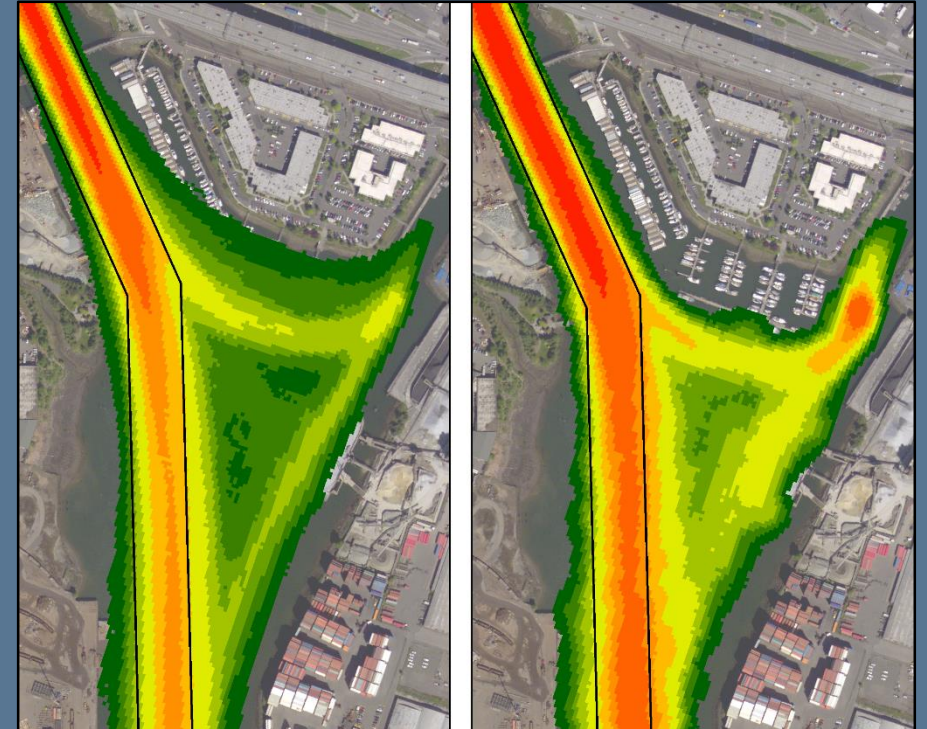


MAPPING SHIP TRAFFIC IN NARROW CHANNELS WITH BENDS USING AUTOMATIC IDENTIFICATION SYSTEM (AIS) DATA

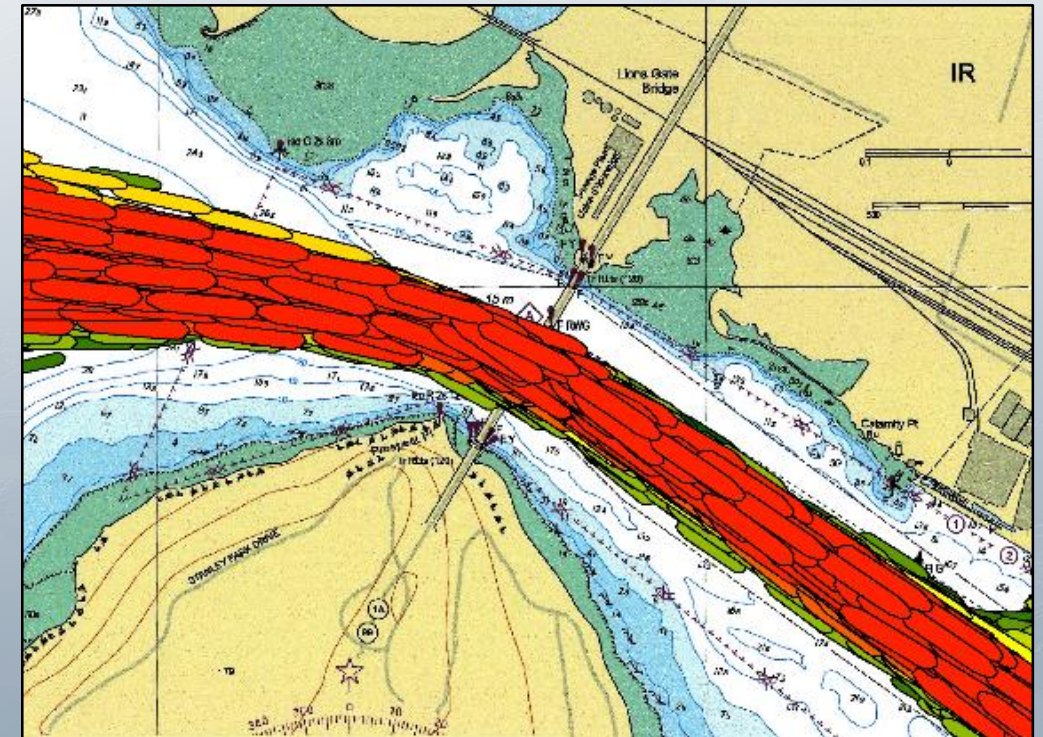
August 3, 2018



*Presented by: Jeffrey Oskamp, PE
Co-Author: Eric Smith, PE*

Outline

- Introduction to AIS
- Traffic Maps
- Traffic Maps in Channels
- Equivalent Swept Path Area Method
- Examples & Illustrations



What is AIS Data?

- **Automatic Identification System (AIS) is...**

“An automated autonomous system for the exchange of navigational information between suitably equipped vessels and shore stations using distinct messages and operating on two designated marine VHF channels.”

- **Standards set by the International Maritime Organization (IMO)**
- **Reporting is mandatory for large commercial vessels**
- **Signals at ~10 second intervals**
- **Each record includes static data, voyage data, and dynamic data**



A Brief History of AIS

- 2002 – IMO Resolution A.917(22) first outlining AIS
- 2003 – IMO Circular SN/Circ.227 with guidelines for installing AIS
- 2004 – IMO receives strong push-back from shipping industries – Pirates!
- 2014 – IMO strongly condemns the publication of AIS data on the web and elsewhere (MSC 73/23)

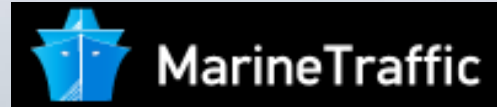


AIS Data Sources

Data from the U.S. Coast Guard

MarineCadastre.gov

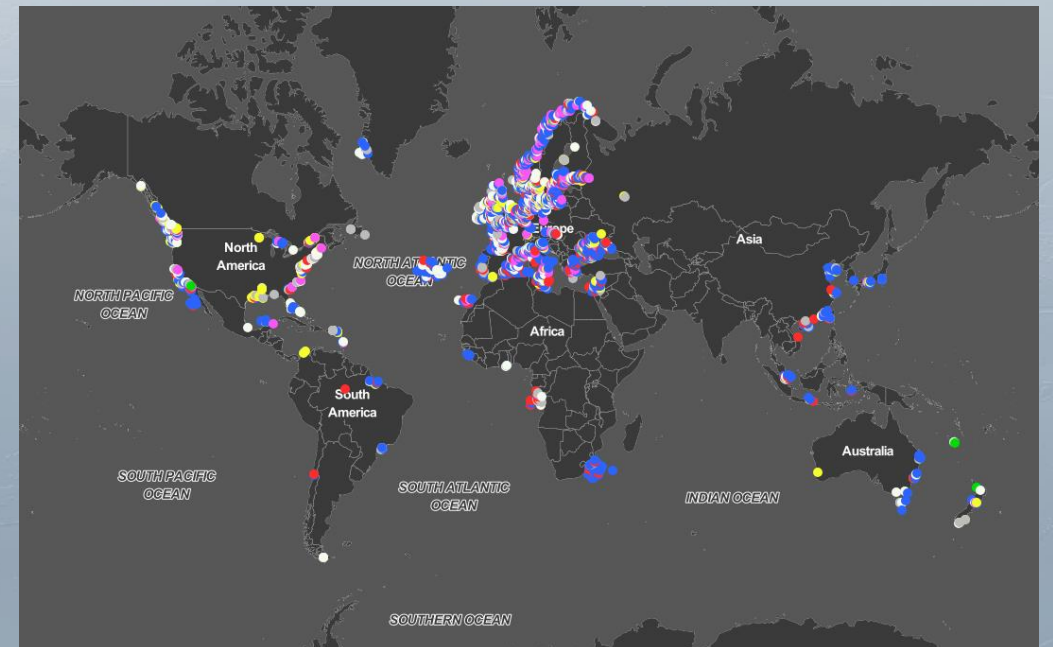
Commercial sources...



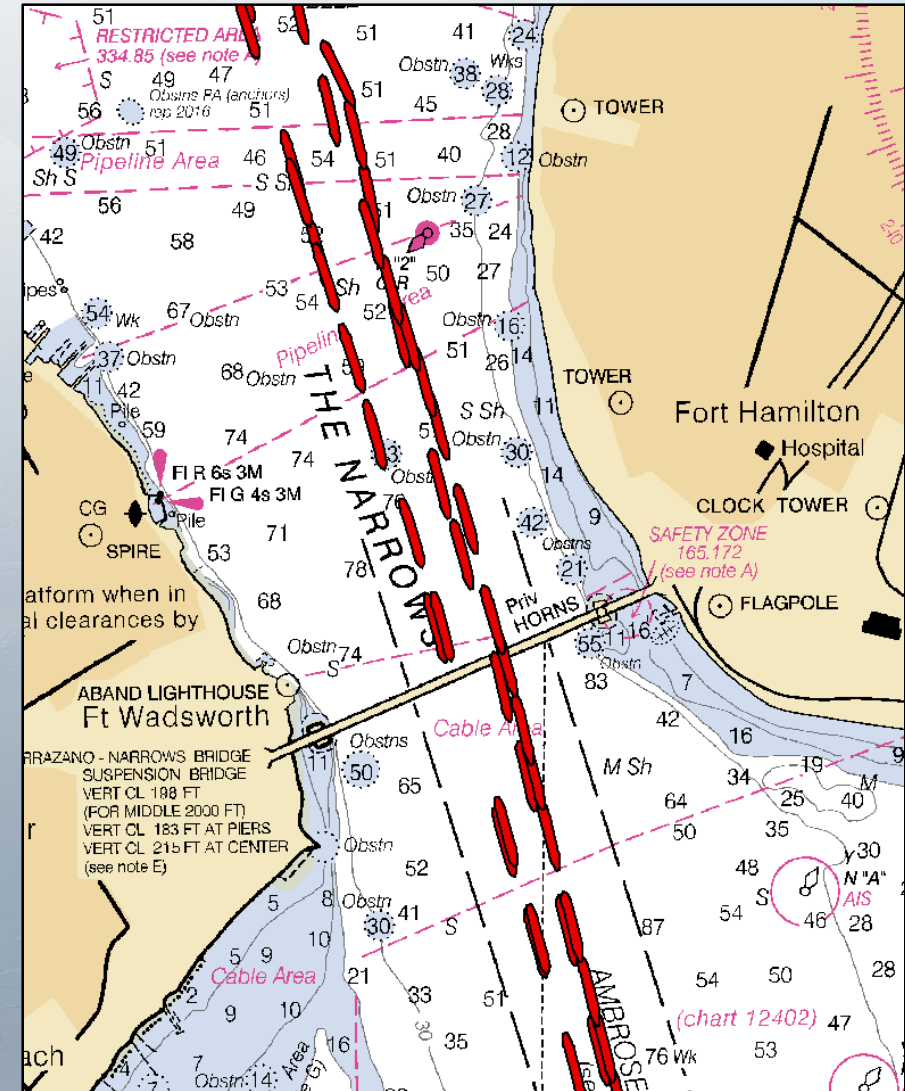
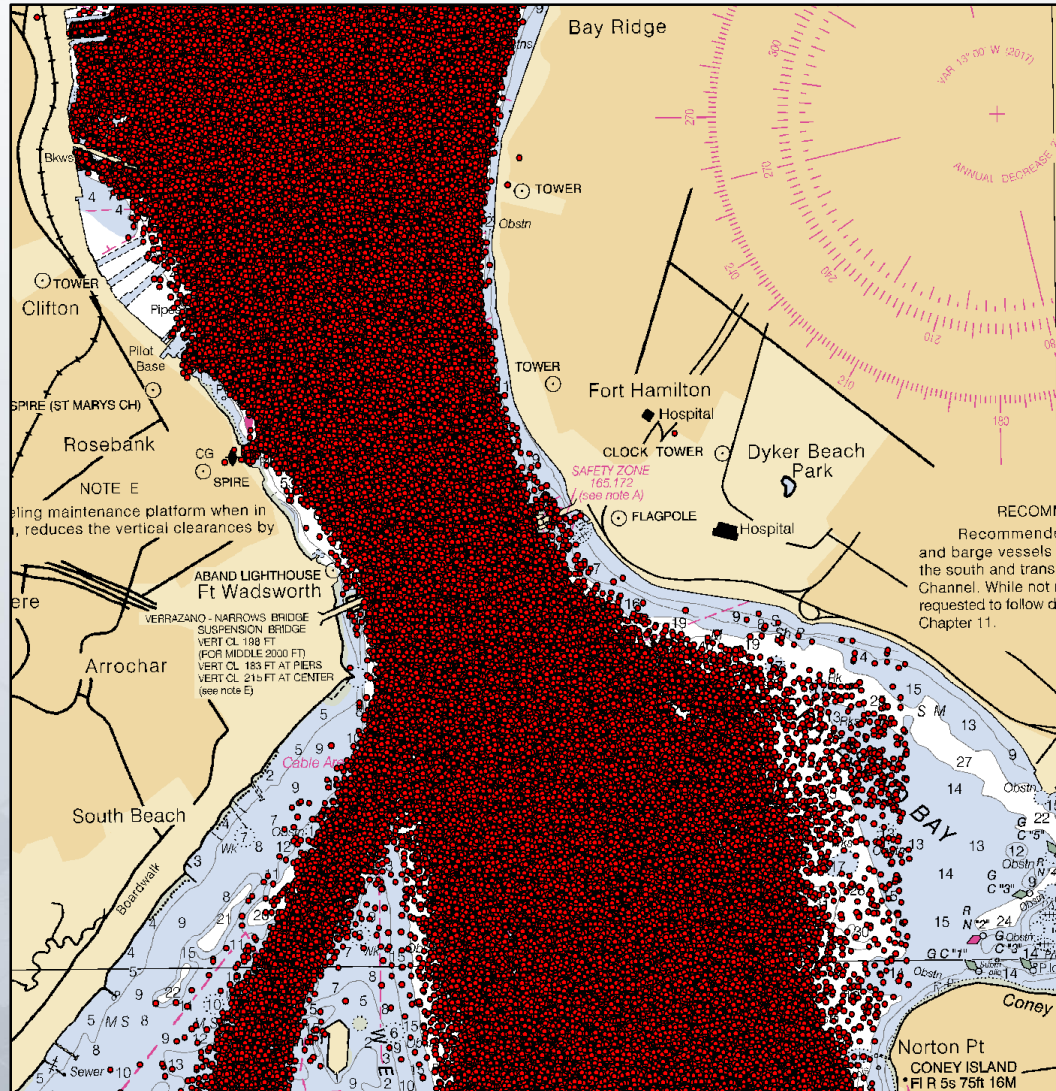
In-house Data Collection



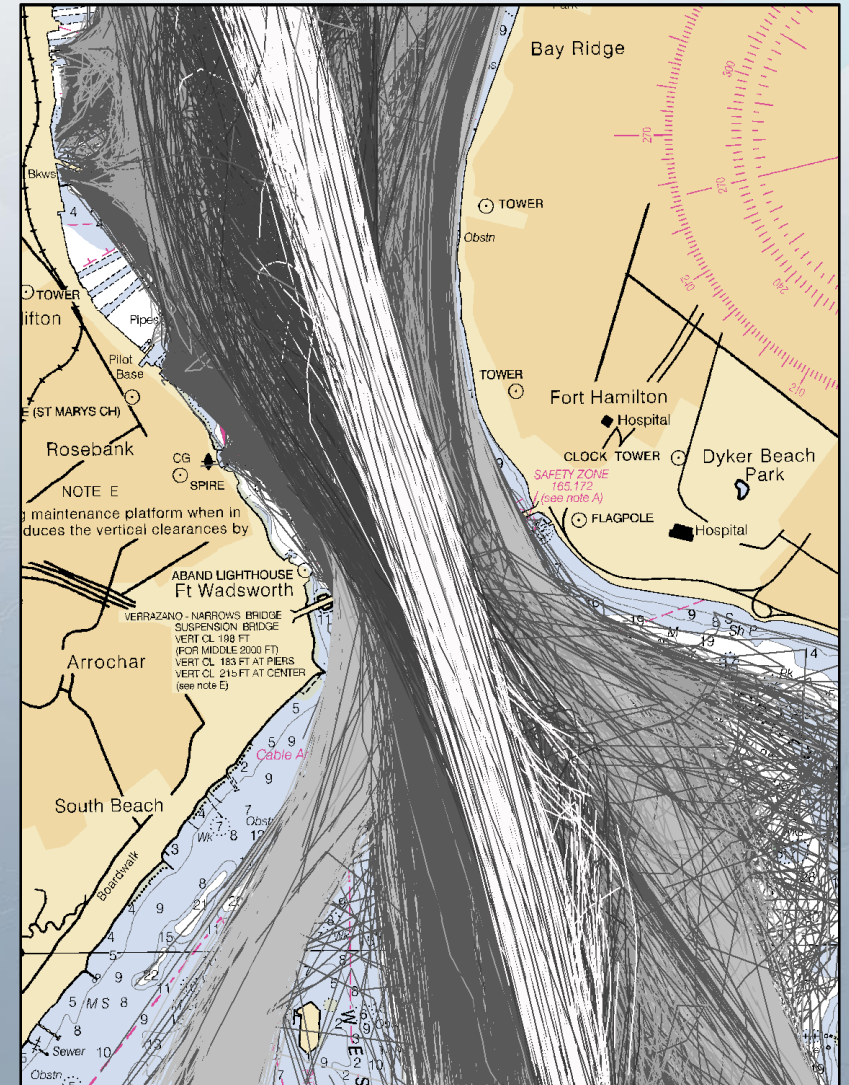
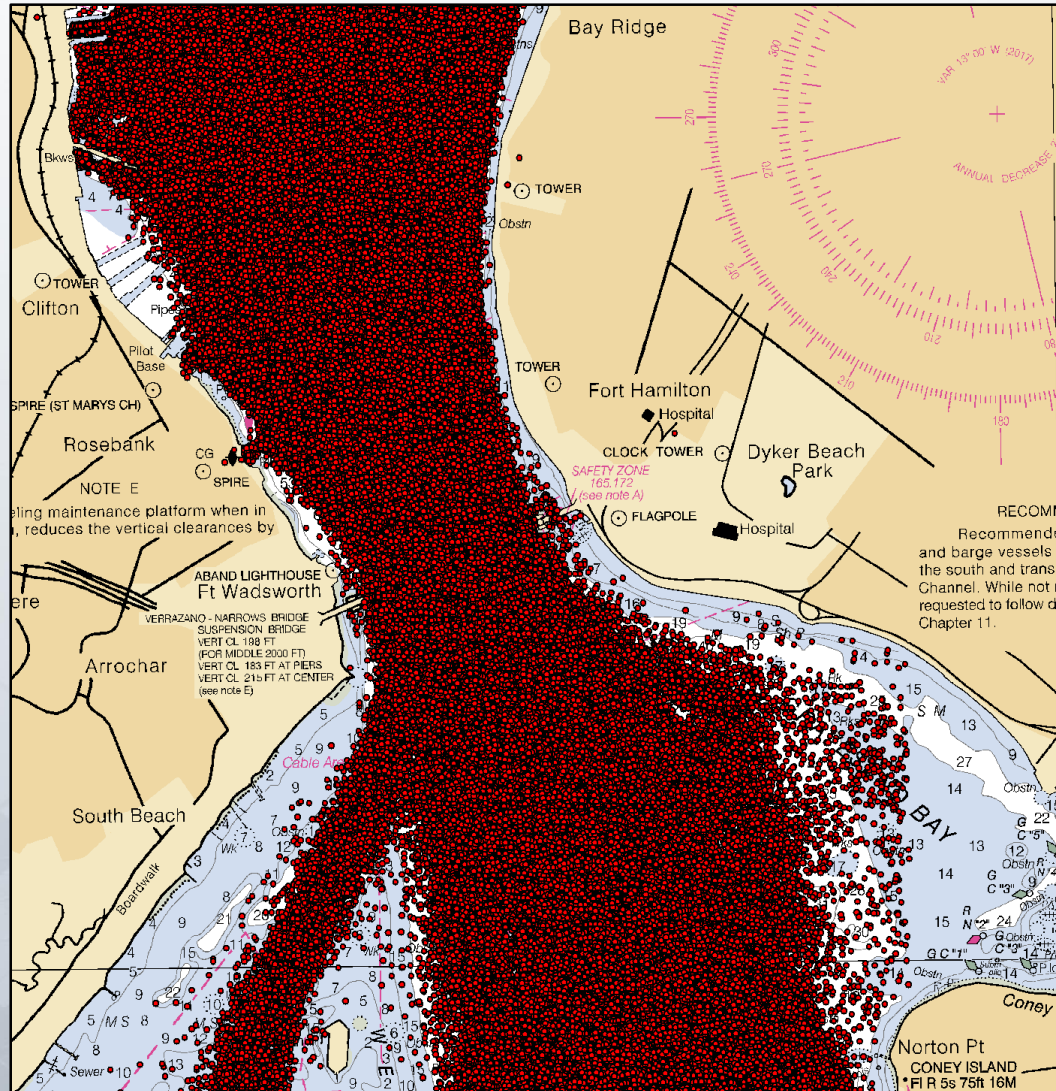
From Free Data Sharing Sites...



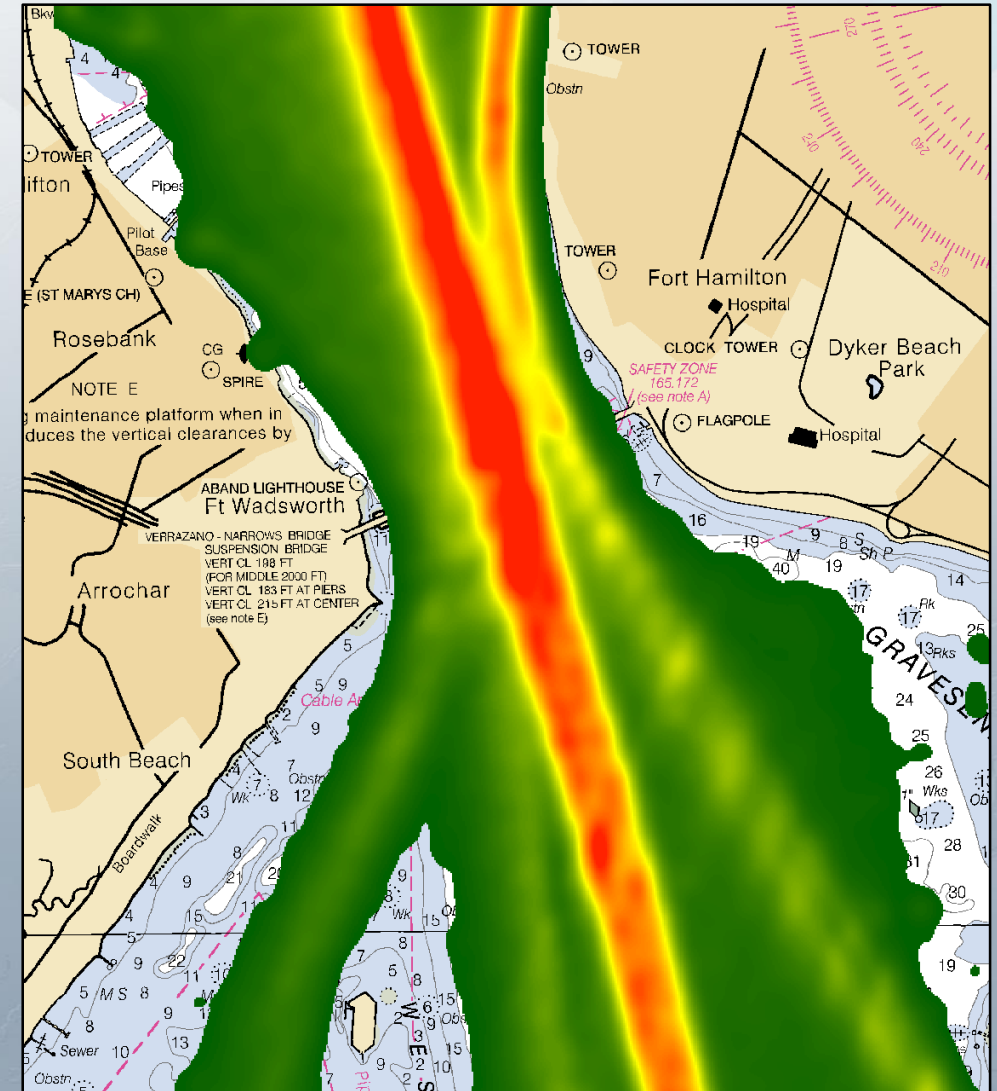
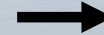
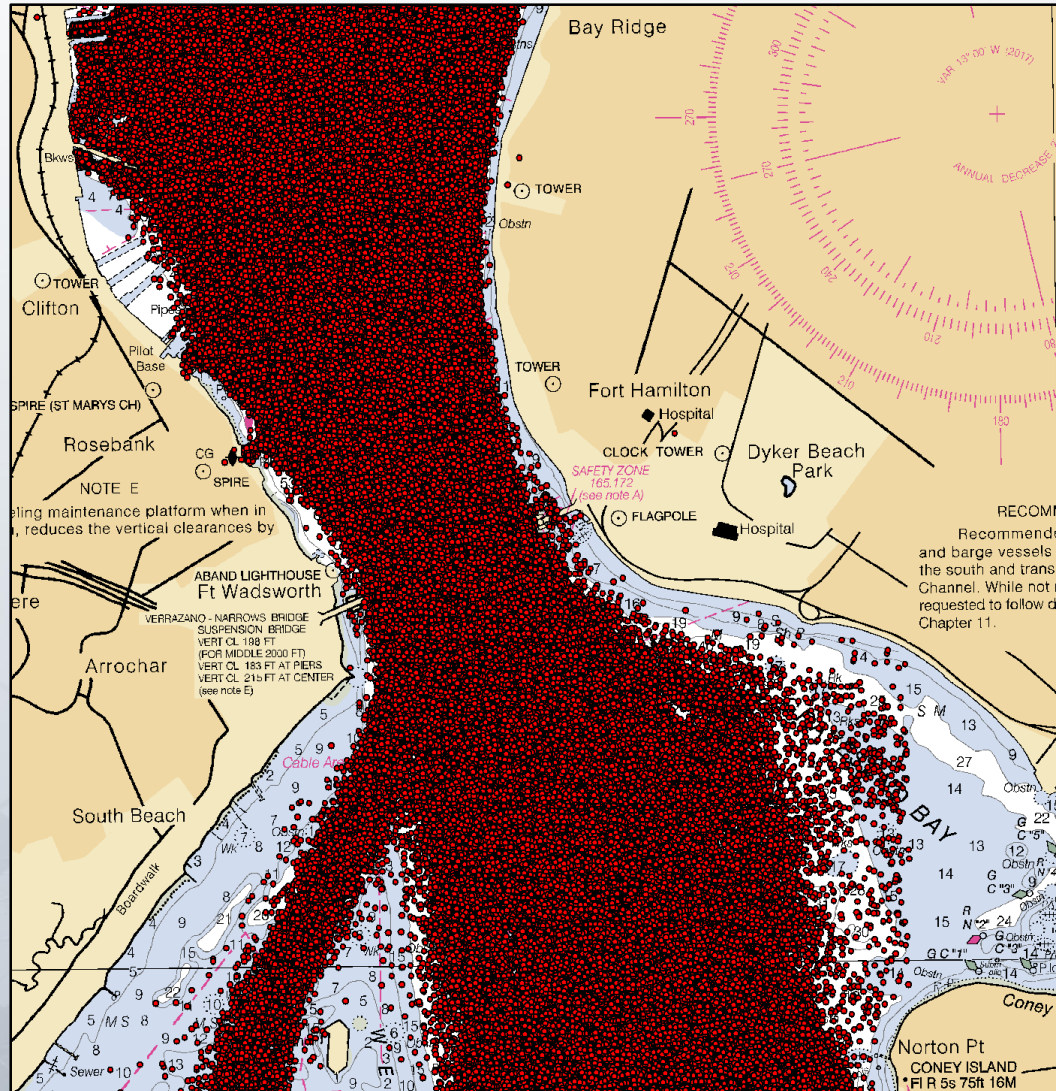
Sorting & Presenting AIS Data



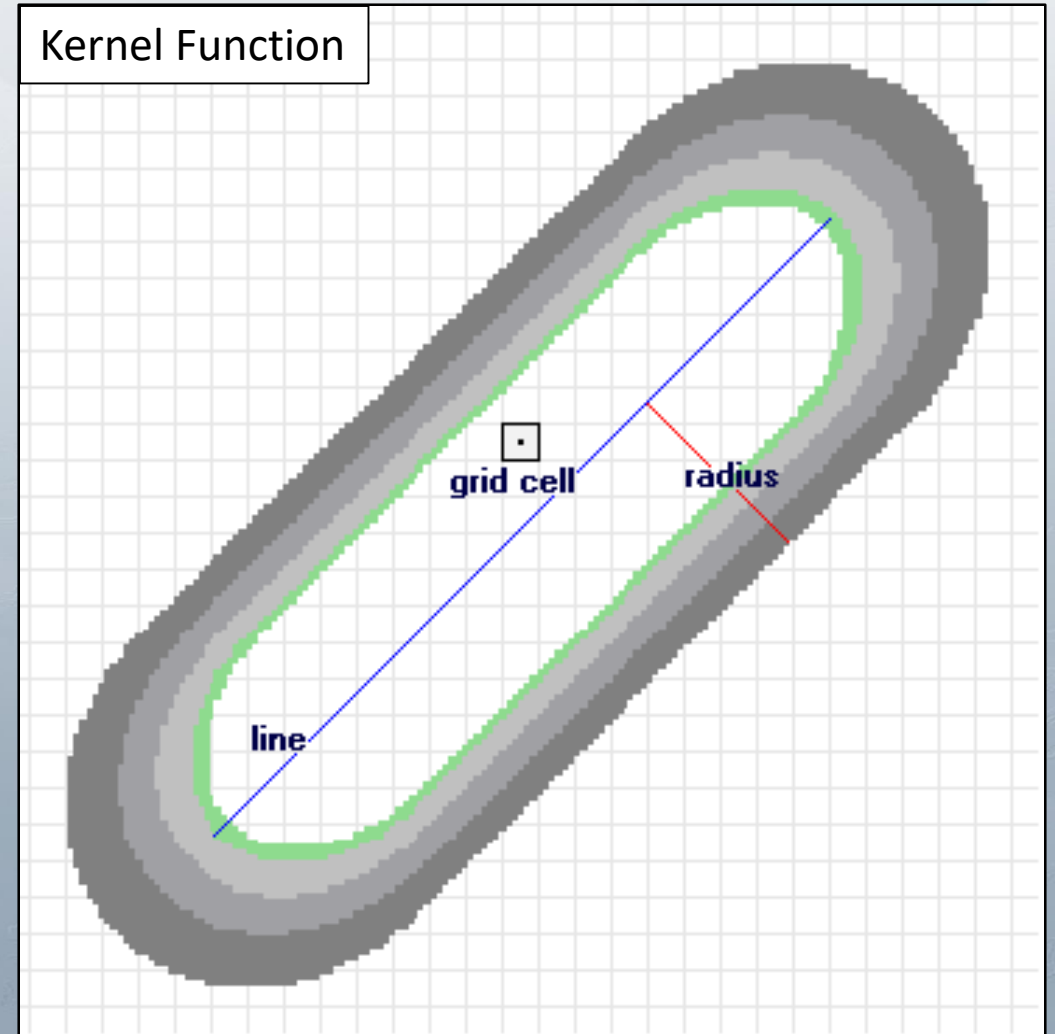
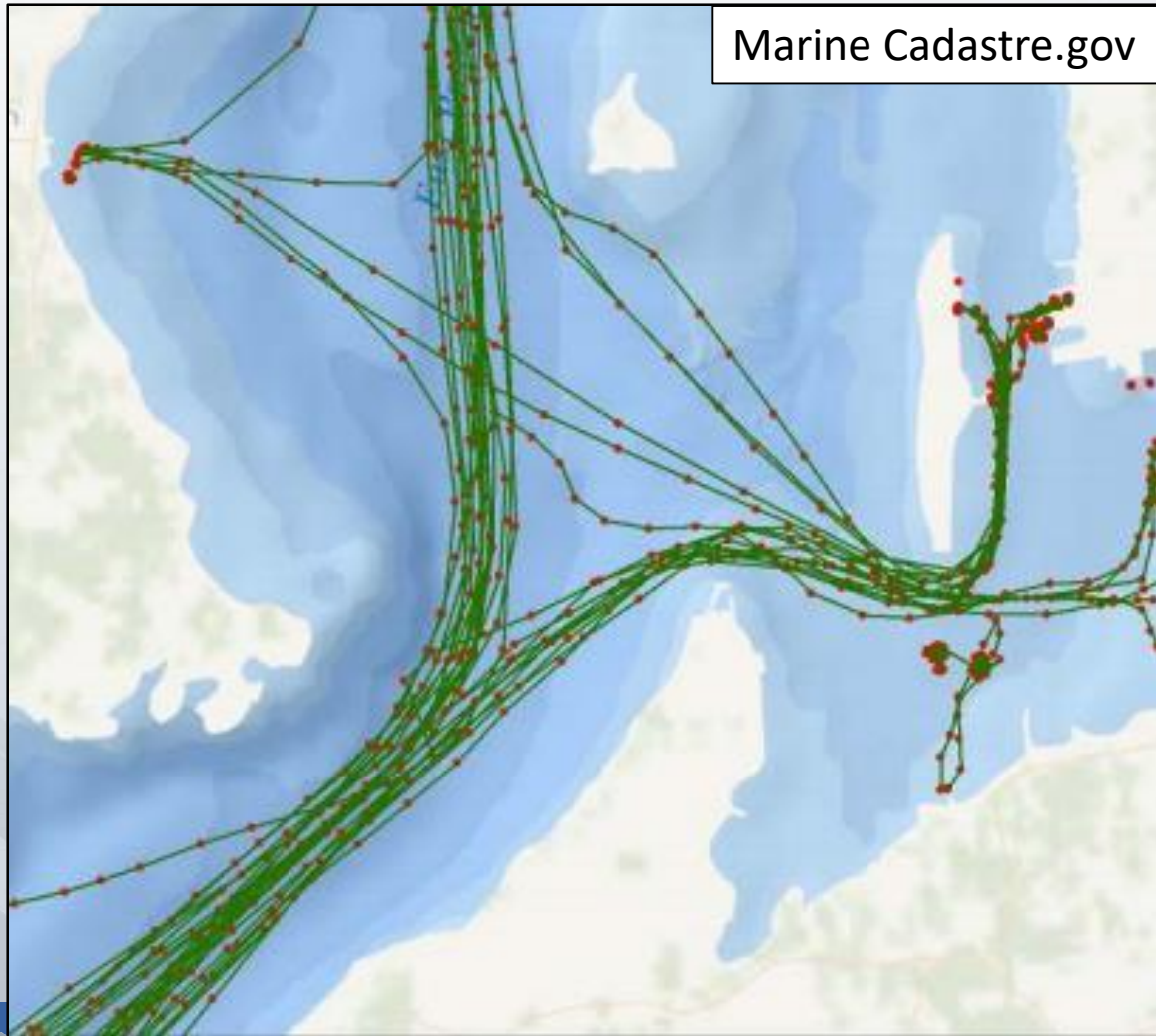
Sorting & Presenting AIS Data



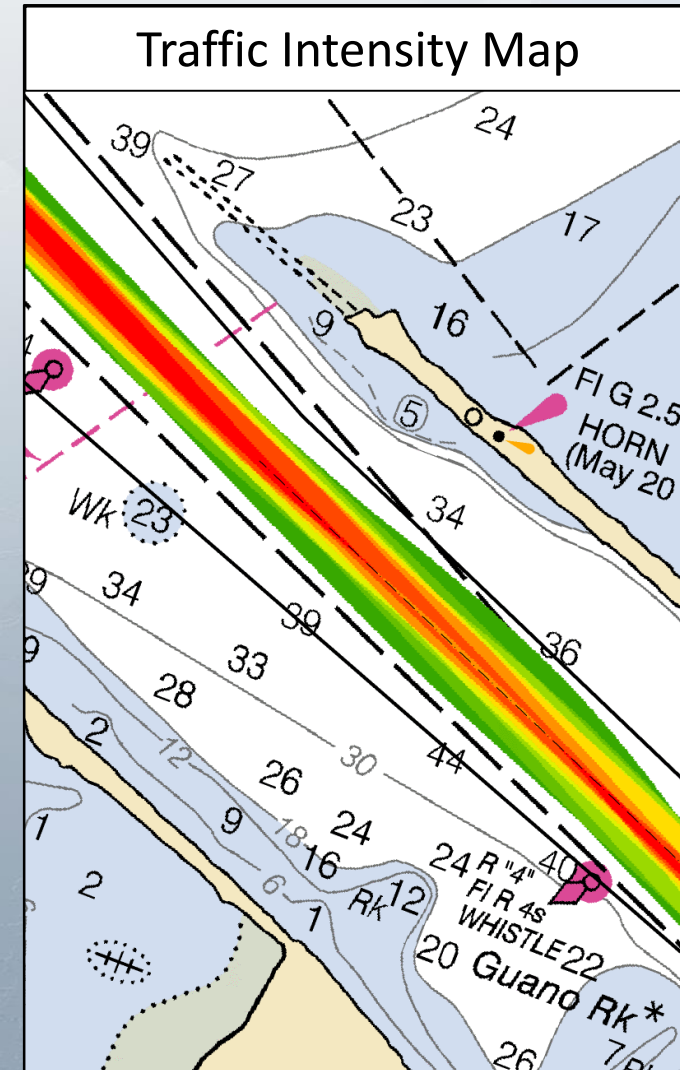
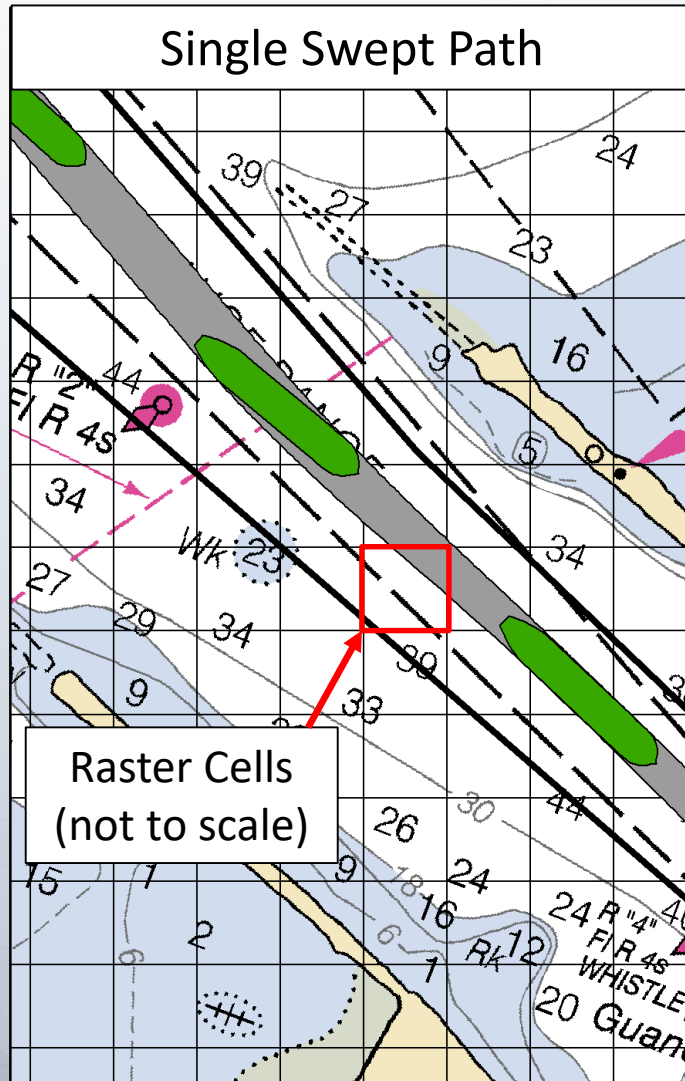
Sorting & Presenting AIS Data



Traffic Maps Based on Track Lines



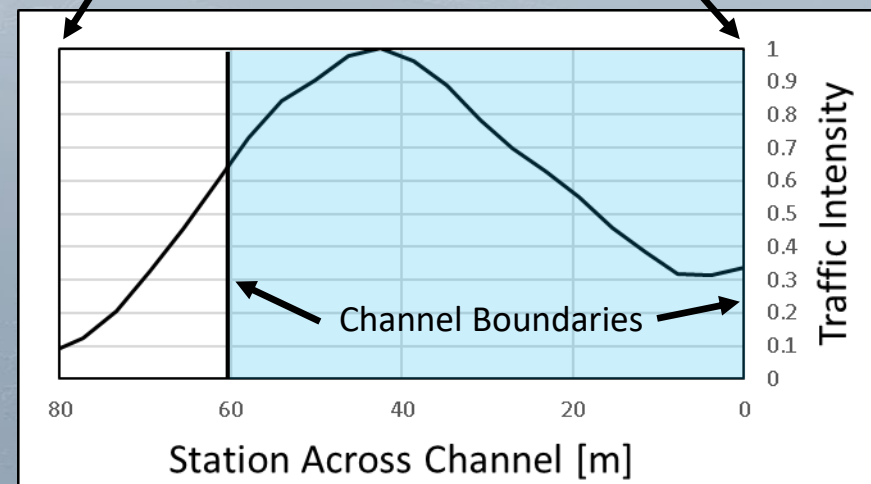
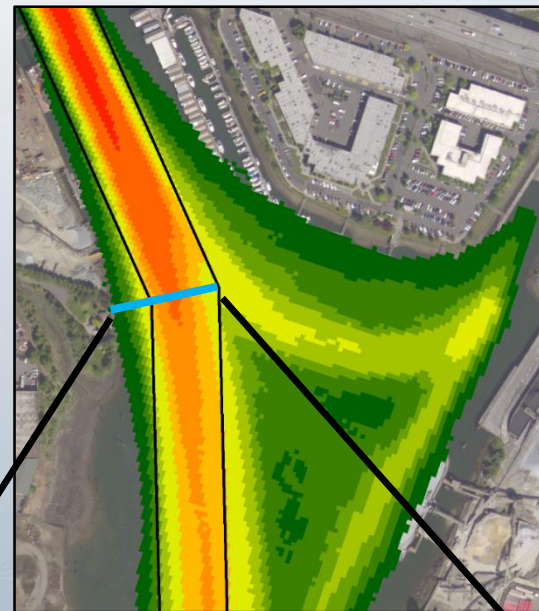
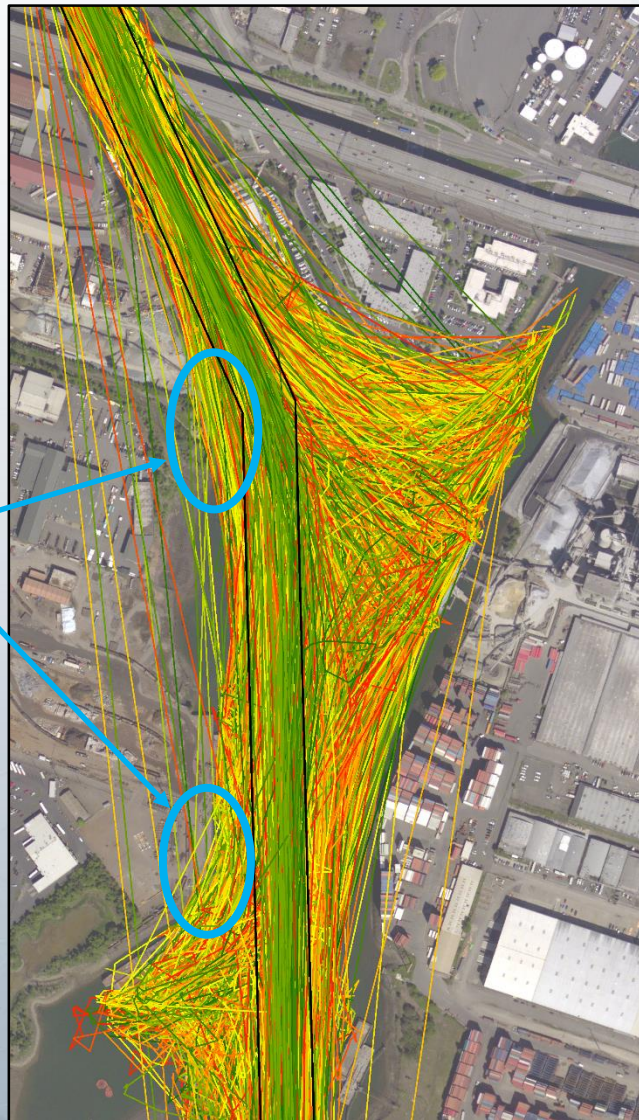
Traffic Maps Based on Swept Path Area



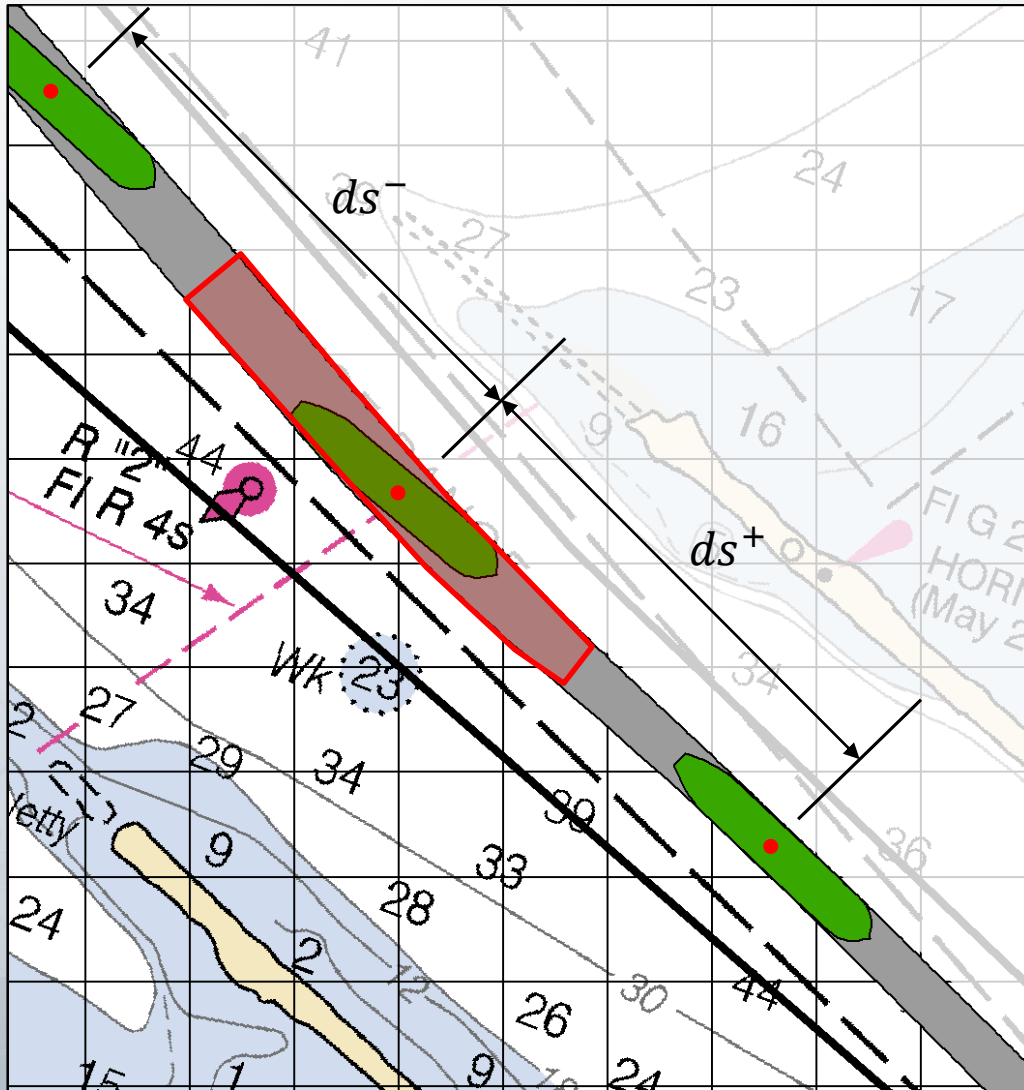
What about channels with bends?

Vessels Outside of
Channel & On Land...

Delete these tracks?
(does that really
solve the problem)?

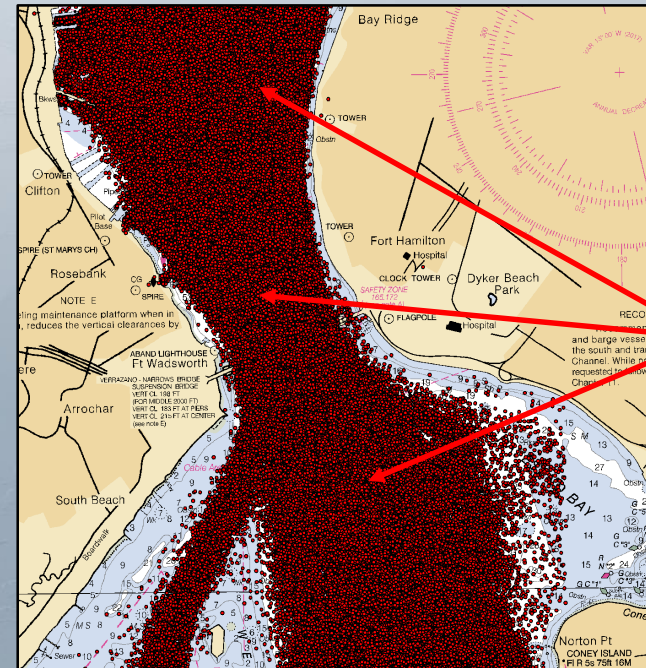


Equivalent Swept Path Area



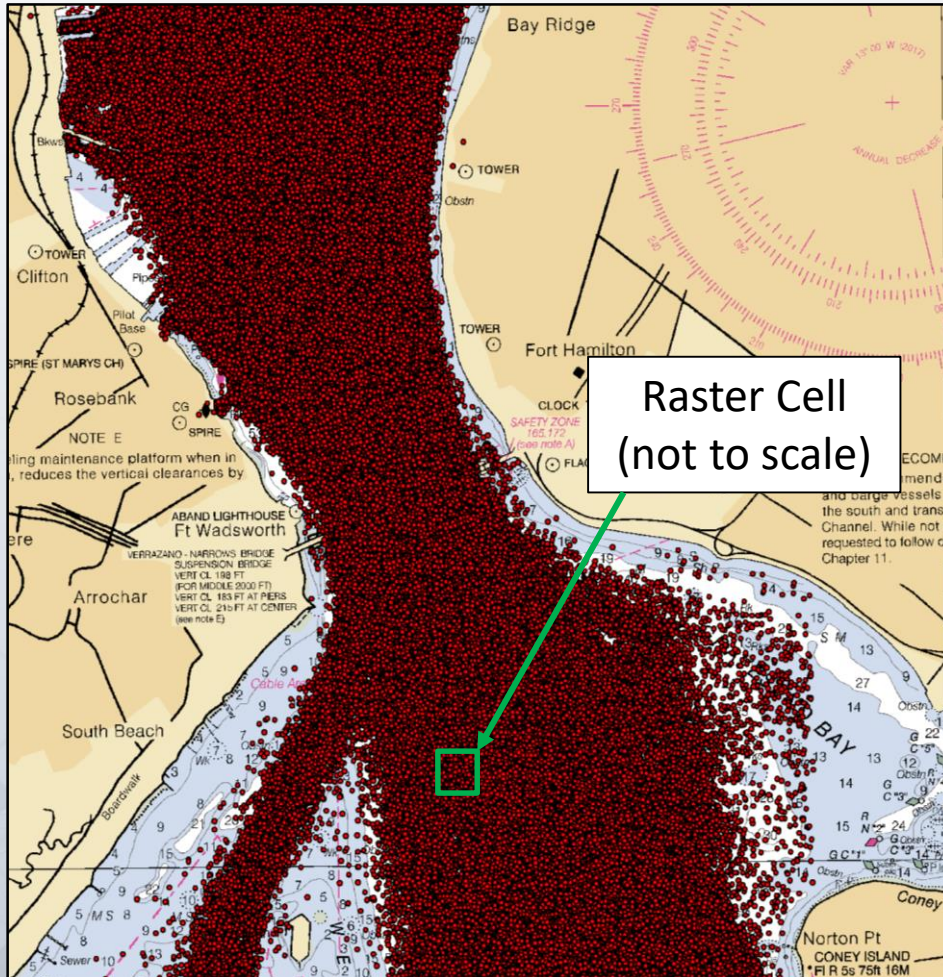
Area Swept by Vessel

$$SPA \cong \left(\frac{ds^-}{2} + \frac{ds^+}{2} \right) * Beam$$



Compute Swept Path for Each Point

Equivalent Swept Path Area



Add up the swept path area for all AIS points that fall inside each cell.

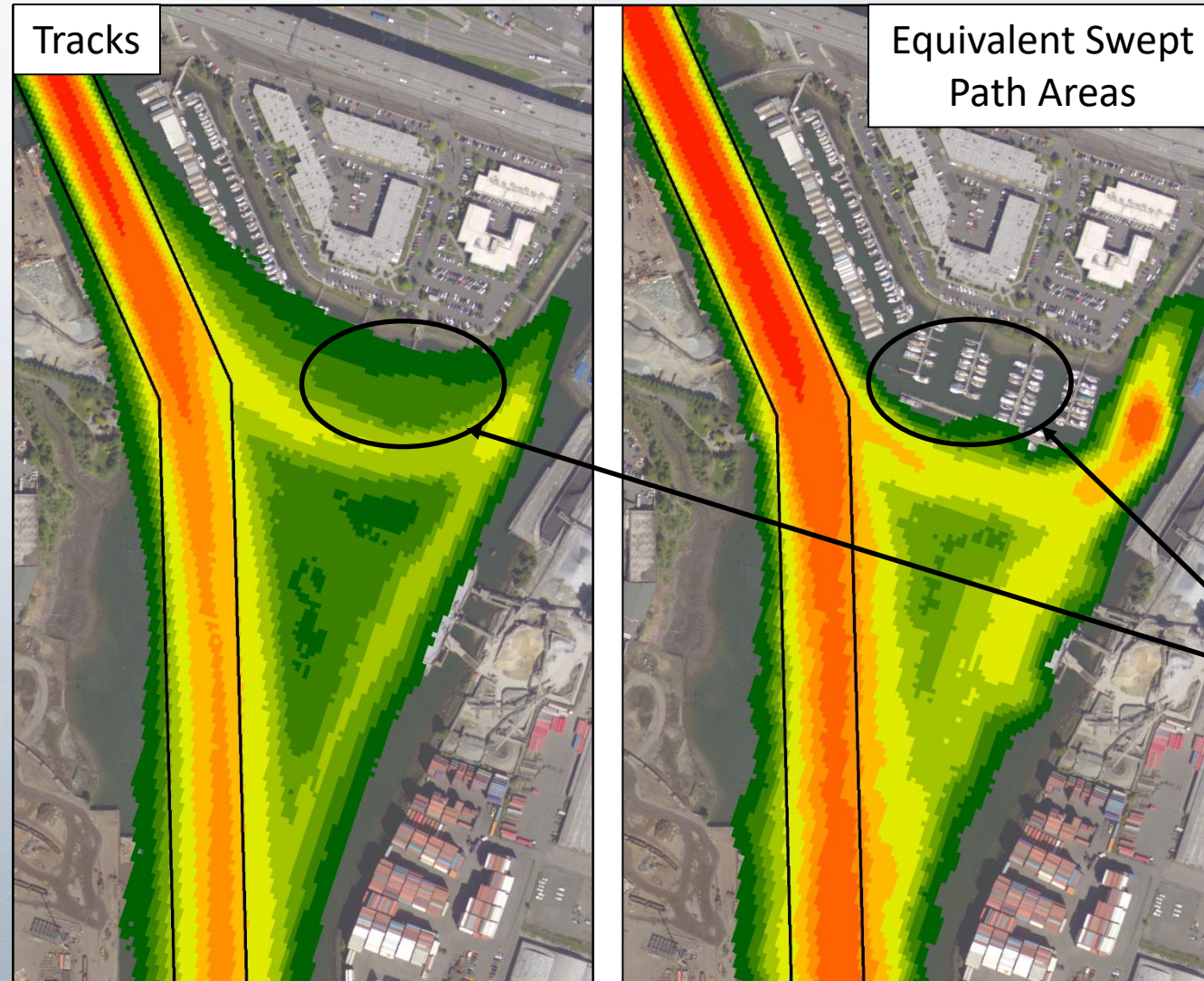
$$Cumulative_{SPA} = \sum_{Raster\ Cell_i} SPA$$

Divide that “cumulative” swept path area by the cell area.

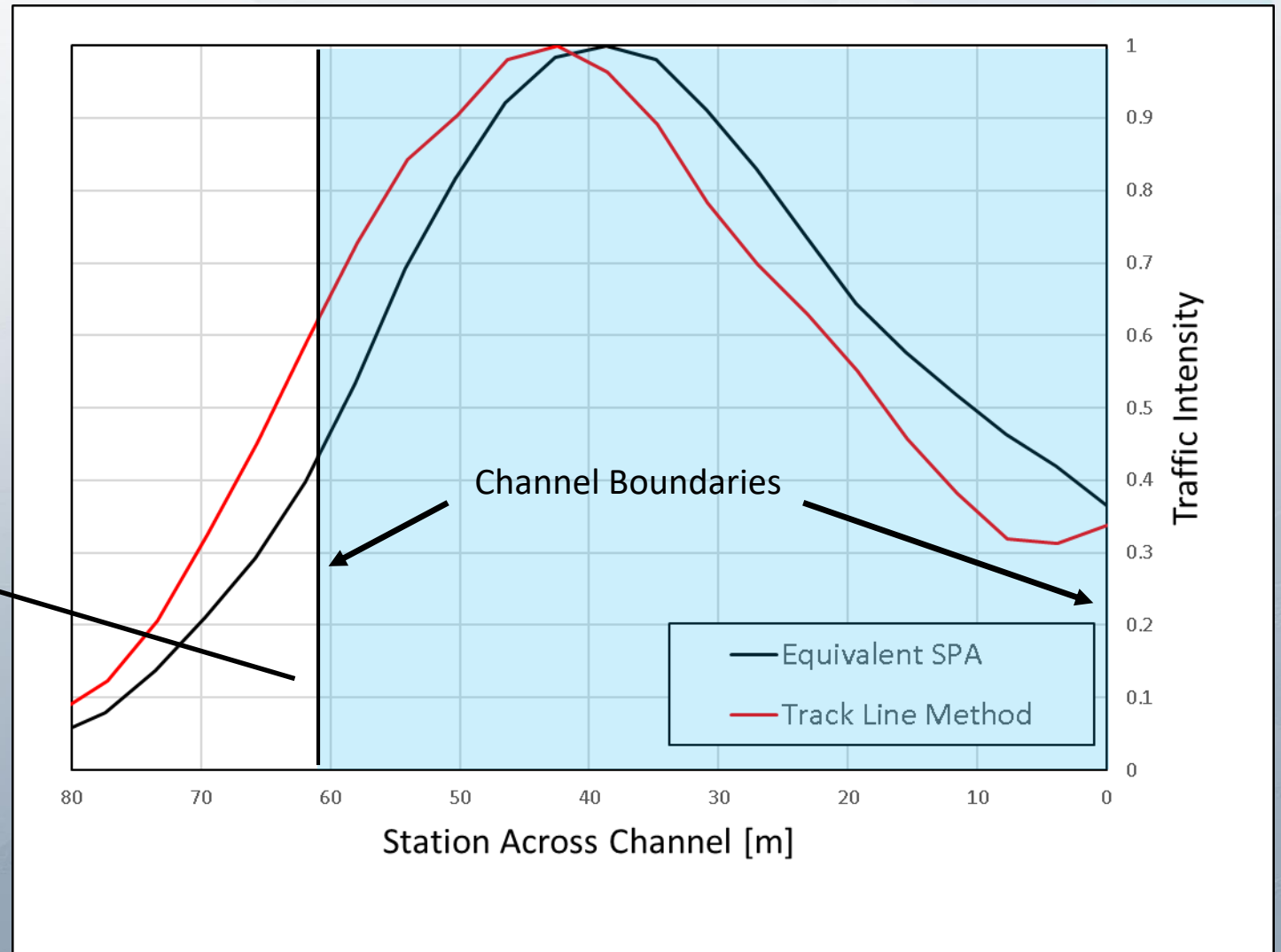
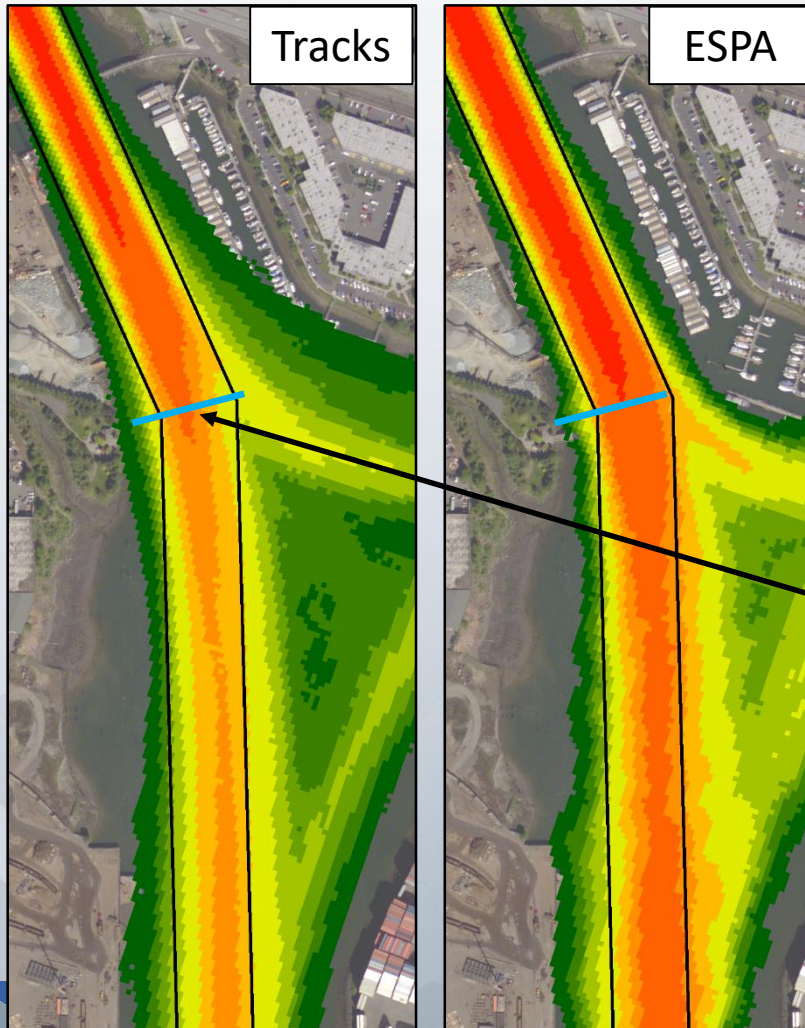
$$N_{Vessels} = \frac{Cumulative_{SPA}}{A_{Raster\ Cell}}$$

Smooth the resulting raster to remove spikes.

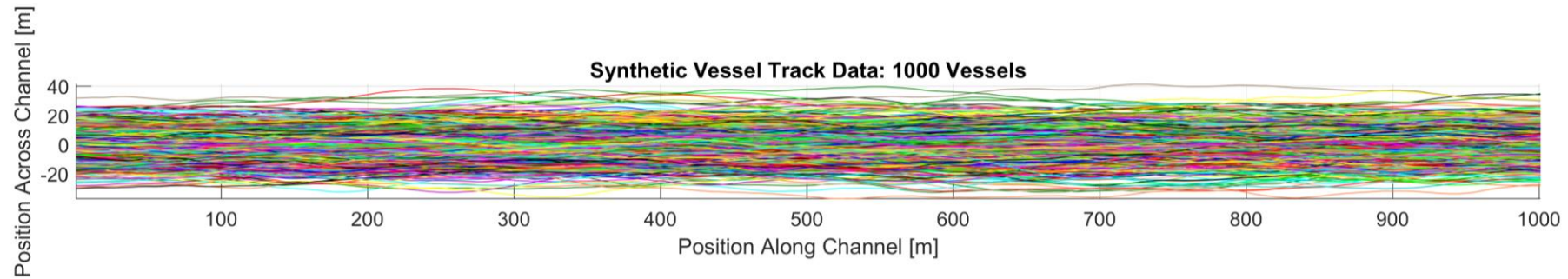
Comparison of Results



Comparison of Results

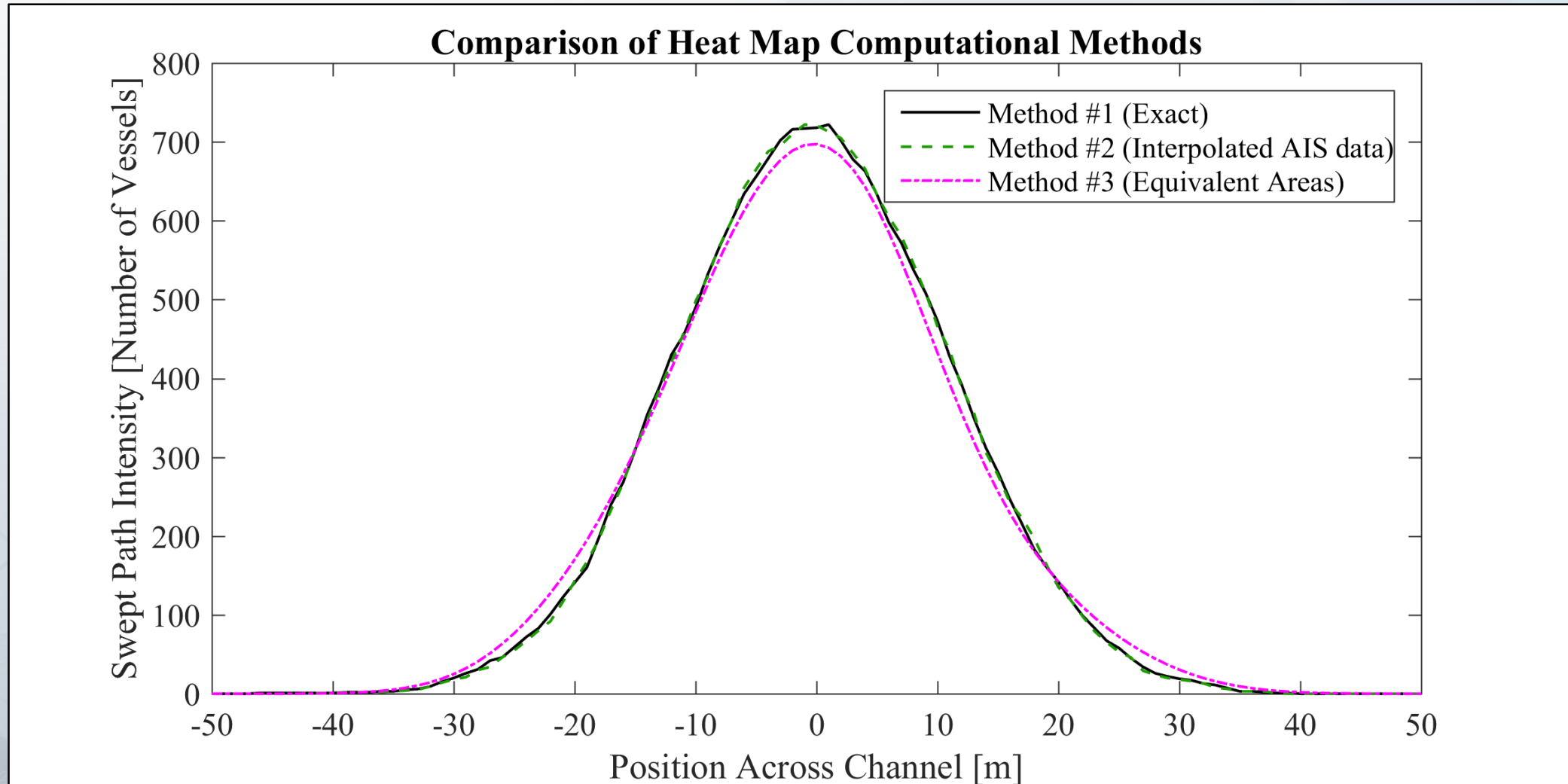


Methods Comparison – Straight Channel



- 1000 synthetic vessel tracks
- First-order Markov Chain Monte Carlo algorithm

Methods Comparison – Straight Channel



Conclusions

- The concept of swept path area can improve vessel traffic maps over the approach presented by BOEM/NOAA by accounting for crab angle of transiting vessels.
- Method of Equivalent Swept Path Areas provides a way to make more accurate traffic maps in channels with bends.
- Using synthetic data, we showed that the traditional track-based approach is superior in straight channels.



Questions?

