AIS data

Marco Puts
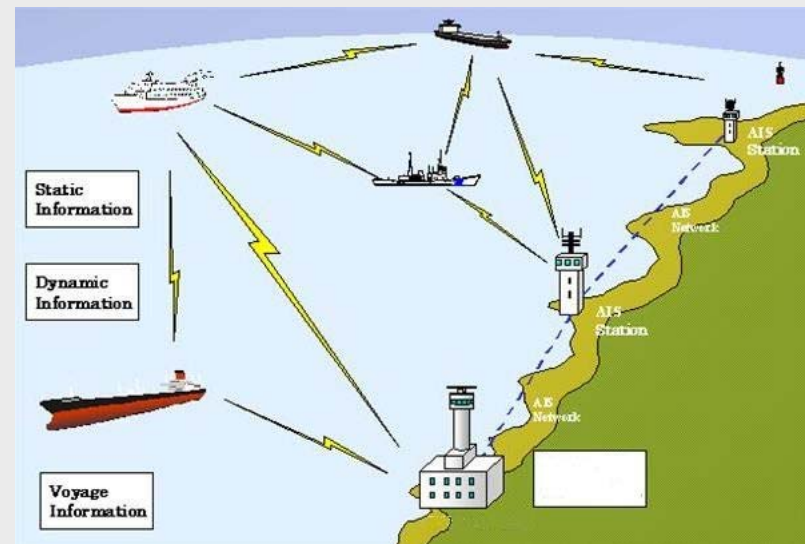
AIS Data

– Automatic Identification System
– Supplements Marine Radar

Used for
– Collision avoidance
– Fishing fleet monitoring
– Vessel Traffic Services (VTS)
– Maritime Security
– Aids to Navigation
– SAR
– Accident investigation
– Fleet and Cargo Tracking

AIS data

The **Automatic Identification System** (AIS) is an automatic tracking system used on ships for identifying and locating vessels bij electronically exchanging data with other nearby ships, AIS base stations, and satellites.

International voyaging ships with gross tonnage (GT) of 300 or more tons, and all the passenger ships regardless of size transmit Automatic Identification Signal (AIS) every 2 – 10 sec their position (when sailing).
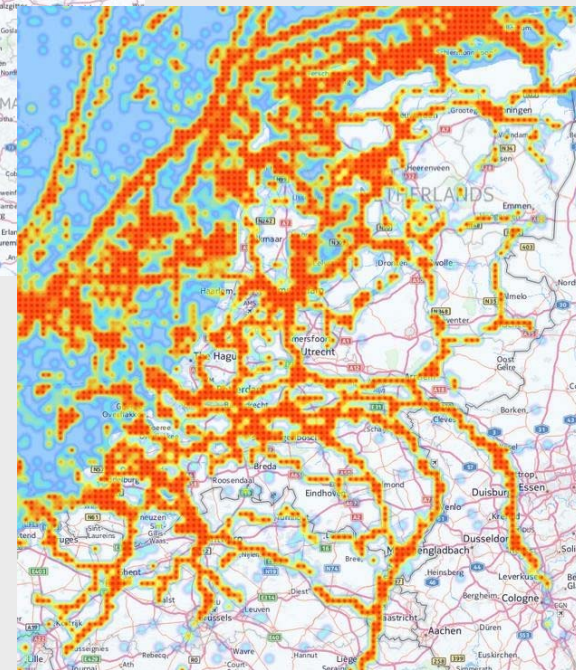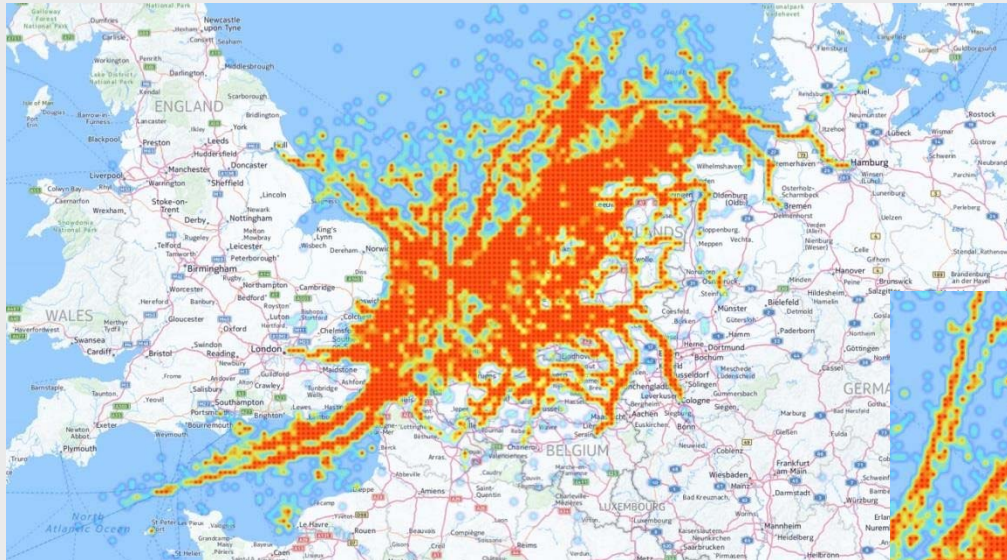
Terrestrial Stations, Cost Guards and Satellites receive AIS data. AIS data has the same structure worldwide.

Contributes to the
- **safety of navigation**
- **traffic management**

ACARS: Aircraft communications addressing and Reporting System

Data: Rijkswaterstaat AIS data
Bron: http://bit.ly/2cWM5Hu

Courtesy of Maarten Pouwels

AIS messages (NMEA)

!AIVDM,1,1,,B,18Spd`0P027gVGt9=Q4:L?v00>@<,0*40,
2015-12-09 18:00:00.093,/144.76.43.242

```
data = row[5]
pad = int(row[6].split('*')[0])
msg = ais.decode(data,pad)
```

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Example of a decoded message

u'cog': 267.20001220703125,
u'id': 1L,
u'mmsi': 574500000L,
u'nav_status': 0L,
u'position_accuracy': 0L,
u'raim': False,
u'received_stations': 9228L,
u'repeat_indicator': 0L,
u'rot': -731.386474609375,
u'rot_over_range': True,
u'slot_timeout': 3L,
u'sog': 0.20000000298023224,
u'spare': 0L,
u'special_manoeuvre': 0L,
u'sync_state': 0L,
u'timestamp': 0L,
u'true_heading': 511L,
u'x': 108.26538848876953,
u'y': 16.097732543945312

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Default values (error codes)

u'cog': 360.0,
u'id': 1L,
u'mmsi': 244780366L,
u'nav_status': 0L,
u'position_accuracy': 0L,
u'raim': False,
u'repeat_indicator': 0L,
u'rot': -731.386474609375,
u'rot_over_range': True,
u'slot_number': 13L,
u'slot_timeout': 4L,
u'sog': 102.30000305175781,
u'spare': 0L,
u'special_manoeuvre': 0L,
u'sync_state': 1L,
u'timestamp': 63L,
u'true_heading': 511L,
u'x': 181.0,
u'y': 91.0

Messages over two lines

!AIVDM,2,1,7,A,553@7402<2<@ppT6220<N1LThhT4n1@5@F22
220S3hG,0*28,2015-12-09 18:00:00.000,/69.43.206.175

!AIVDM,2,2,7,A,656ol06tH8888888888888888880,2*2F,2015-12-
09 18:00:00.000,/69.43.206.175

```
row =
"!AIVDM,2,2,7,A,553@7402<2<@ppT6220<N1LThhT4n1@5@F2
2220S3hG656ol06tH8888888888888888880,2*2F,2015-12-09
18:00:00.000,/69.43.206.175".split(",")
data = row[5]
pad = int(row[6].split('*')[0])
msg = ais.decode(data,pad)
```

AIS - messages

Location records-> every 2-10 secs (dep. on speed), 3 mins at anchor
containing MMSI

Static records -> every 6 mins
containing MMSI & IMO (also type of ship, not very detailed)

MMSI (Maritime Mobile Service Identity) -> 9 digits

IMO (International Maritime Organisation)
-> 7 digits: 6 digits + check digit
(e.g. 9074729: (9*7) + (0*6)+(7*5)+...=13**9**

Preliminary reference frame of ships

- Started by counting all valid MMSI's for the Netherlands for 6 months (26,044 MMSI's)

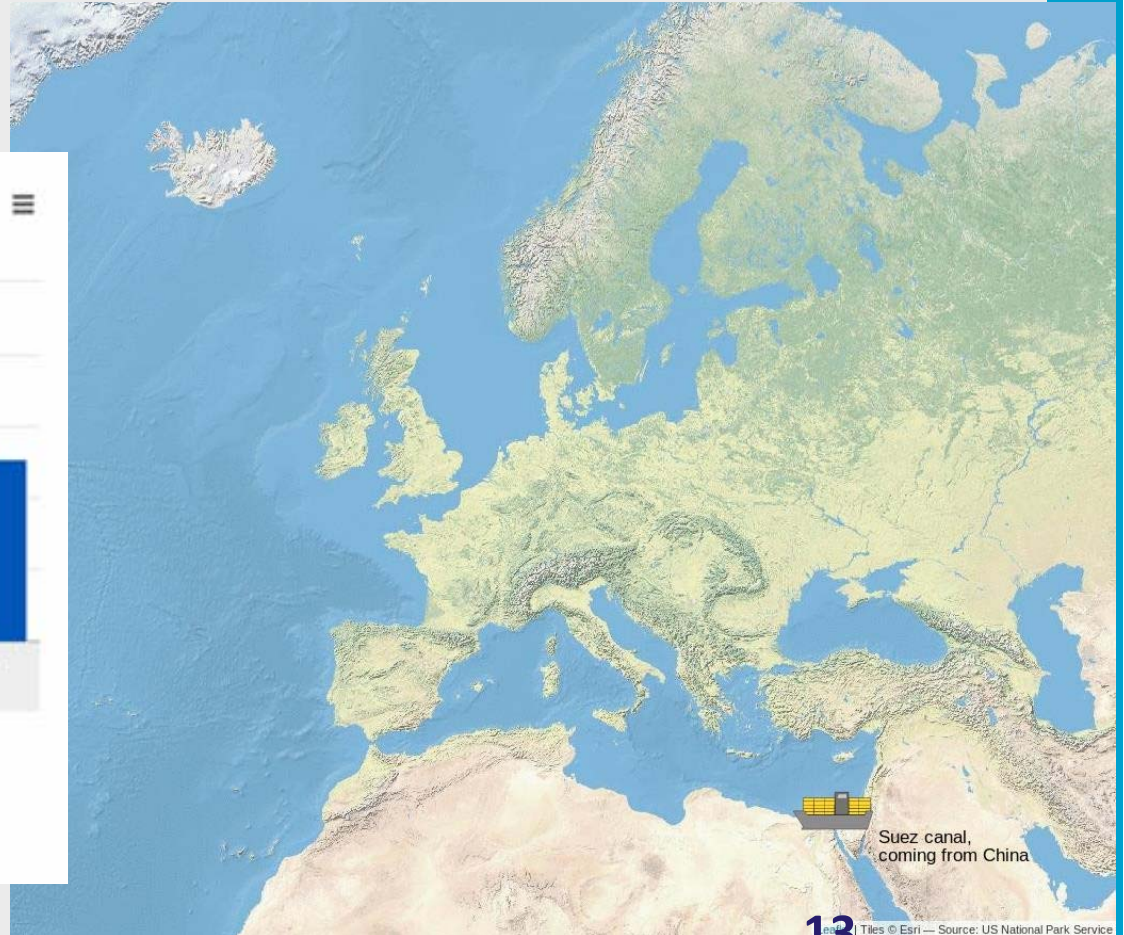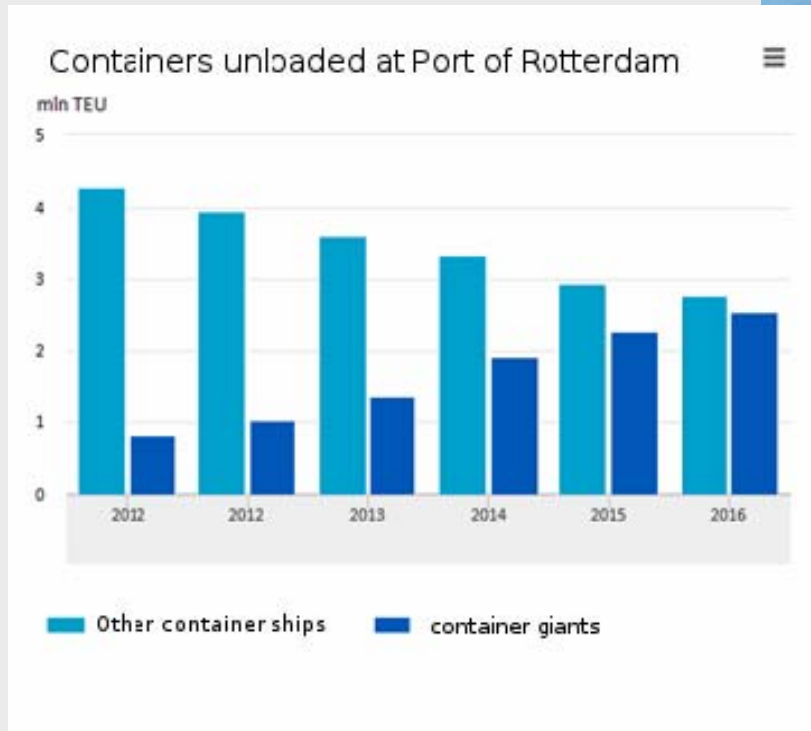- Previous list compared to one hour of Messages (3,264 MMSI's)

Preliminary reference frame of ships & Port of Amsterdam

- All ships in Port of Amsterdam confronted with preliminary frame of ships

- Result confronted with maritime stats for 1 day
  * all ships in maritime stats in our data
  * arrivals
  * inland/other ships
  * random errors

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Reference frame of ships & Port of Amsterdam

Transsshipment

Containers unloaded at Port of Rotterdam
mln TEU

Other container ships   container giants


Suez canal,
coming from China

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https://research.cbs.nl/AIS_transshipment

Transshipment of containers via Rotterdam

Containers arriving on container vessels from origins overseas are unloaded in Rotterdam.
Nearly 11000 container vessels visited The Netherlands in 2016. About 900 of them were giant container vessels that can carry 10000 standard containers (TEU) or more. These giants account for almost 50% of the container transport towards The Netherlands. About one third of the containers are transported to another maritime port via sea. This is called container transshipment*).
Rotterdam is a major hub in the transshipment of maritime containers along the coastline of Europe and North Africa. This short sea area is the most important destination of transshipment containers that arrive on container giants from across the ocean or from the far east.
In the visualisation the container flow (expressed in weight of the cargo) from in this example China via Rotterdam is shown per main commodity category.

*) Transshipment means the unloading of containers or goods from one ship and its loading into another to complete a journey to a further destination
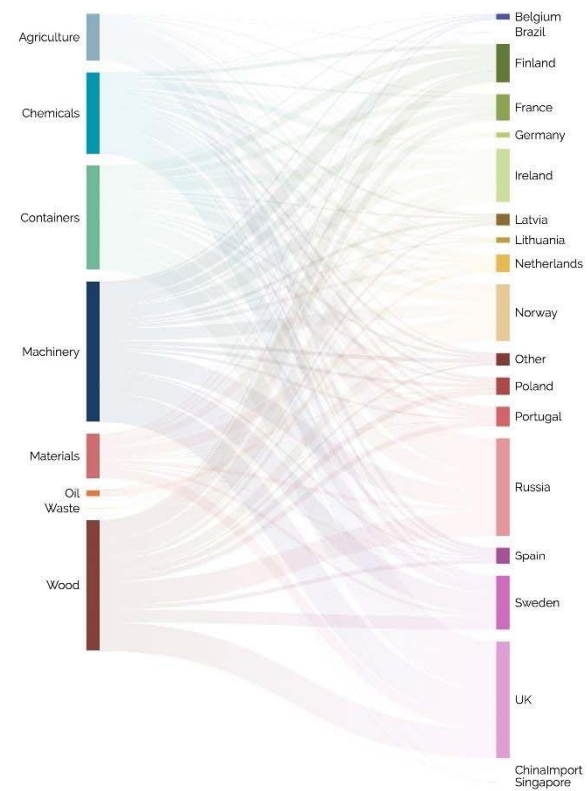
Kay Schröder
Scientific/Art
Direction

Mart Fijten
Information
Visualization

Kenny Jeurissen
3D Modelling

Sten Martens
Development

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Inland waterways

- – Calculating journeys by looking at the time a ship lay still, reverse geocode and then derive journeys with distance.

- – Calculating intensity on network: how much ships pass a point on the river

Inland waterways Journeys

- Calculating location where ship stops by time between two points where ship does not move.
- Problem with locks in inland waterway where ships lay still but are not loading/unloading
- Sometimes the stop is not caught properly; The time for a push/tug to change is shorter than the time travelling through a lock.
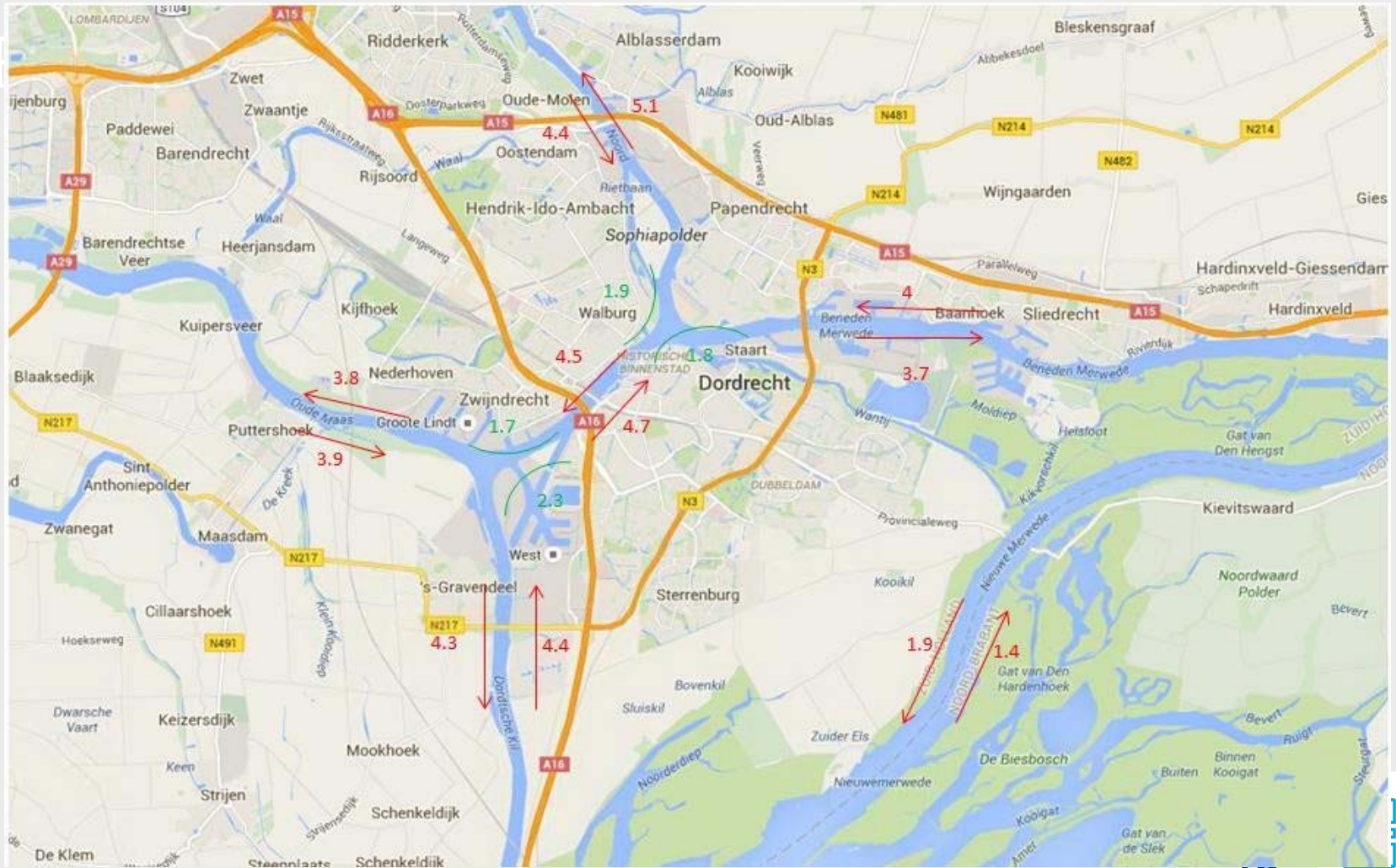
Inland waterways Journeys

– Reverse geocoding optimized for roads. coordinates sometimes give errors

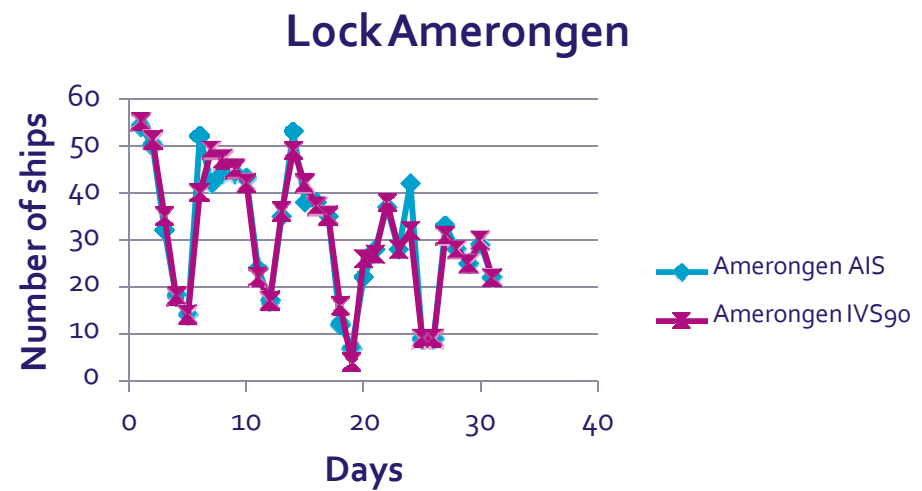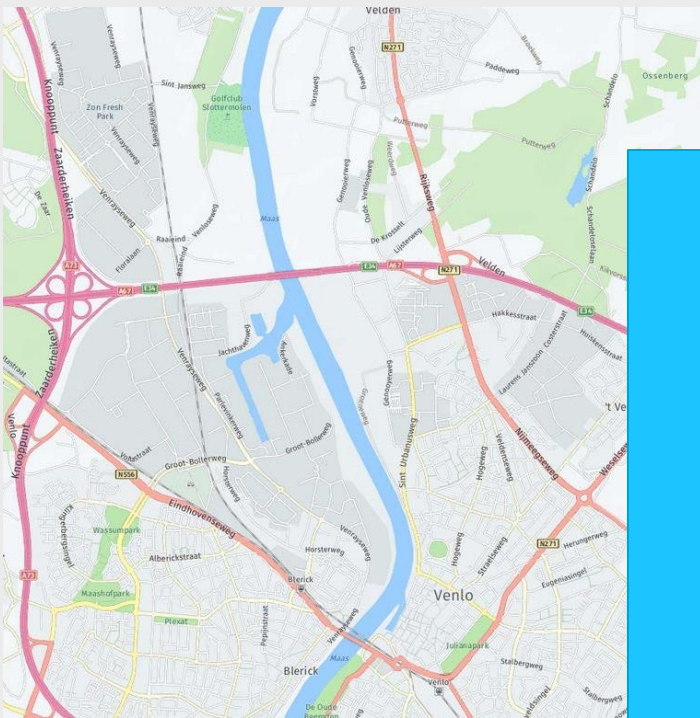– Lot of journeys within the port of Rotterdam

Inland waterways intensity

– We calculate the times a ship passes a line by using the angle between the point of reference and two points.

– Depending on the flow of the river we use horizontal or vertical lines

– We have direction and speed for each point
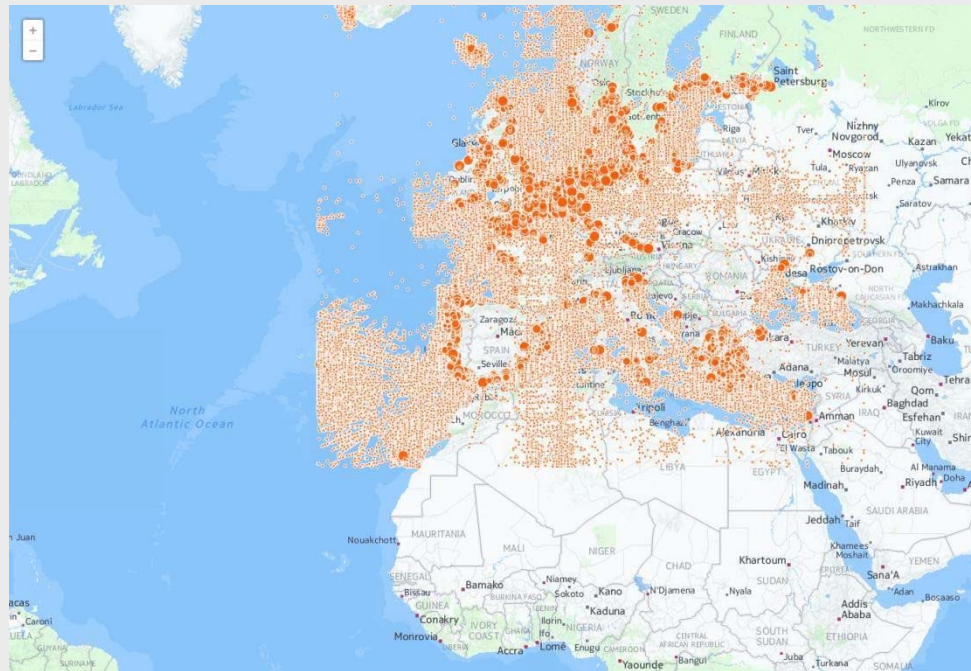
– This method cannot be used for open sea

Inland waterways intensity

European data (maritime)

Traffic analyses