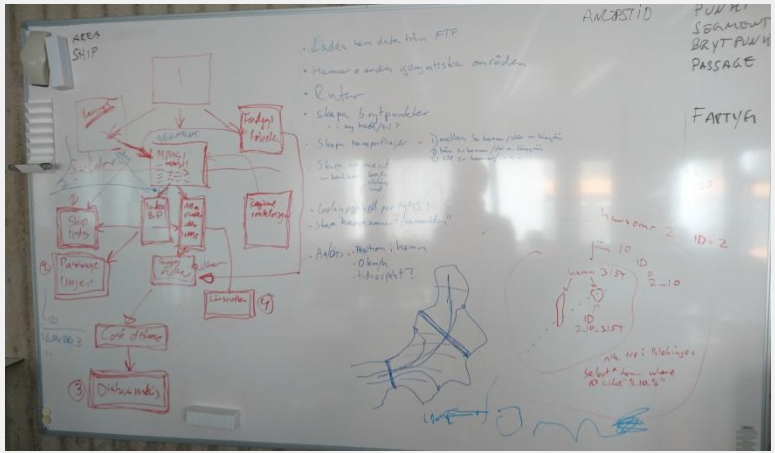
Statistiska centralbyrån Statistics Sweden

Spatial thinking and learnings using AIS data

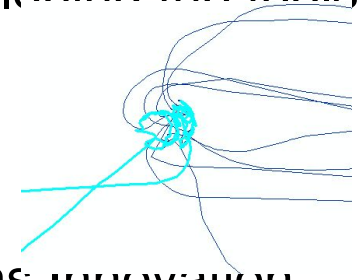


Marcus Justesen, GIS-analyst

Ljubljana 2016-10-13

The Project – what are we doing?

- Work in progress, phase 2/3 : developing the tools and methods
  - A pilot study has been done
  - Next phase is implementation
- Partly funded by Vinnova (Swedens Innovation Agency)
- Joint venture between Transport Analysis and Statistics Sweden (with a bit different objectives)



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The Project – what are we doing?

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Input

AIS data for Baltic Sea, years 2013-2015

Output

- Port to port distance calculations by:
  - Domestic/international/ inland waters
  - ship type
- List of vessels entered in Swedish ports
- Passage lines
- Traffic in county regions

Statistical results

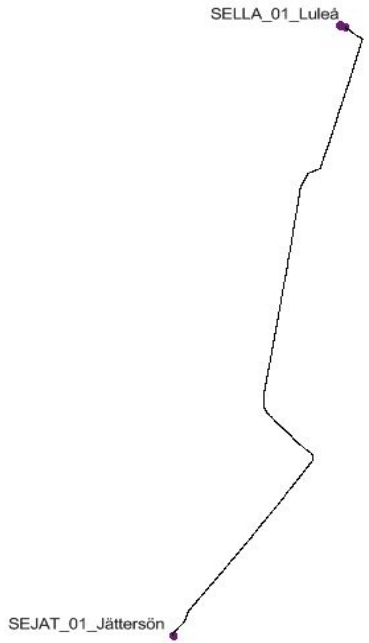
Challenges

- Data must be restructured to better suit our purposes
  - Data should be reduced
  - We will in the end only use a small part of total data
- Part of filtering the data must be done geographicaly
- We must identify transports between Swedish ports
  - Lines must be created from points
  - Ports have to be created – using AIS data

Restructuring data: creating lines

Four attributes are needed to create transport lines between ports:

- Ship id (MMSI)
- Position
- Time
- Ports
  - This is not available to us so must be created



Using AIS data to create ports

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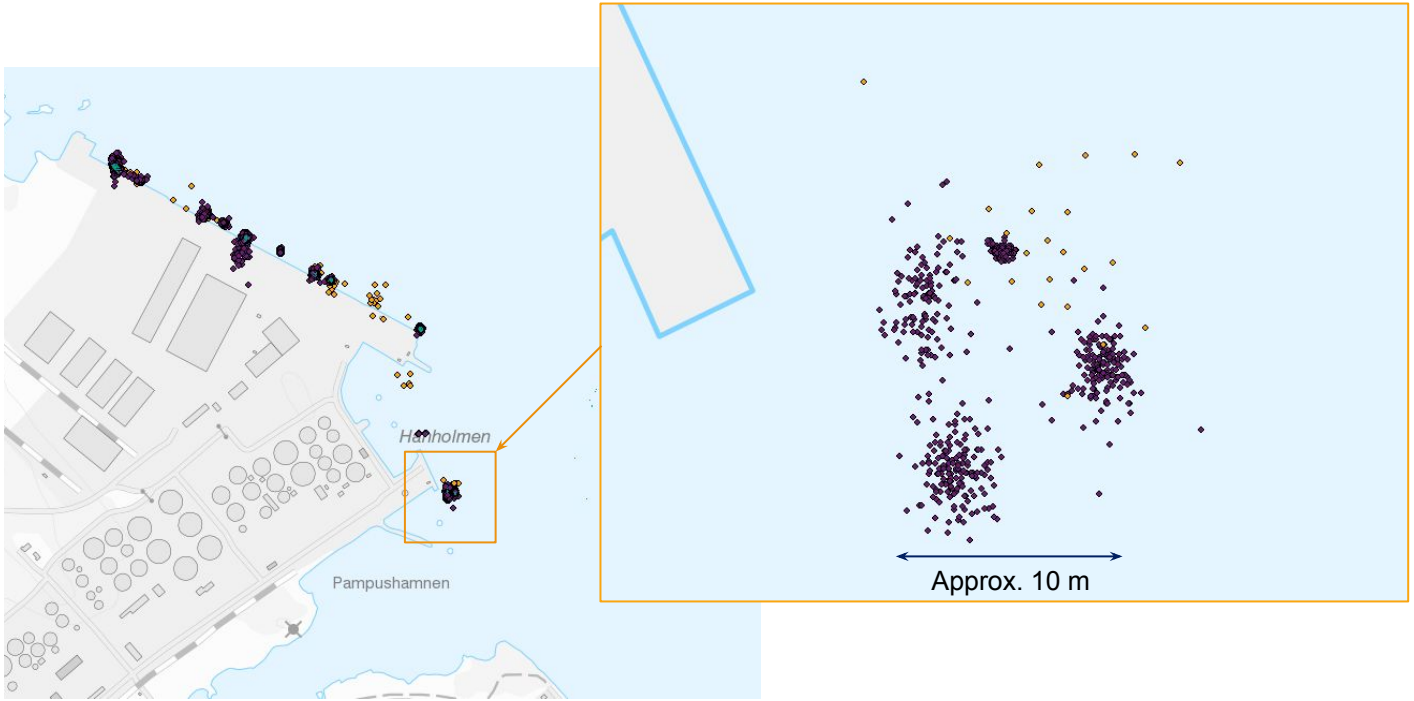
High data resolution can be useful when creating ports



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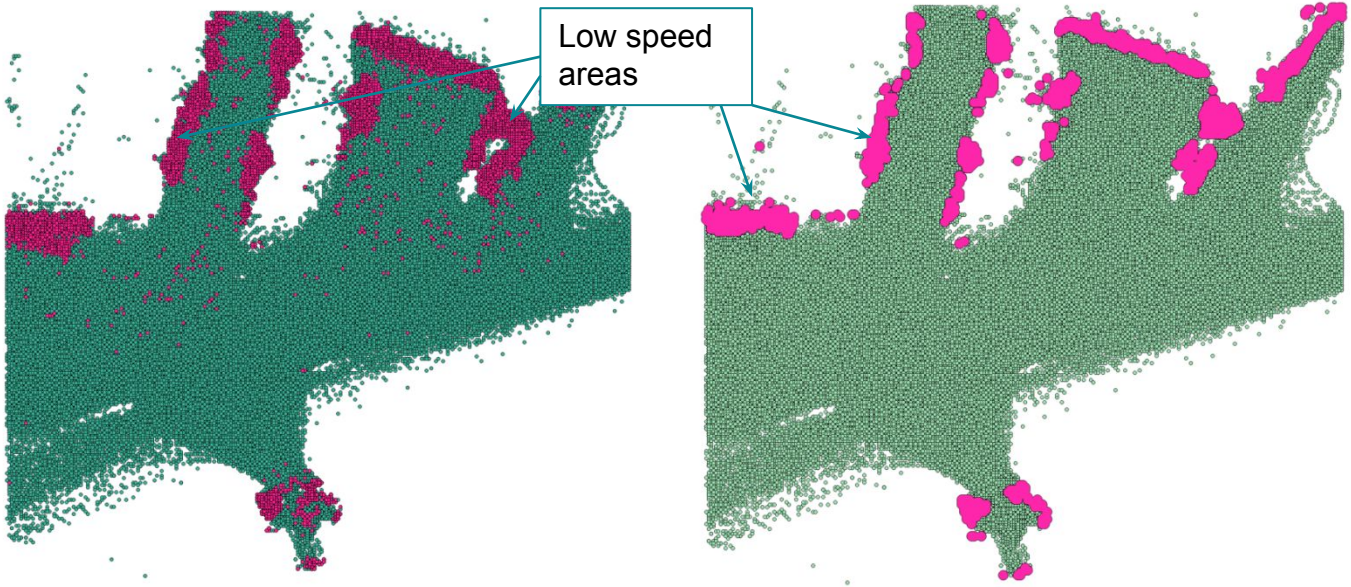
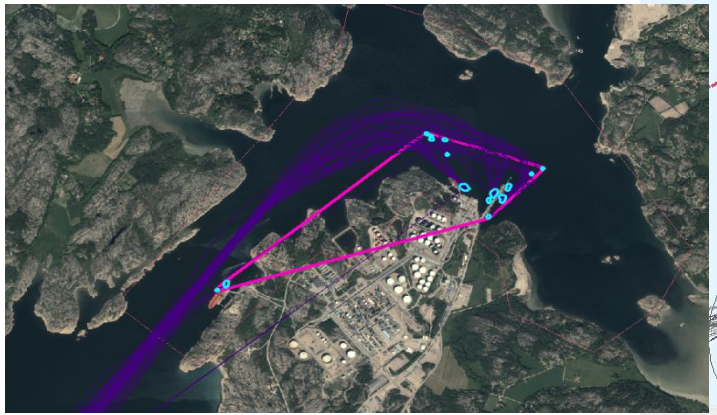


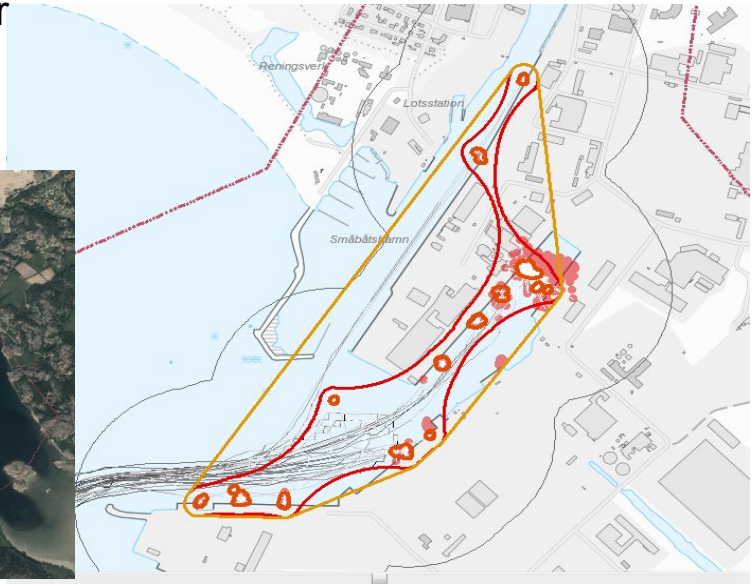
Original data

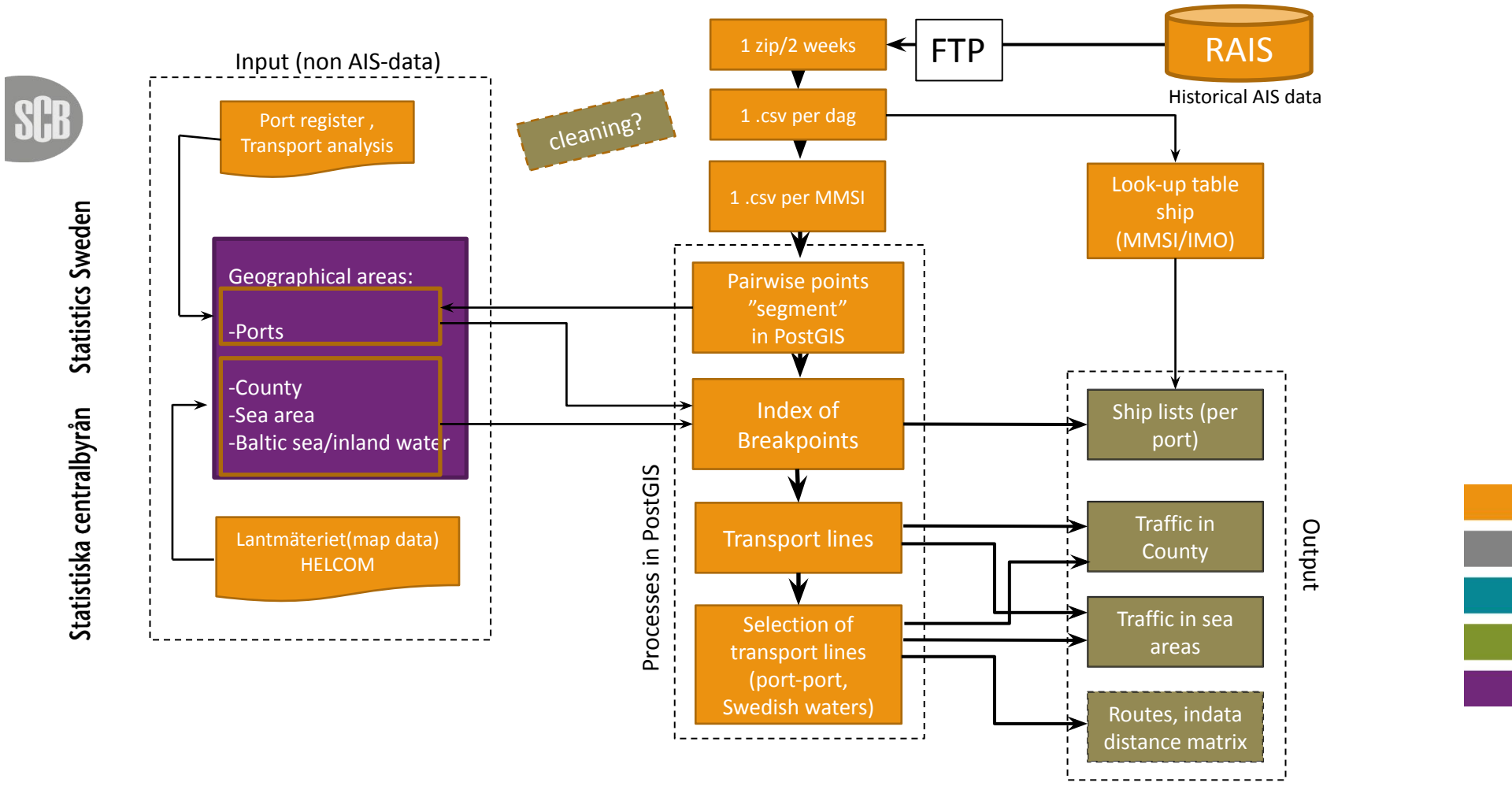
Aggregated data (10m resolution)

Ports, status and results

- Work still in progress, but:
  - Rough port areas created for all countries around Baltic Sea
  - Good port areas created for Swedish ports



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Statistics Sweden
Input (non AIS-data)
Port register , Transport analysis
Geographical areas:
-Ports
-County
-Sea area
-Baltic sea/inland water
Lantmäteriet(map data) HELCOM
cleaning?
1 zip/2 weeks
FTP
RAIS
Historical AIS data
1 .csv per dag
1 .csv per MMSI
Look-up table ship (MMSI/IMO)
Processes in PostGIS
Pairwise points "segment" in PostGIS
Index of Breakpoints
Transport lines
Selection of transport lines (port-port, Swedish waters)
Output
Ship lists (per port)
Traffic in County
Traffic in sea areas
Routes, indata distance matrix

Index of breakpoints

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	id [PK] serial	mmsi integer	angomr integer	ts timestamp without time zone	enter boolean
1	1	209734000	1640	2013-01-03 00:06:41	FALSE
2	2	209734000	1640	2013-01-03 00:15:41	TRUE
3	3	209734000	1640	2013-01-03 17:12:41	FALSE
4	4	209734000	1541	2013-01-03 21:00:55	TRUE
5	5	209734000	1541	2013-01-04 14:58:49	FALSE
6	6	209734000	1752	2013-01-11 18:37:10	TRUE
7	7	209734000	1752	2013-01-11 18:49:21	FALSE
8	8	209734000	1782	2013-01-11 19:32:31	TRUE
9	9	209734000	1782	2013-01-11 20:50:45	FALSE
10	10	209734000	1782	2013-01-11 20:56:46	TRUE
11	11	209734000	1782	2013-01-12 07:11:46	FALSE
12	12	209734000	1541	2013-01-12 14:40:51	TRUE
13	13	209734000	1541	2013-01-17 10:35:11	FALSE
14	14	209734000	1752	2013-01-24 02:14:59	TRUE
15	15	209734000	1752	2013-01-24 02:29:39	FALSE
16	16	209734000	1782	2013-01-24 03:03:19	TRUE
17					
18					
19					
20					
21					
22					
23					

Entering port area

Leaving port area

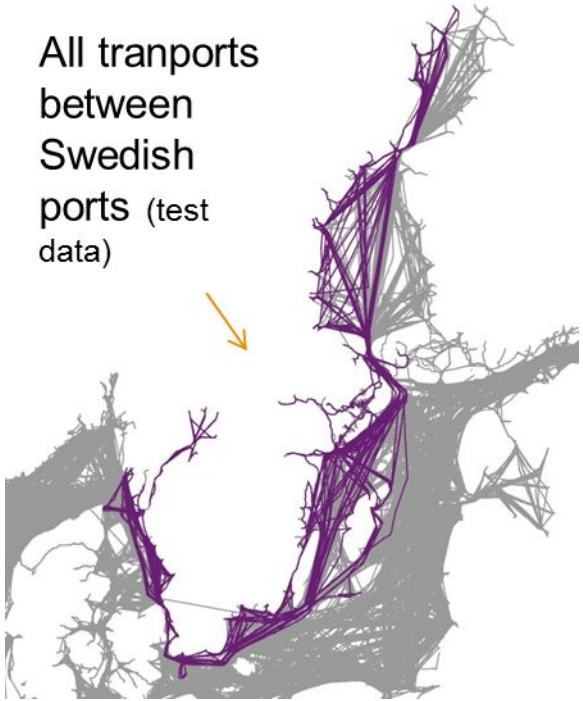
Index of breakpoints

From each exit to next enter in the index a line can be created that represents the transports between ports (or within regions)

Some advantages of this:

- We only create the lines we are interested in, e.g. transports between Swedish ports
- It makes us flexible and can create ad hoc tranport lines
- Saves us data storage space

And we use this as input for the distance matrix model!



Distance matrix

- Distances between ports is used to calculate transport perfomance (tonne kilometers)
- Distance between ports should equal distance of the most common route.
- A transportation network is created
  - Built from the line we created earlier, converted to raster with 1 km resolution.
  - Additionial weights are added to the network:
    - Destination
    - density
- Most common route is calculated using shortest path analysis (the resulting route= route with least accumulated cost)

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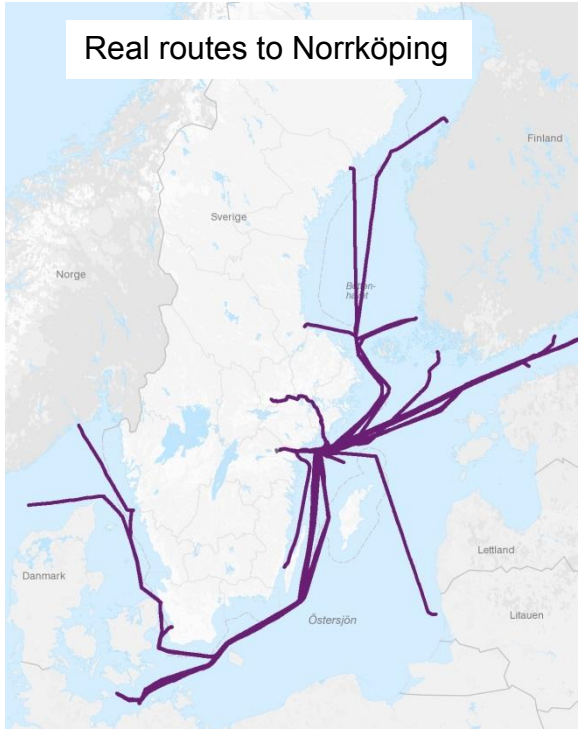

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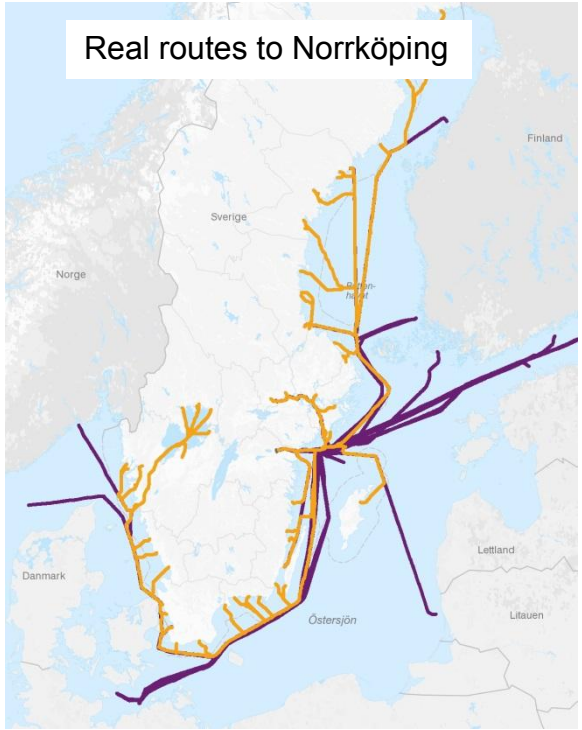

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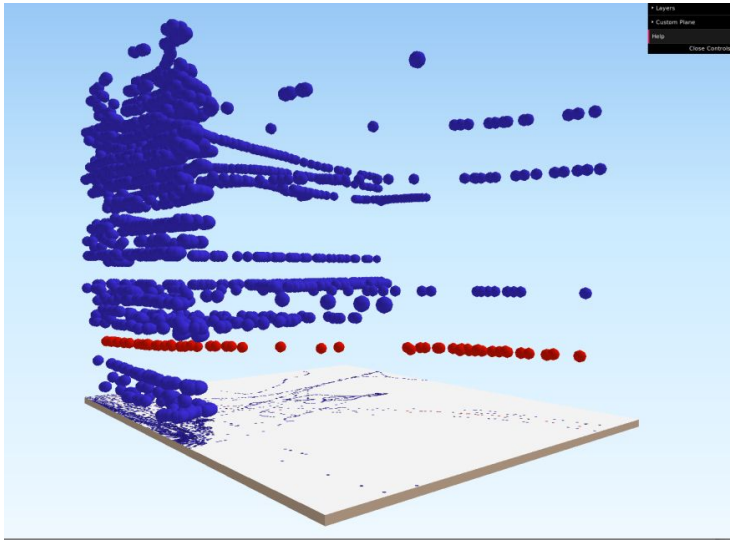
Thank you!



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