# Data Sources and Performance Measures for the Marine Transportation System

**Ned Mitchell, PhD**
**Research Civil Engineer**
**Coastal and Hydraulics Lab**

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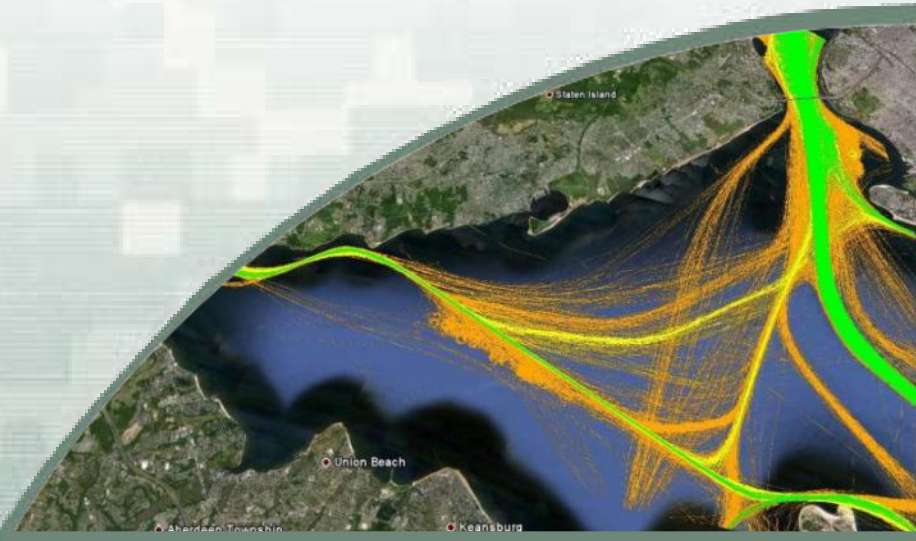
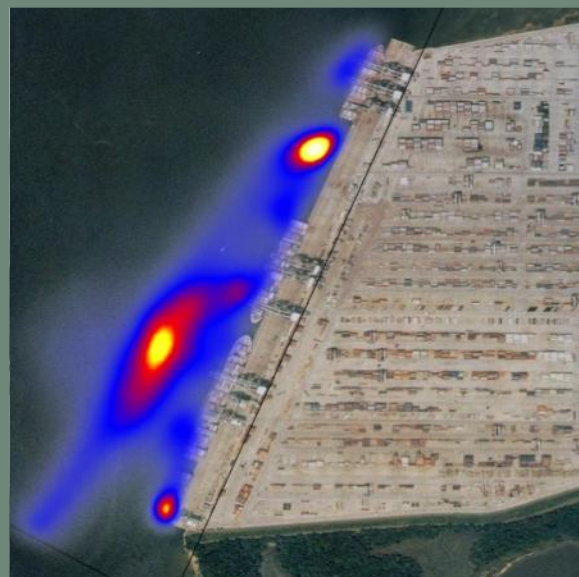


US Army Corps of Engineers®

ERDC
Engineer Research and Development Center

# Background

- Corps is resource-constrained but must maintain an aging water resources infrastructure portfolio that is critical to national well-being.
- Navigation projects at coastal ports and along inland waterways facilitate marine transportation and help support complex, dynamic, global freight supply chains.
- Challenge going forward is how to optimally support these existing and emerging freight corridors using available resources.

# Intermodal Freight Systems

- Waterborne freight corridors cannot truly be separated from landside (road, rail, pipeline) systems.

- Federal policy discussions and sponsored research increasingly center on intermodal systems and the need to evaluate supply chains across modes.

- USACE Leadership has been stressing systems-based approaches to Civil Works mission execution.


# Marine Transportation Data Spectrum

**Reported (but not observed!) data**

**Directly observed in transit**

**Continuous system monitoring**

## U.S. Customs

WATERBORNE COMMERCE OF THE UNITED STATES

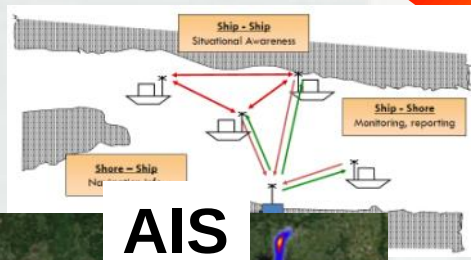
Calendar Year 2011

Part 1–
Waterways and Harbors
Atlantic Coast

PIERS
THE STANDARD IN TRADE INTELLIGENCE

## LPMS data


## AIS




## Inland barge data

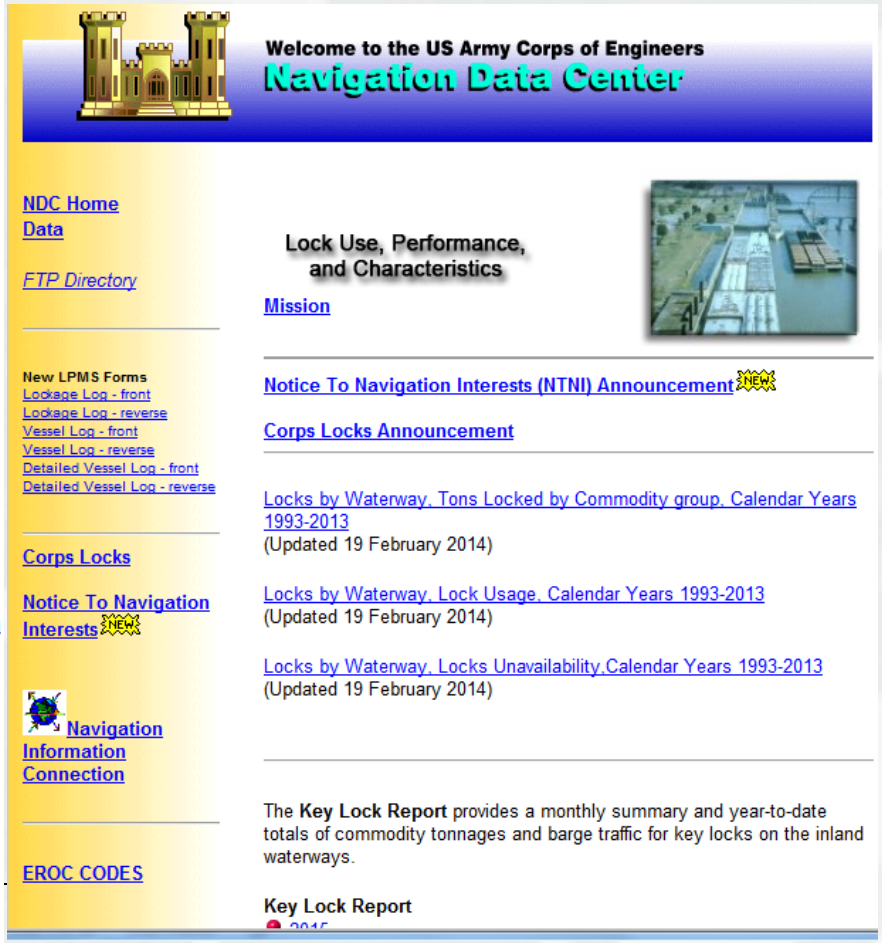

**Tradeoffs …**

ERDC

# Some Public Data Sources

http://www.navigationdatacenter.us/data/data1.htm


http://www.navigationdatacenter.us/lpms/lpms.htm



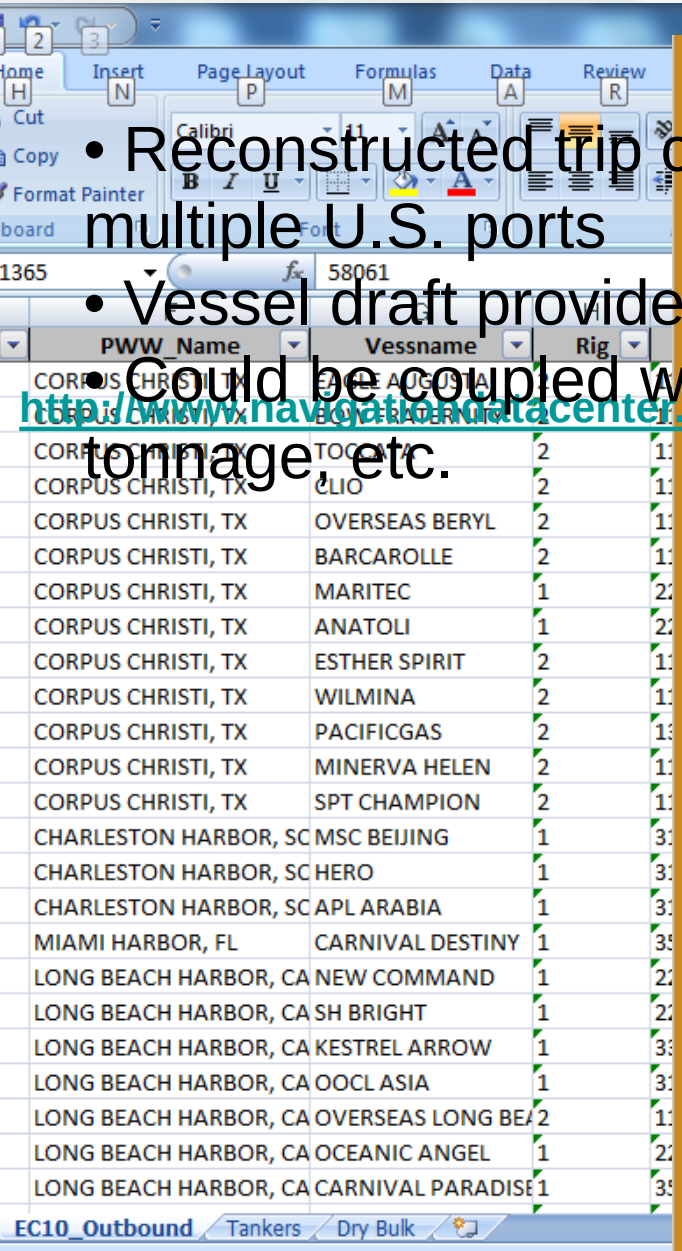
# Dredging Information System (DIS)

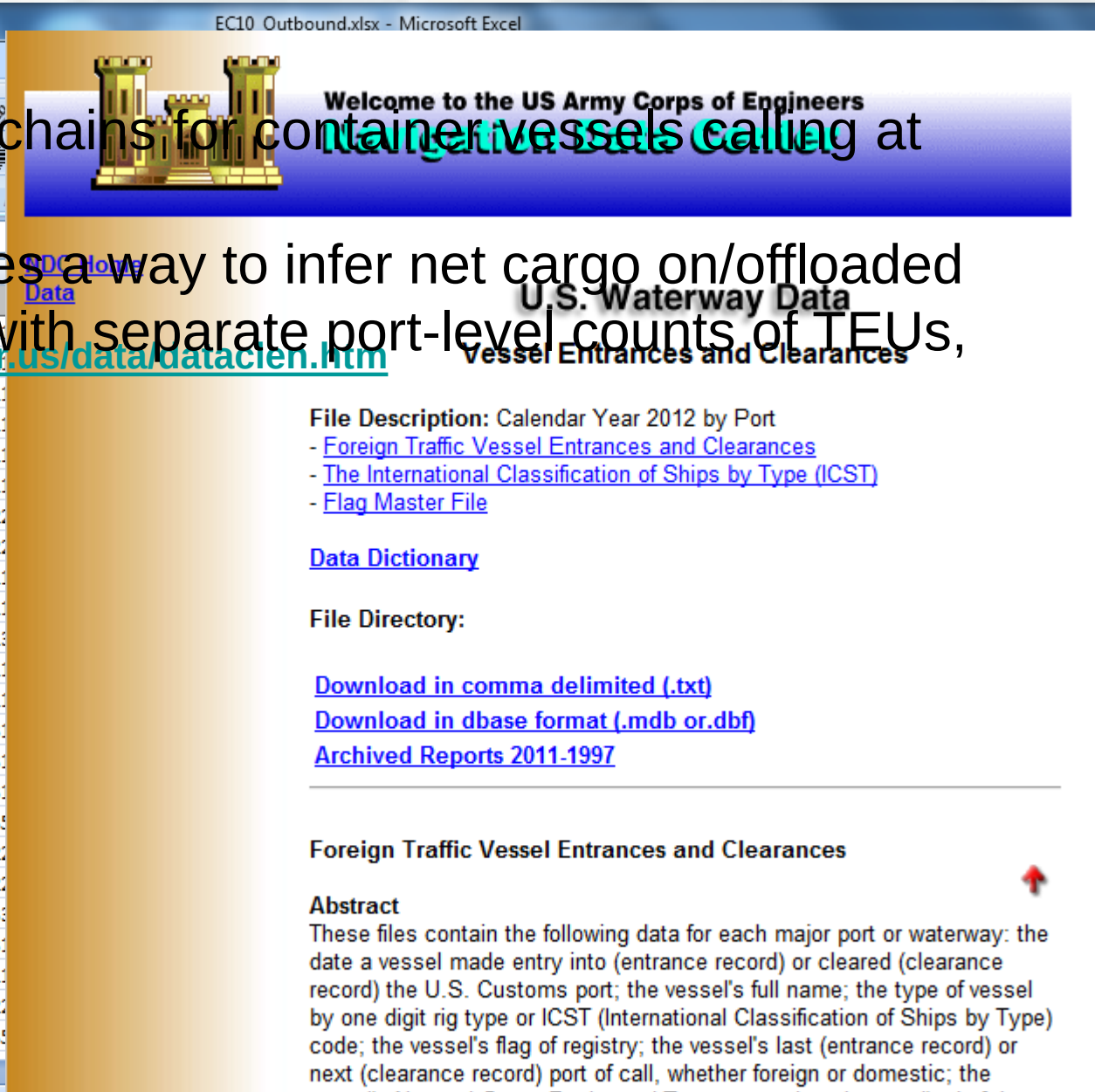
http://www.navigationdatacenter.us/data/datadrgsel.htm

- Thousands of dredging events (O&M and new deepenings) over last 25 years.
- Location, quantities of material moved, cost, start/end dates.

# Entrances and Clearances

- Reconstructed trip chains for container vessels calling at multiple U.S. ports
- Vessel draft provides a way to infer net cargo on/offloaded
- Could be coupled with separate port-level counts of TEUs, tonnage, etc.




http://www.navigationdatacenter.us/data/datacien.htm

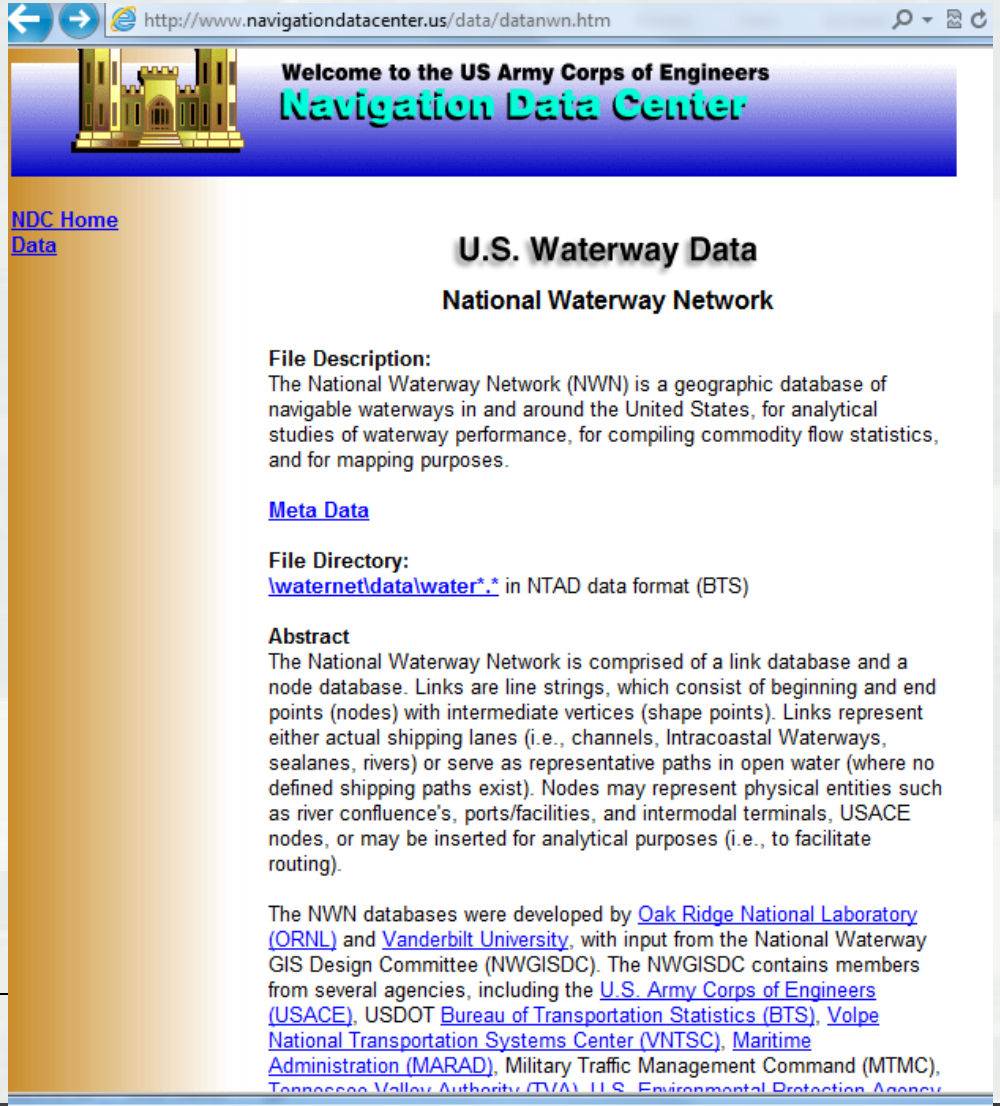
# National Waterway Network

http://www.navigationdatacenter.us/data/datanwn.htm

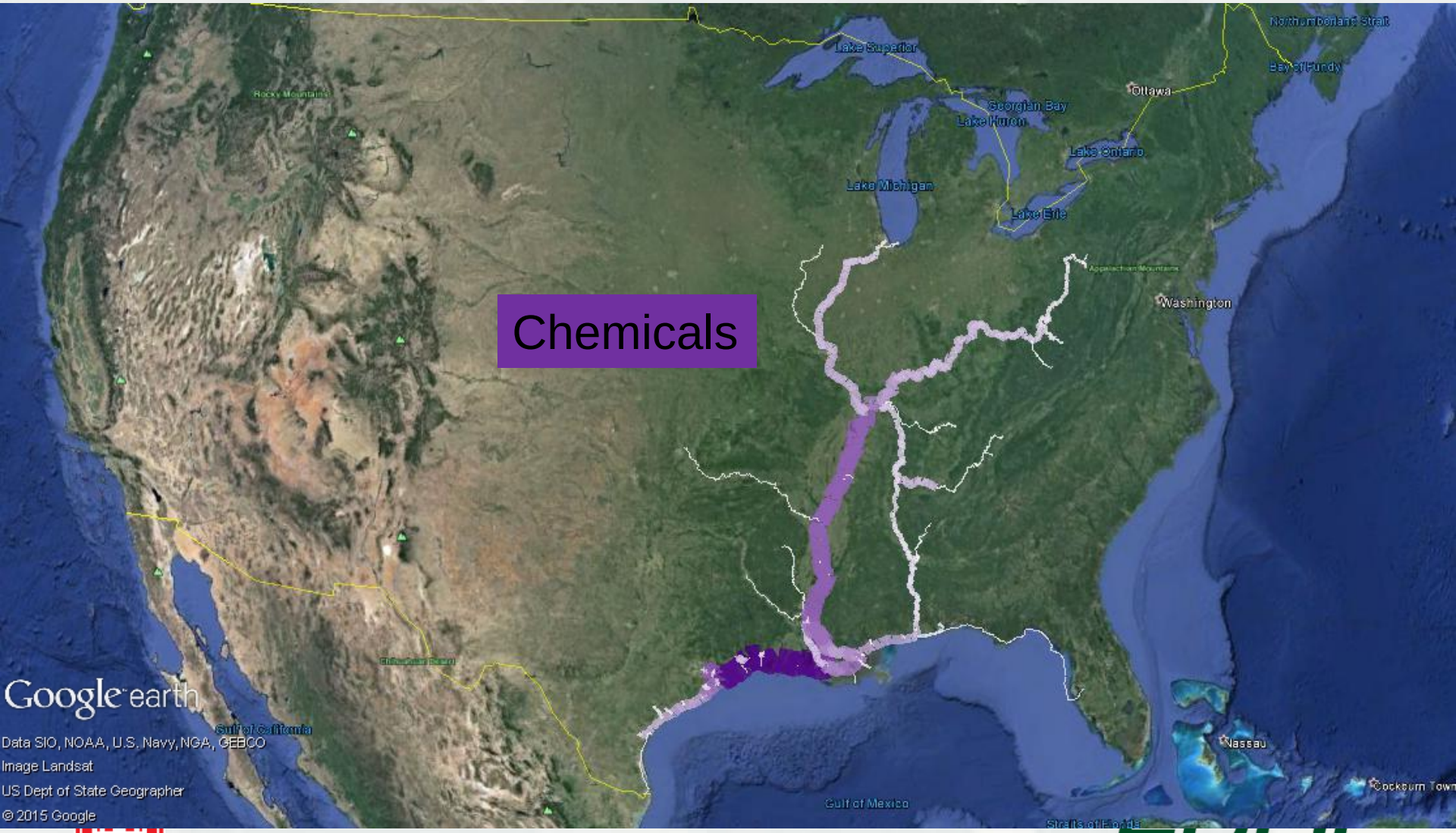
- Transiting tonnage totals by commodity group for 3000+ waterway segments around the U.S.

- Spatial network for GIS application development

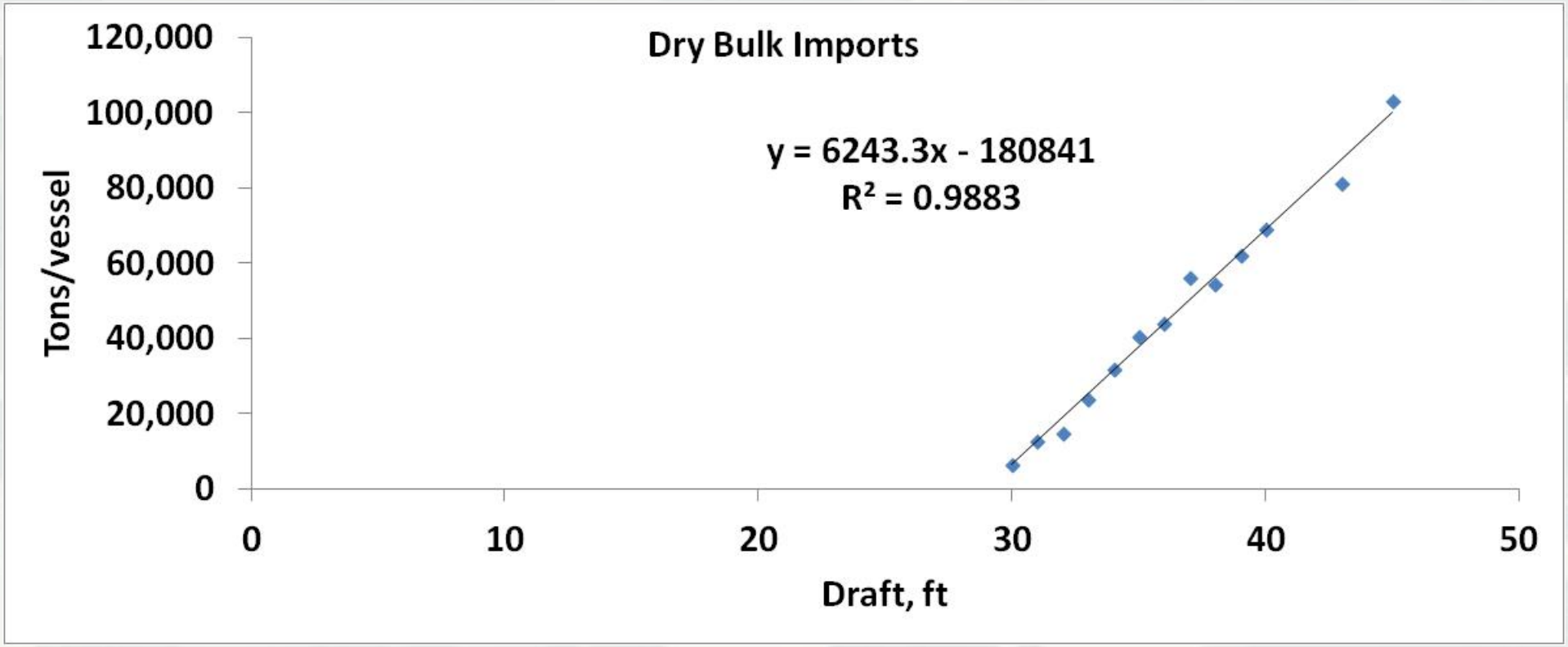
- Segment-level flows and transfers to/from road/rail/pipeline can be inferred.



# Waterway Freight Corridor Examples



# Tons per voyage analysis: National Summary



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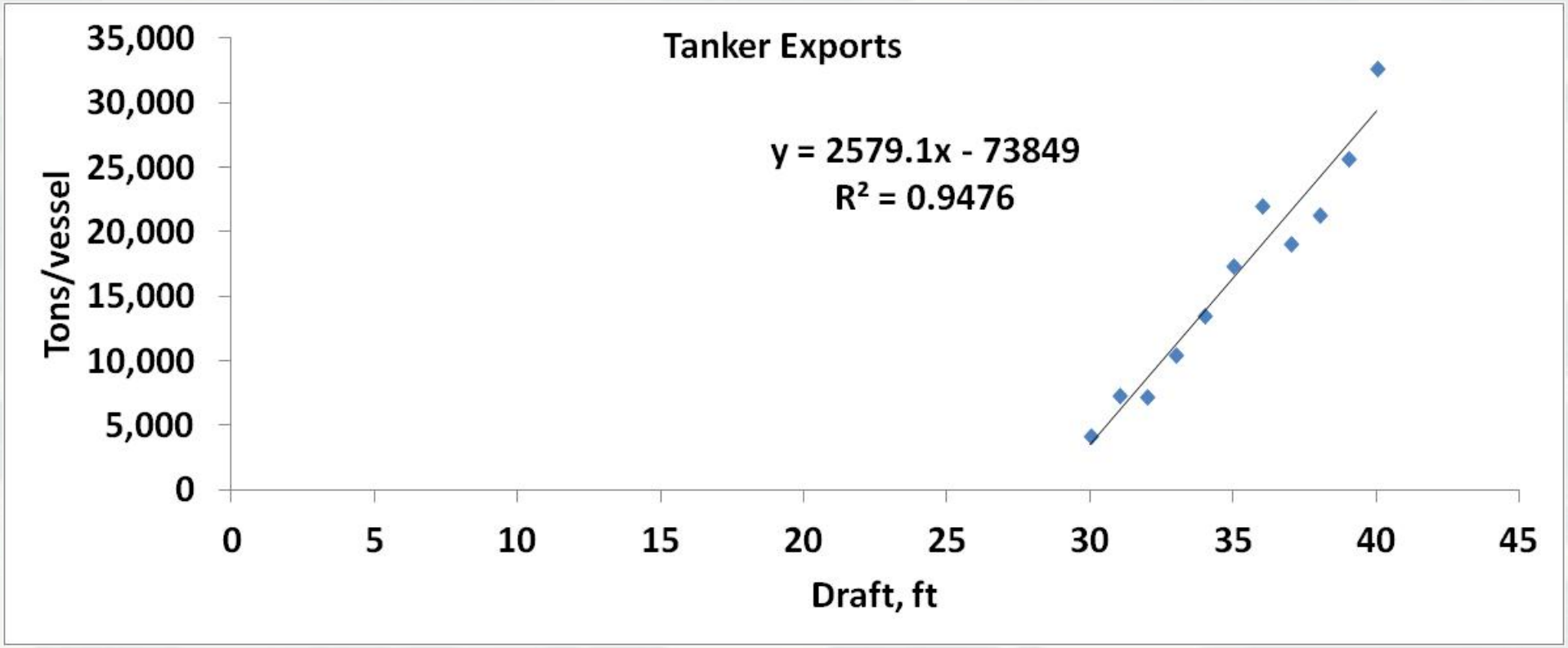
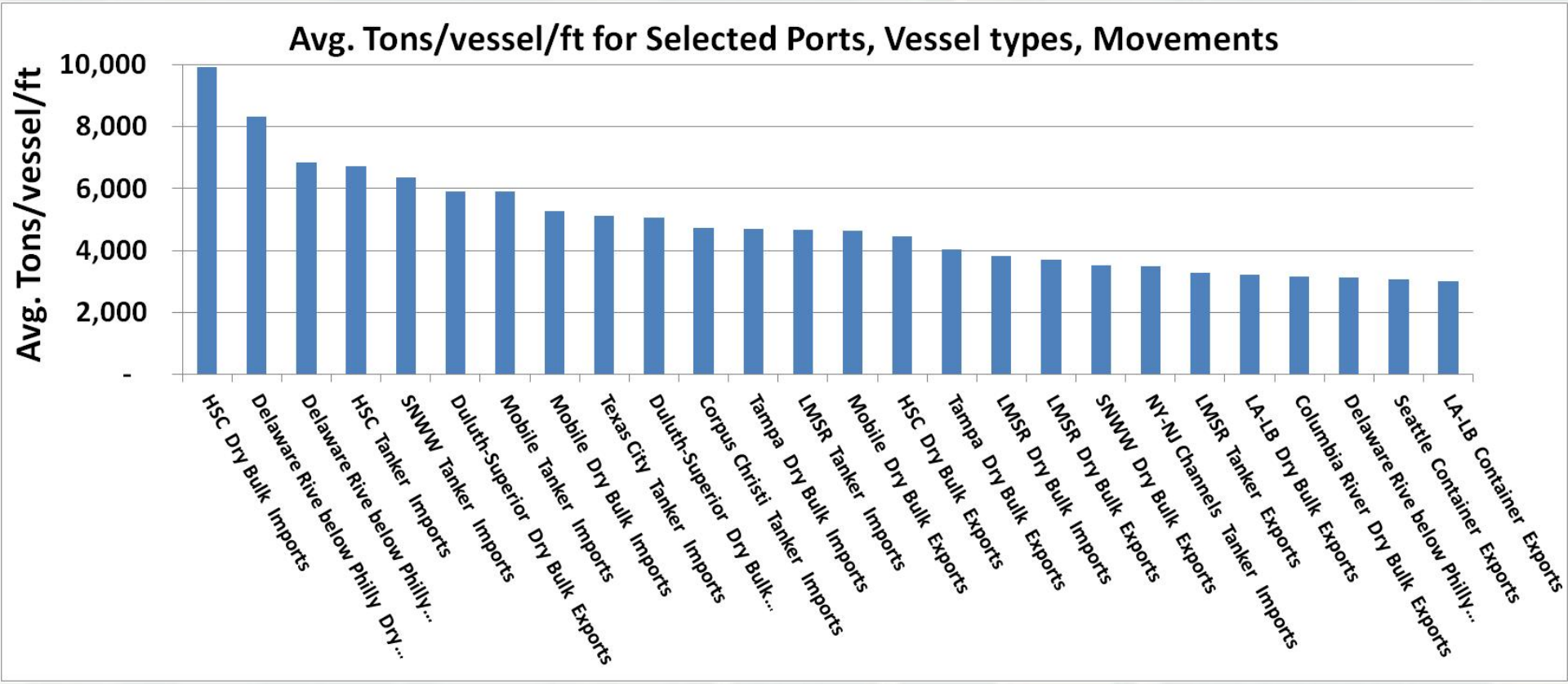
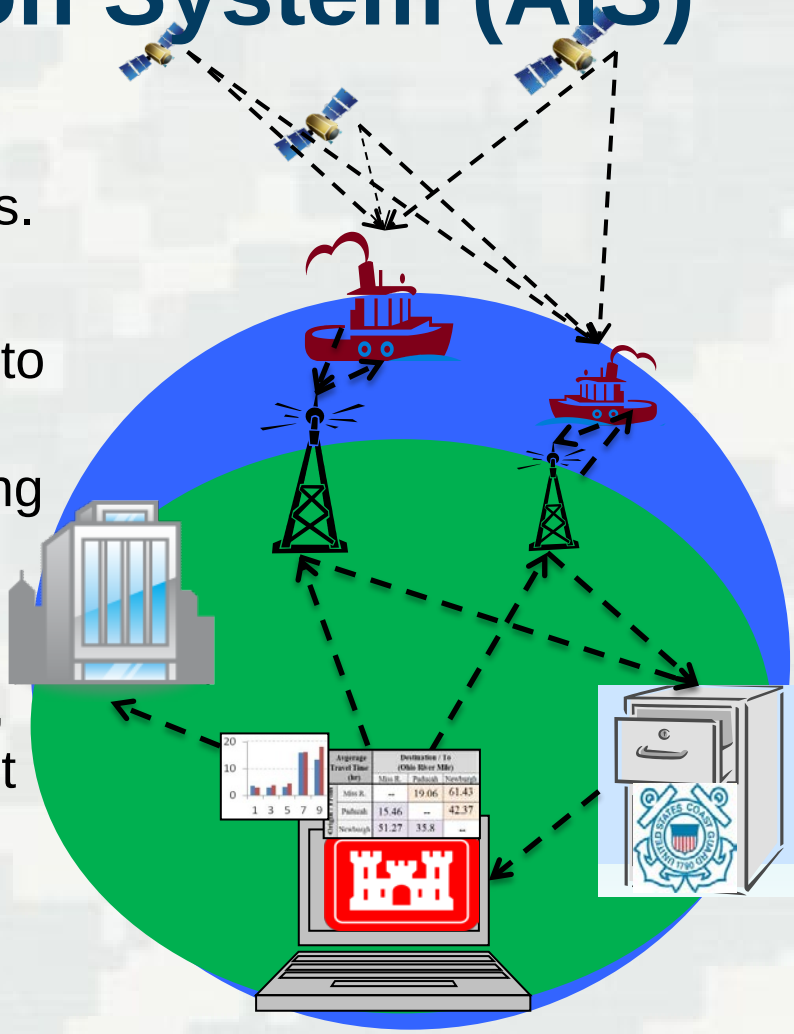


# Vessel Draft Sensitivities

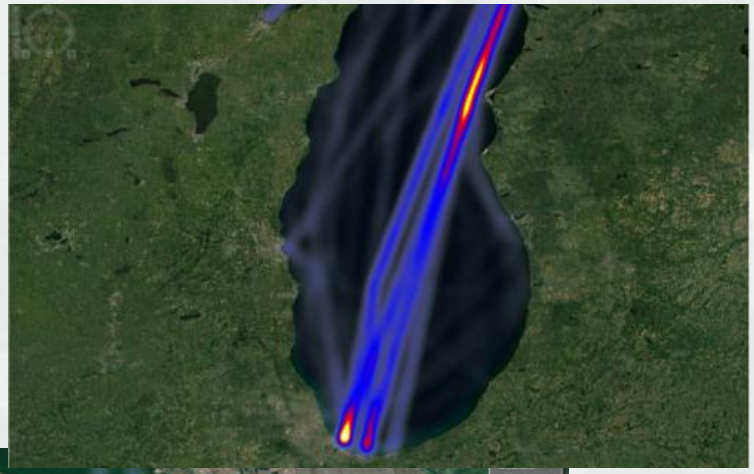


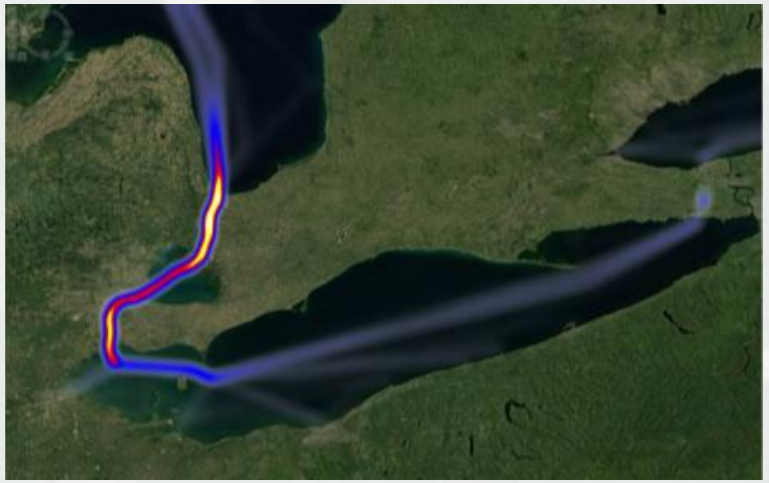
# Automatic Identification System (AIS)

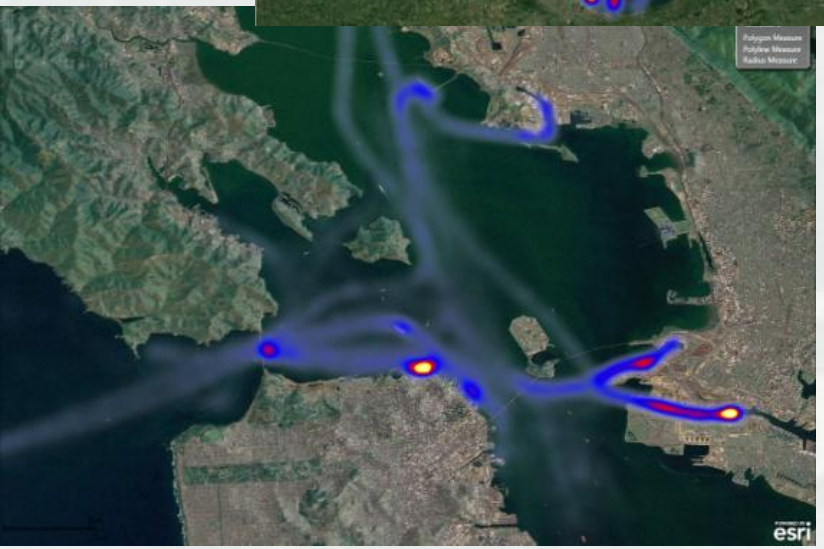
- Coast Guard mandate for nearly all commercial vessels operating in U.S. waters.
- VHF messages broadcast from the vessels to network of shore-based towers at intervals between 2 seconds and 5 minutes depending on operating state.
- Envisioned for maritime domain awareness, i.e. collision avoidance and port security, but shows great potential for many other applications to the national Marine Transportation System (MTS).

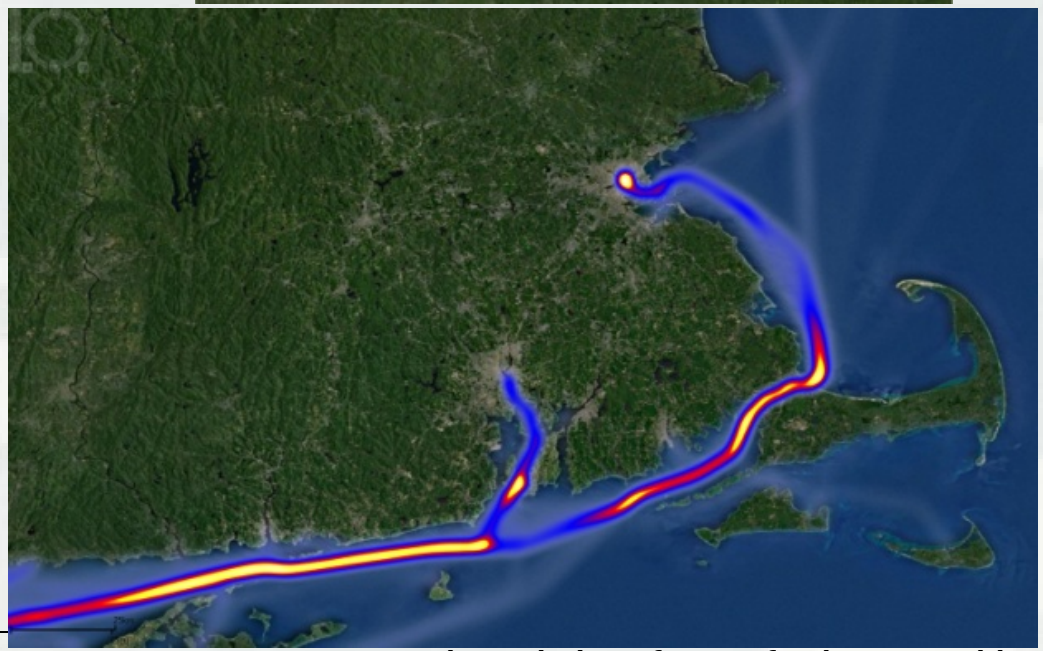


# Navigation Systems Performance Monitoring via AIS



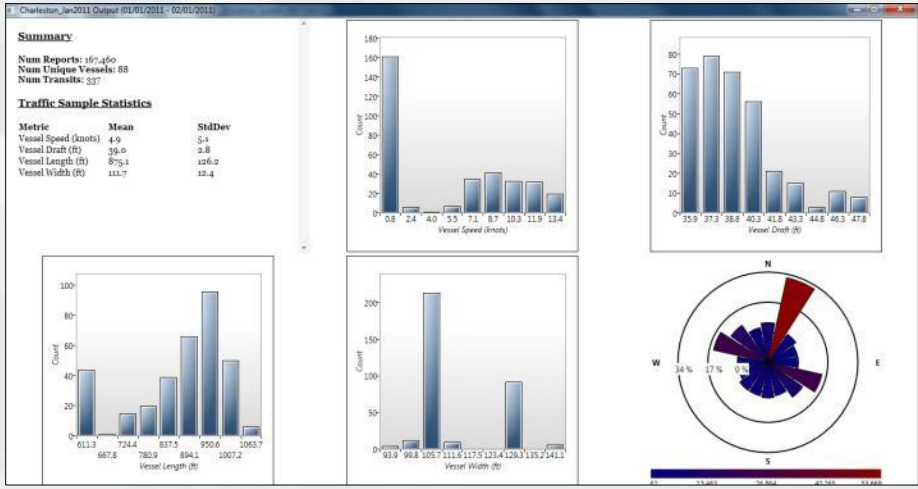


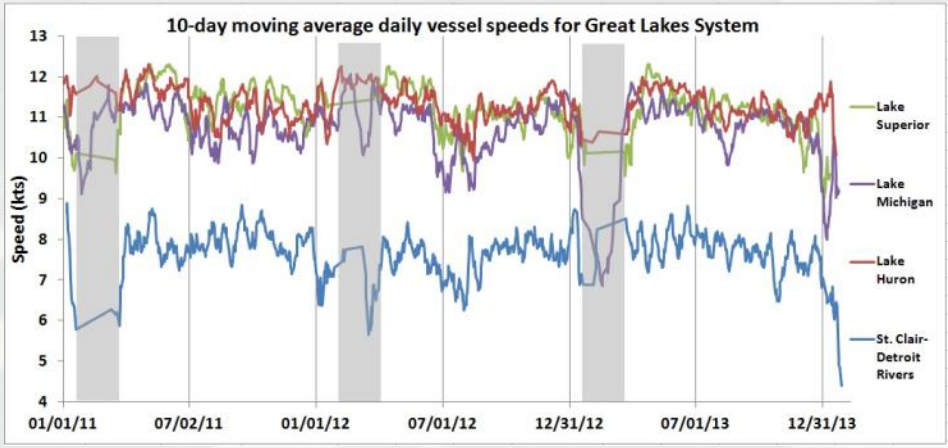


# Performance Monitoring via AIS

- Automatic Identification System Analysis Package (AISAP)
  - traffic densities
  - O-D travel times, dwell times
  - fleet characteristics, movements and seasonal variations
  - traffic response to disruptions or waterway improvements
  - Tidal dependence
  - incident investigations
- Analyses are *scalable* across time and space, so single channels can be monitored for a few hours, or entire coasts can be monitored for years.

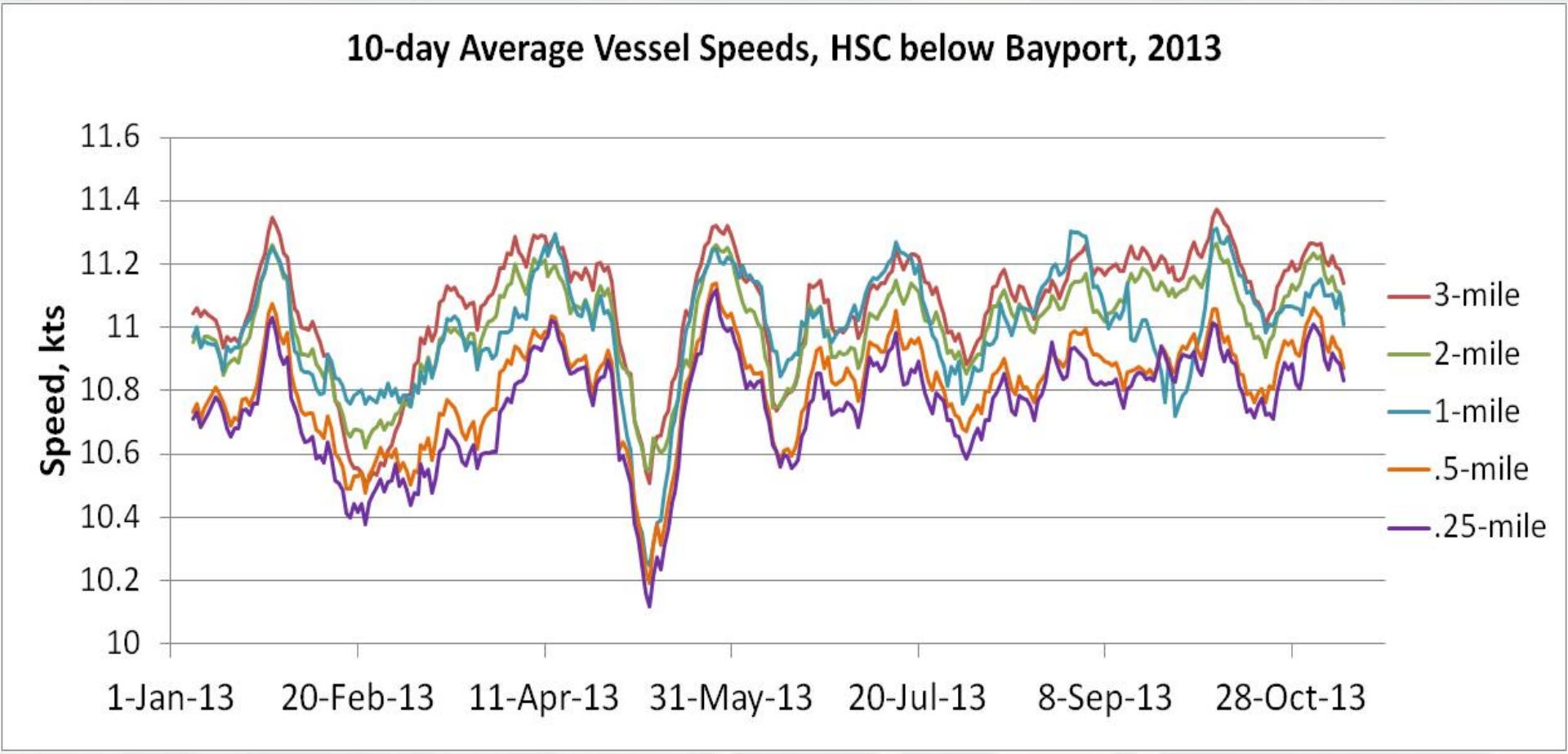


# Bayport Ship Channel, Texas

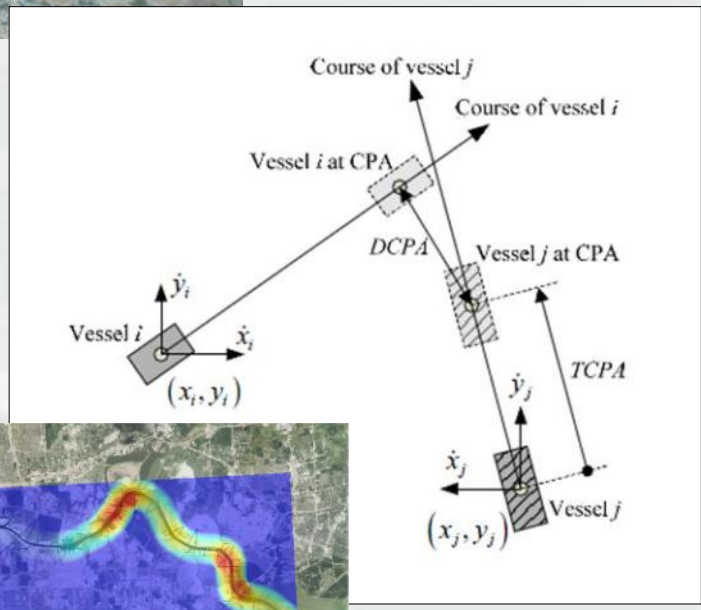
http://wvpress.org/news/gps-takes-big-rig-driver-narrow-pocahontas-road/

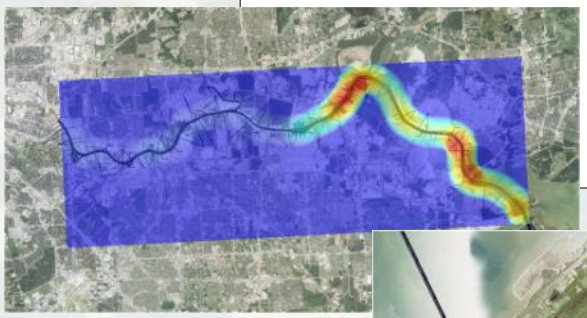
# AIS Vessel Transit Data
# Vessel Speeds Approaching Bayport Flare

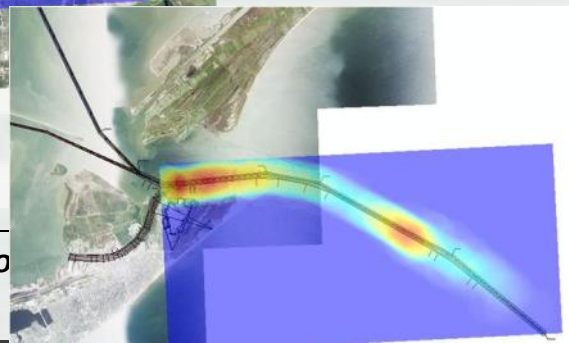


# AIS for Collision Risk Analysis:

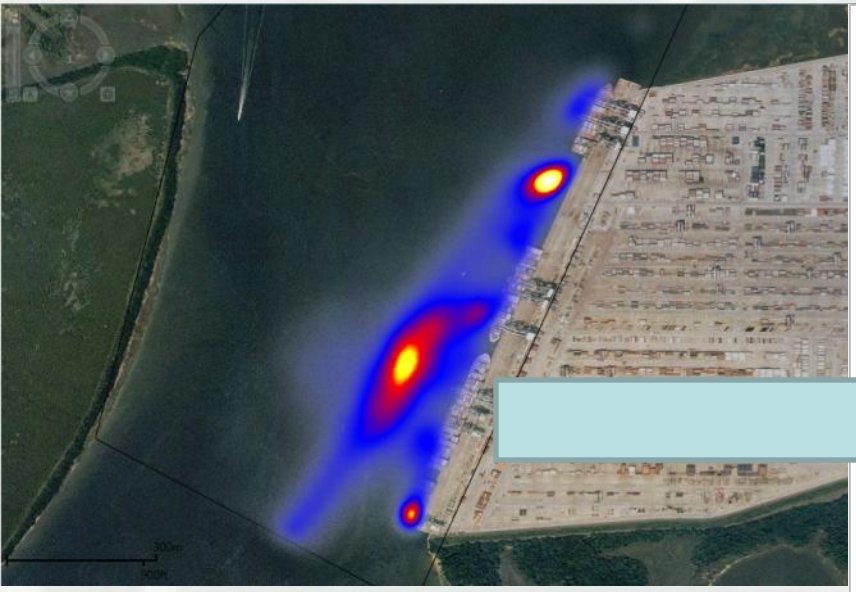
- Use archival AIS data to establish baseline collision risk levels within ports and waterways
- Compare segments of waterway based on proximity of transiting vessels to one another, with consideration of respective headings, courses over ground, and speeds
- Several methodologies in the literature, usually with very localized application → NAIS provides basis for national assessments

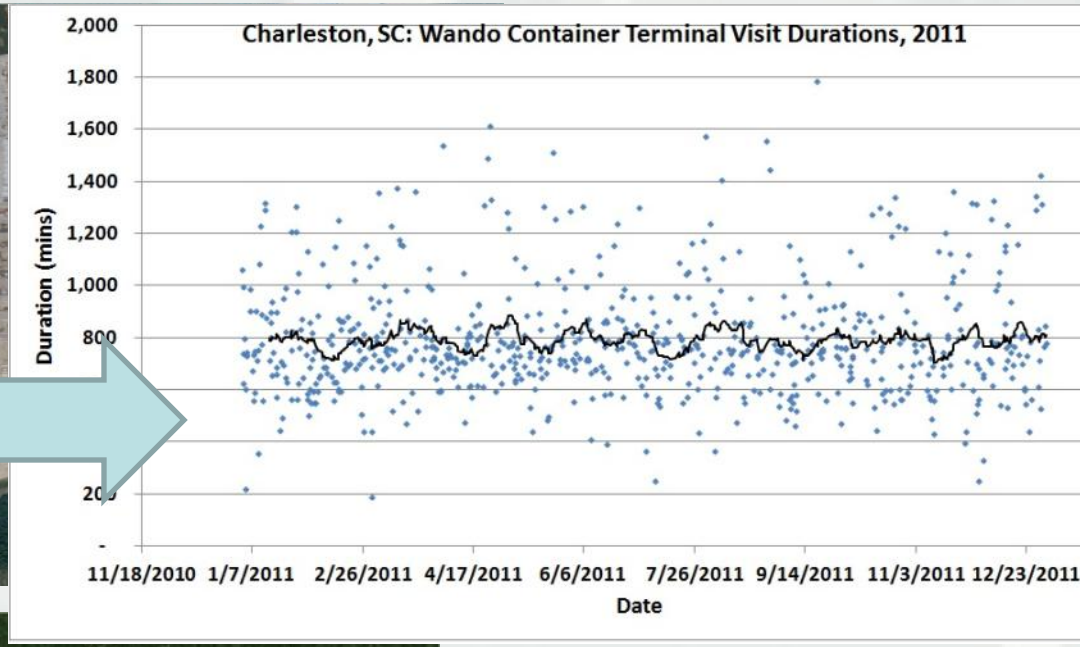



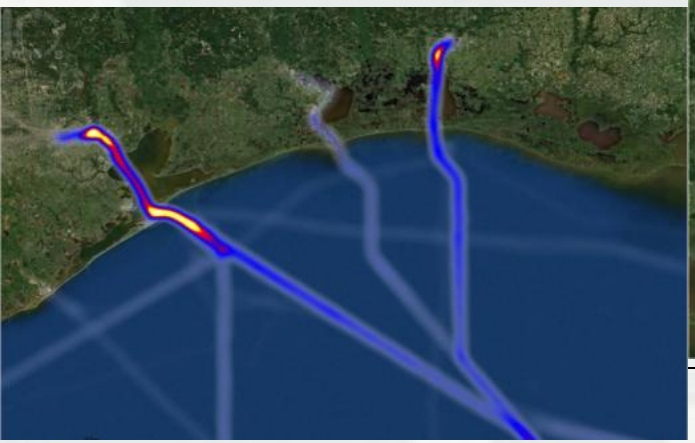



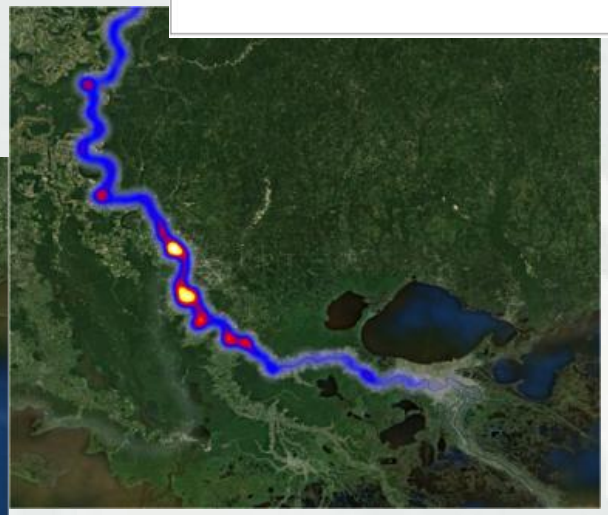


# Port/Anchorage Dwell Times, Travel Times

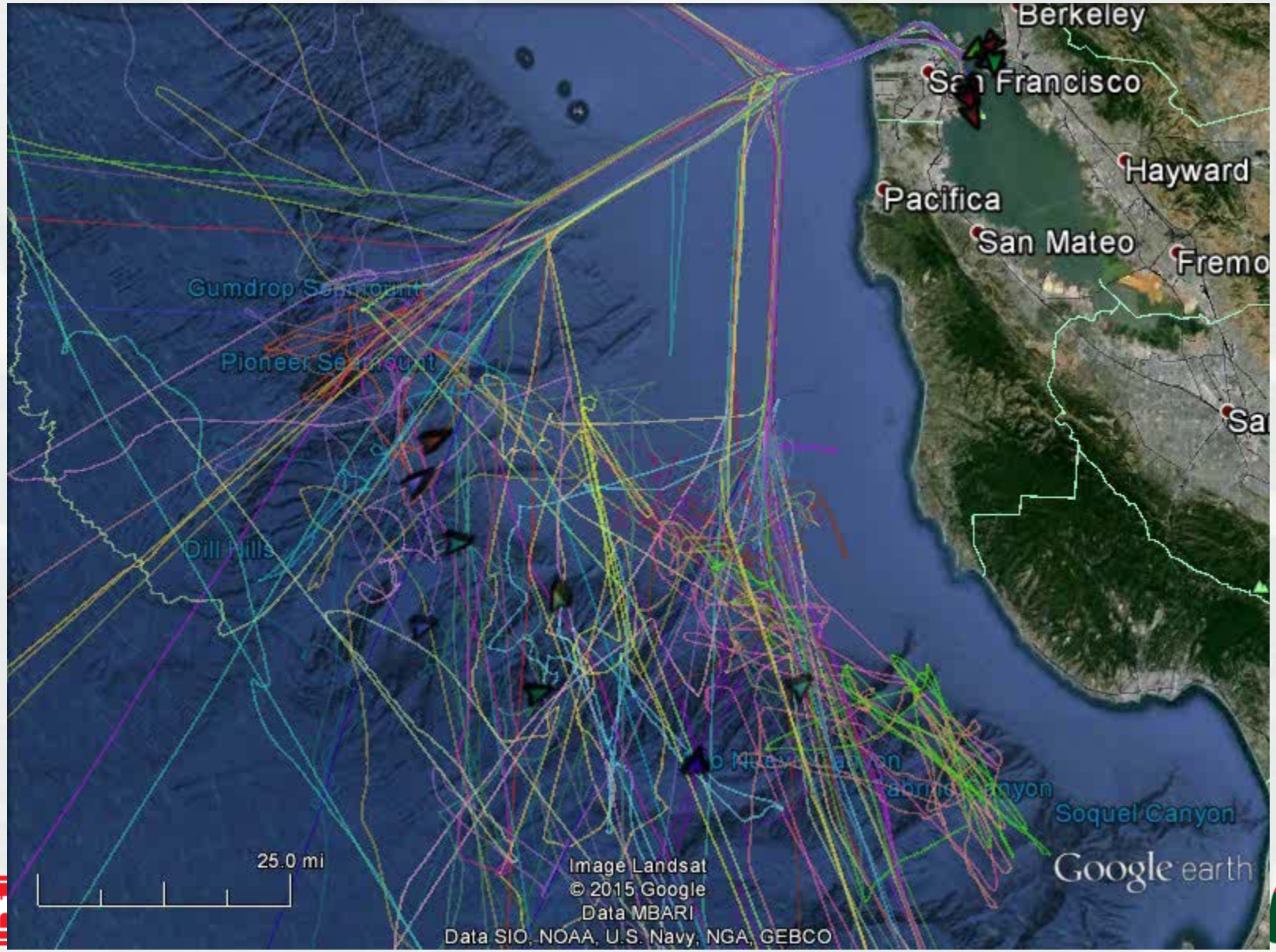






# West Coast Port Slowdown: Oakland



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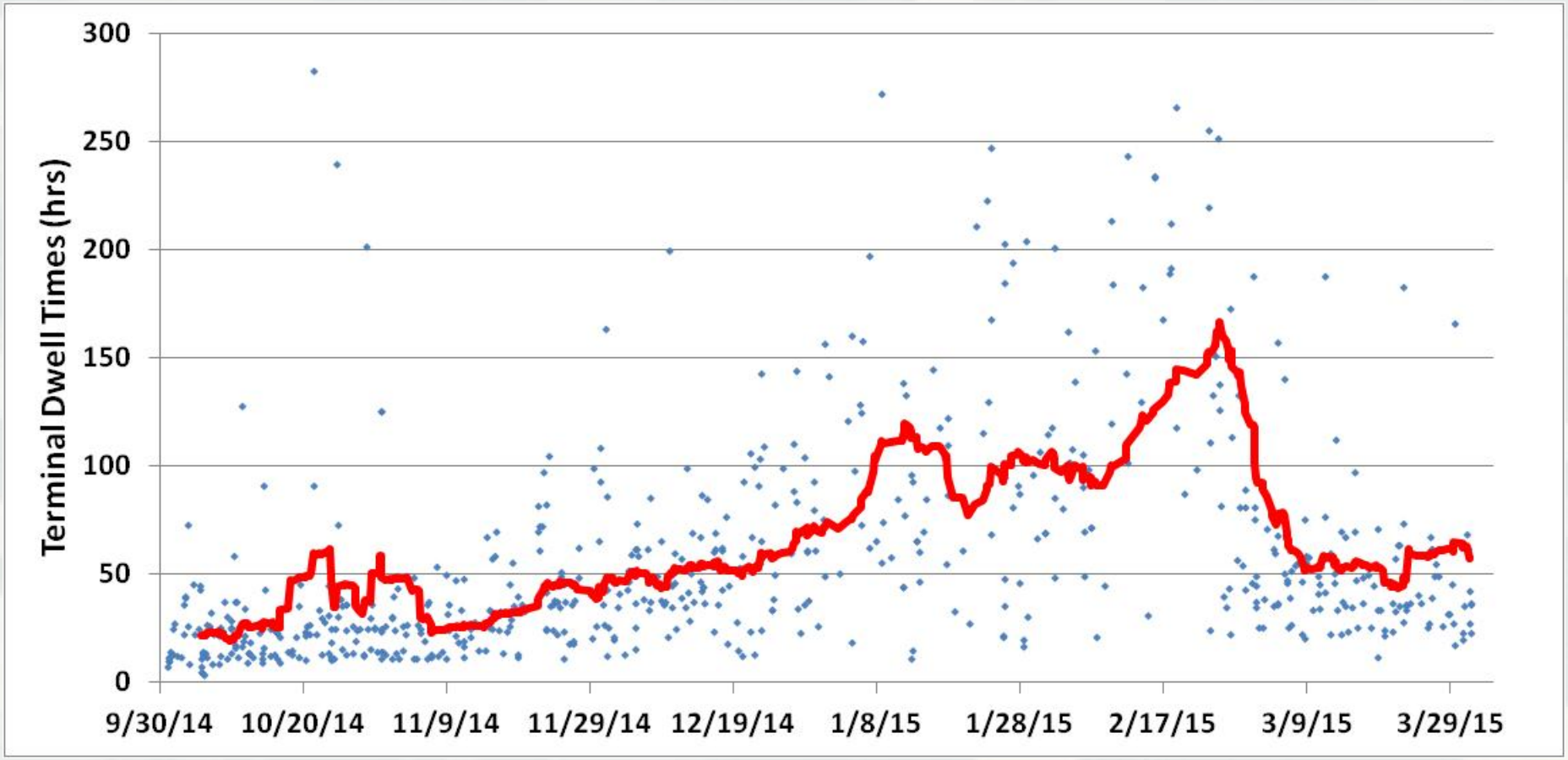
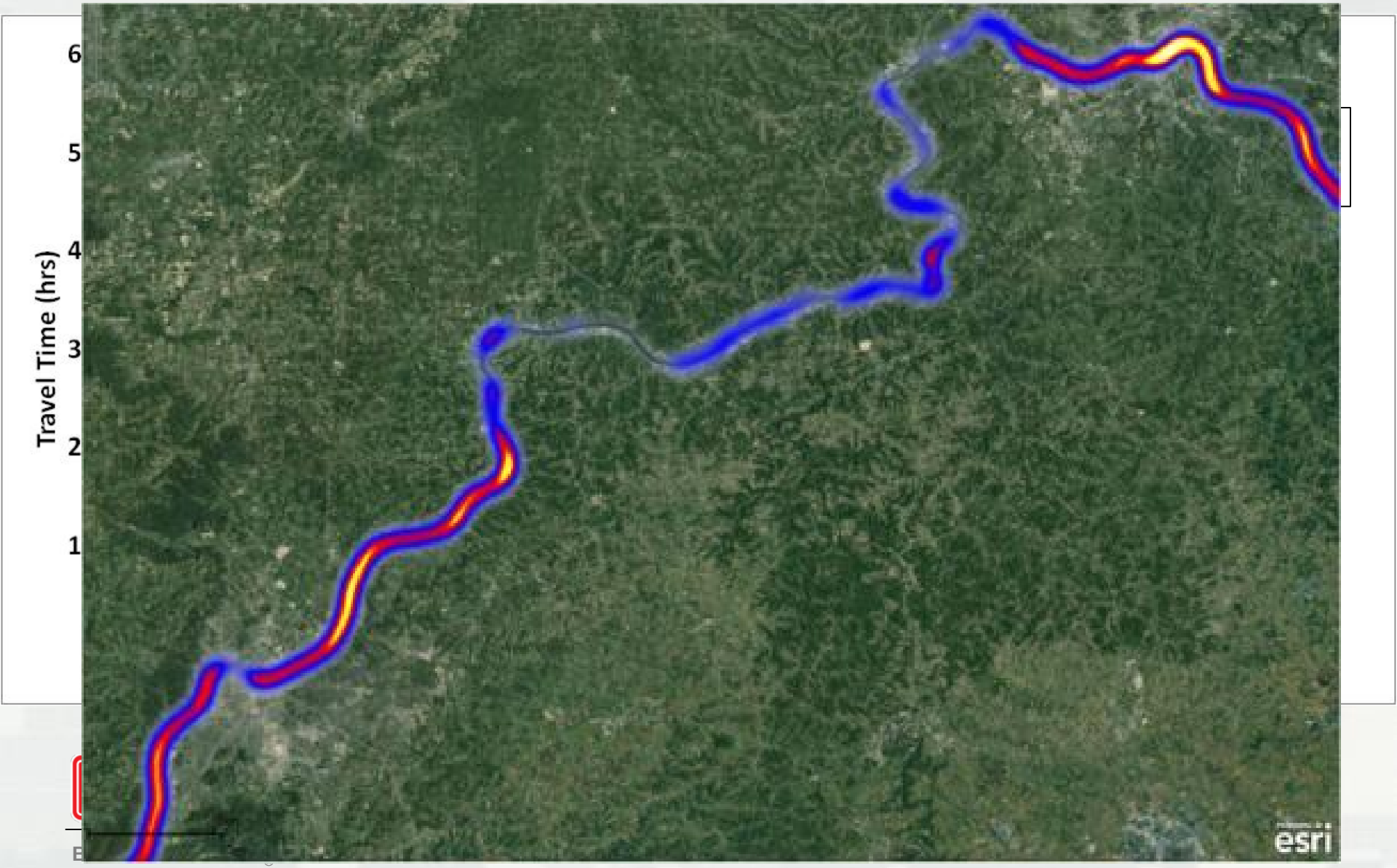


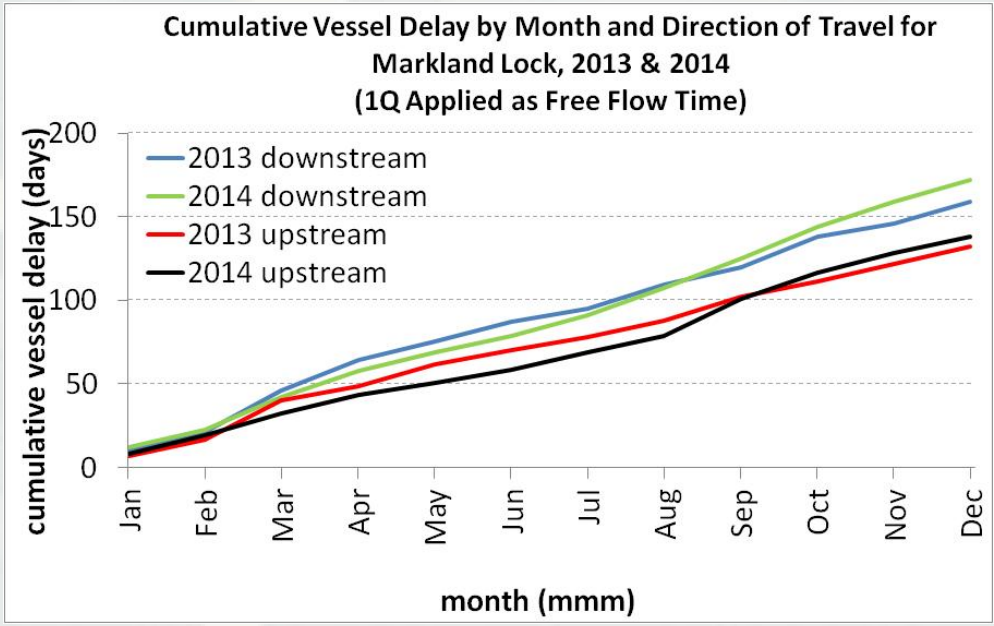
# Inland Waterways Example



# Inland Waterways Example

- Cumulative delay provides an objective baseline, combining congestion metric (avg. delay) with traffic volume.

- Performance can be tracked through time, comparisons made between locks, and correlations with nearby segments tracked ~> system disruptions.



# Towards Freight Fluidity Analysis

- **Ultimately we seek a means of evaluating the performance of entire intermodal freight supply chains.**

- **Data from across the spectrum help inform this process.**

- **Opportunity to merge AIS and GPS probe datasets with traditional reported data to provide a more complete picture of intermodal freight fluidity.**

# Data Sources and Performance Measures for the Marine Transportation System

## Questions?

**Ned Mitchell**
Kenneth.n.mitchell@usace.army.mil
**601-634-2022**