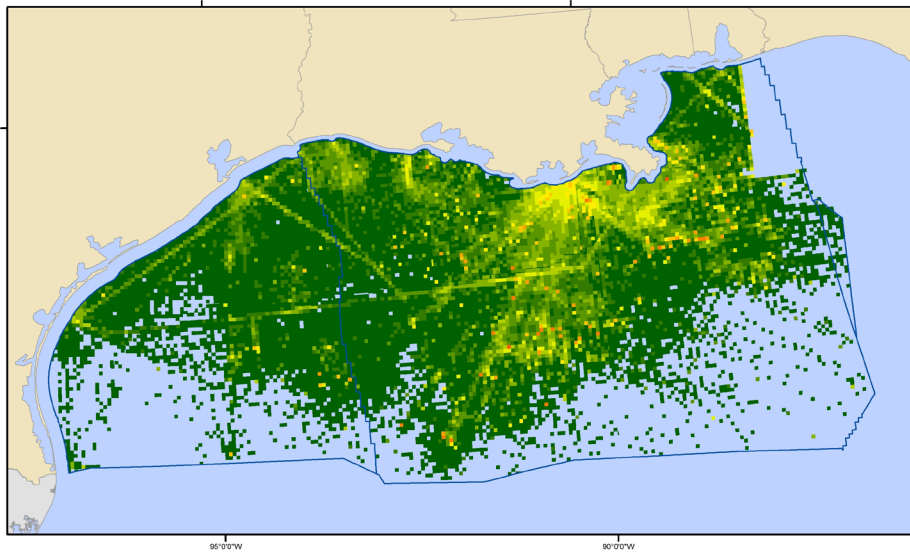
# AIS for spatial allocations

## 2017 Commercial Fishing Operations



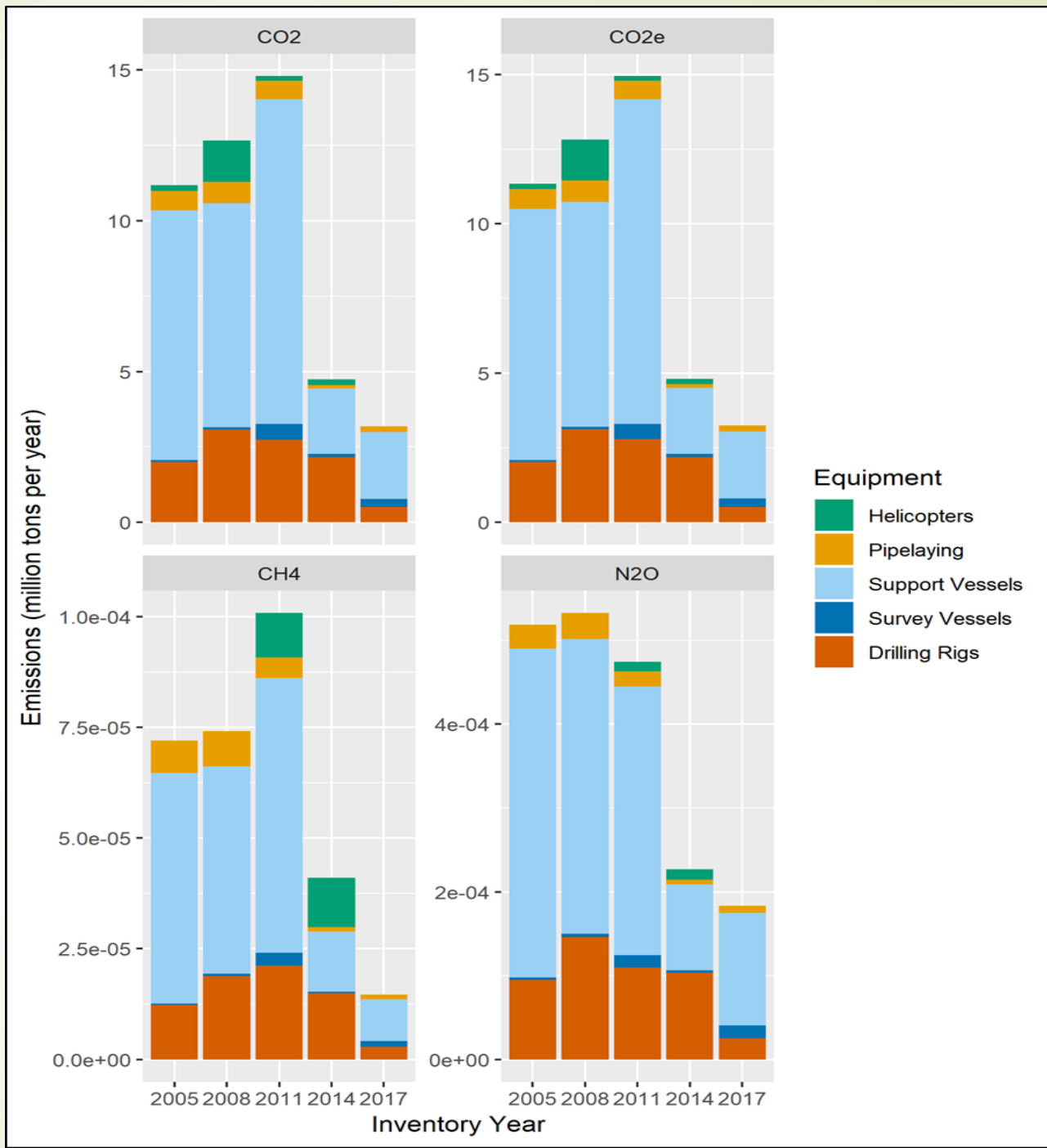
- Vessel count appears to be incomplete
- AIS mapping shows where commercial fishing activities tend to occur and where emissions are likely

# Comparing NOx emissions 2011 2014 2017

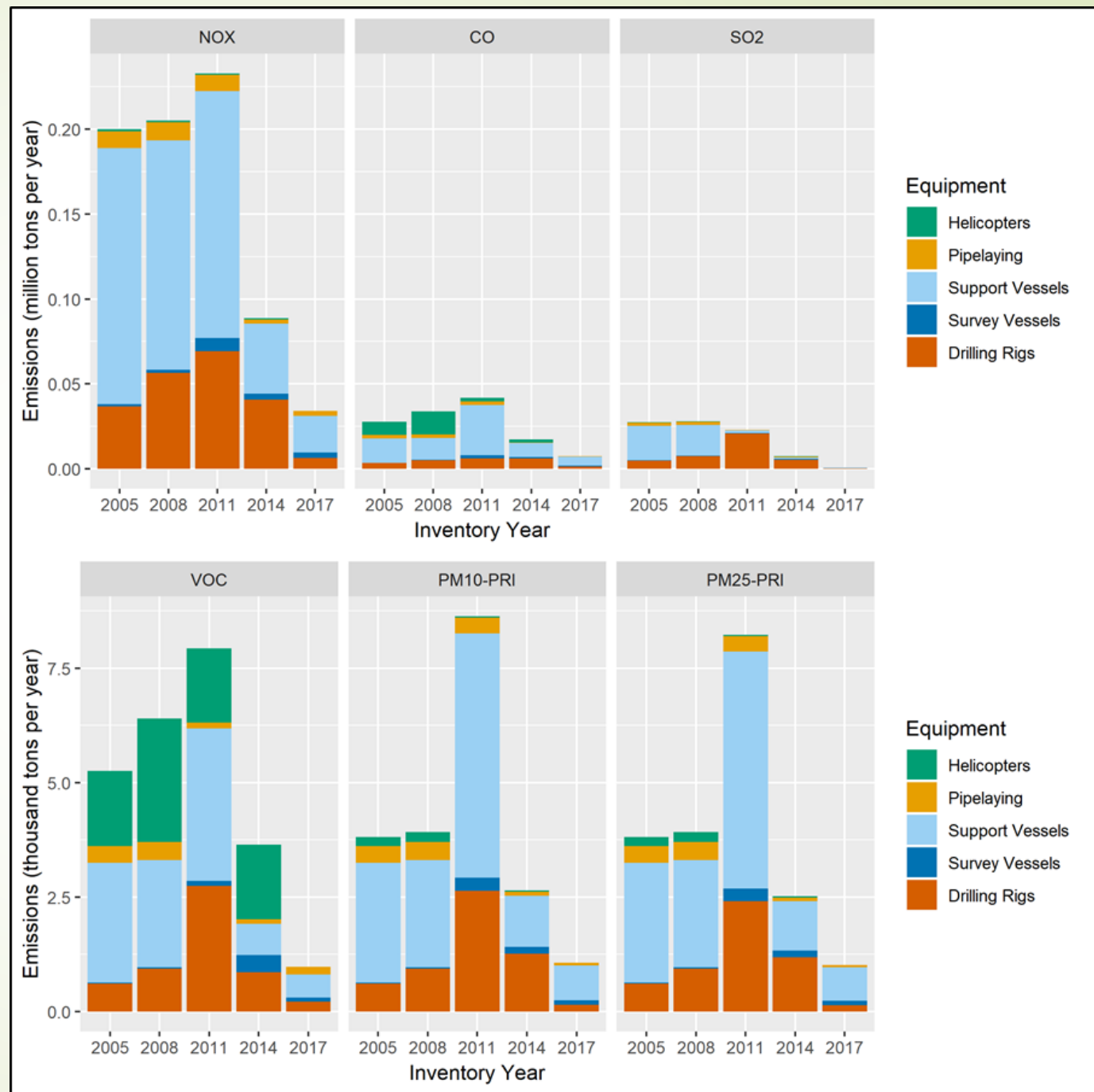




# Emissions Comparison



# Emissions Comparison





# Acknowledgments

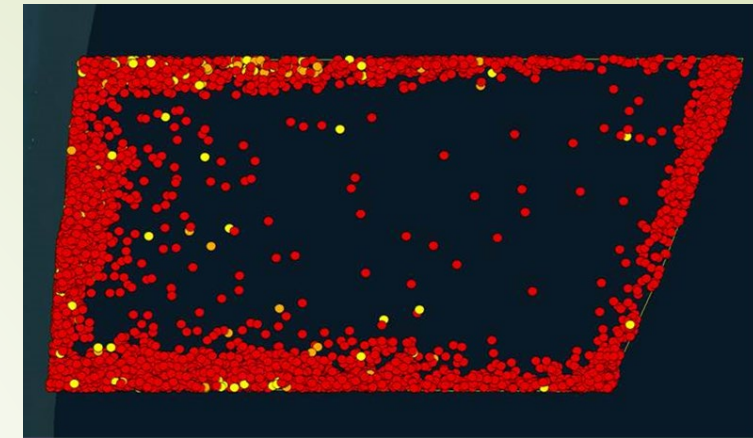
- Holli Ensz – BOEM
- Heather Perez, Roger Chang, Jennifer Sellers, Darcy Wilson - ERG
- Chris Leslie, Rob Eccles, Bob Kessler – Oceanneering

<https://www.boem.gov/2014-Gulfwide-Emission-Inventory/>

*Study concept, oversight, and funding were provided by the U.S. Department of Interior, Bureau of Ocean Energy Management, Environmental Studies Program, Washington, DC under Contract Number M16PC00012*

# Quality checks for input data

Processing AIS data requires considerable cleanup



- Remove “**Ghost vessels**”
- Identification and removal of **erroneous** data (2017 problem with Point of Interest (POI) transmitter)
- Identify unusually **large duration times**
  - Stationary vessels
  - Near the boundary of study area
- Identified and gap-filled **missing/erroneous vessel characteristics** (vessel type)
- Remove vessels that AIS does not accurately represent (**fishing and military**)



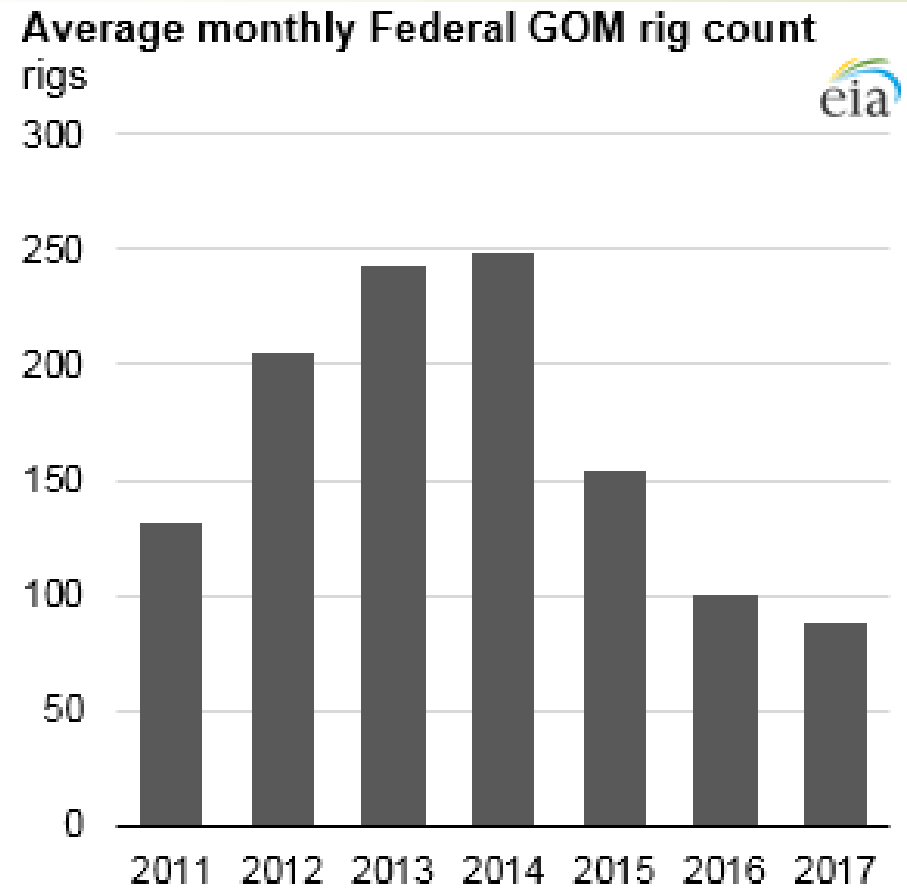
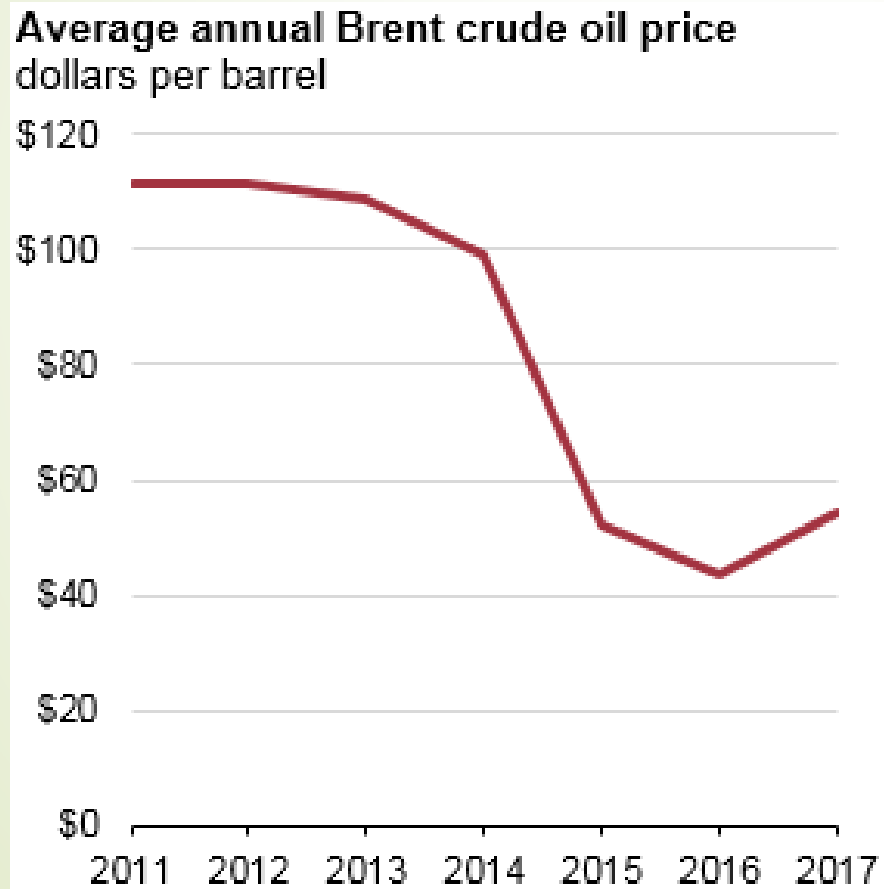
# Improvements using AIS approach

- **25** vessel types in 2014/17, compared to **15** in 2011
- Better accounting for engine **category** and **regulatory tier**
- Calculated **engine loads** (vs default load assumptions)



- Highly detailed spatial and temporal resolution
- Able to **exclude** state water activities
- **Reduction in assumptions**

# Supplemental slide – 2014/2017 rig count decline





# Supplemental slide – Shallow water vs deep water operations

