AARHUS UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL SCIENCE
DCE – DANISH CENTRE for ENVIRONMENT and ENERGY

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Emission inventory for ships based on aggregated AIS data

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Disposition

- AIS data used in existing inventory for the Arctic
- Current level of AIS data/opportunities to support a global inventory
- Ways to apply AIS data in such a global inventory

AIS data used in existing inventory for Arctic

- Traffic data from the Danish Maritime Authority (DMA) based on satellite and land base sampled AIS data
  - High intensive traffic areas (coasts of Norway, Iceland, Faroe Islands and Baltic sea) covered by terrestrial base stations and AIS receivers
  - Outside these areas AIS data is gathered from two, sometimes three, polar orbital satellites (sampling intervals 20 mins – 2 hours)

- The AIS data is further processed by DMA into
  - Grid cell resolution: 0.5^{o} x 0.225^{o} long-lat
  - Average sailing speed and sailed distance per month in 2012
  - 14 ship types, 16 ship length categories (LPP)

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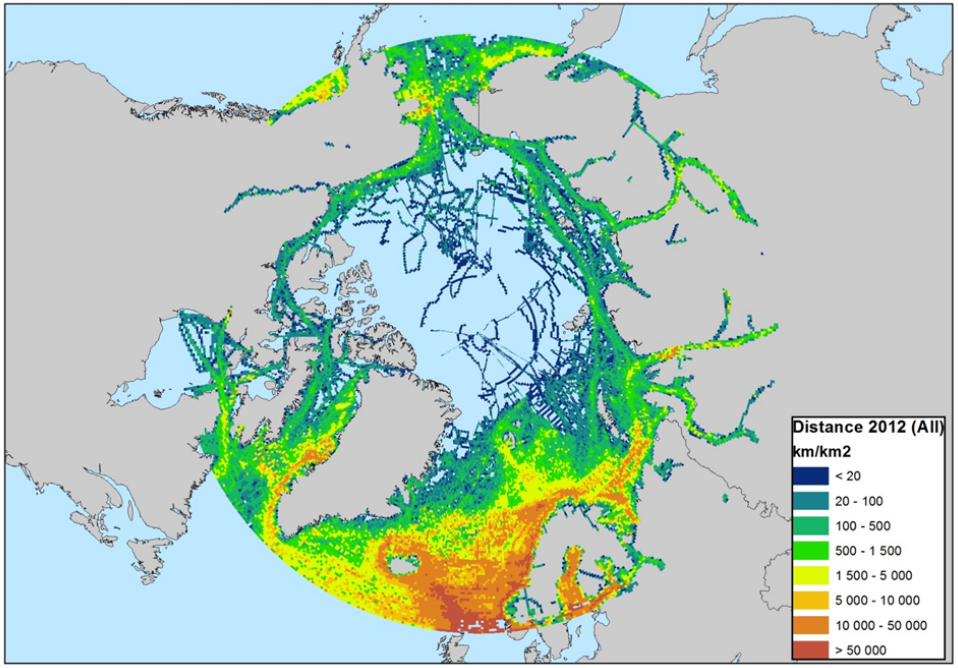
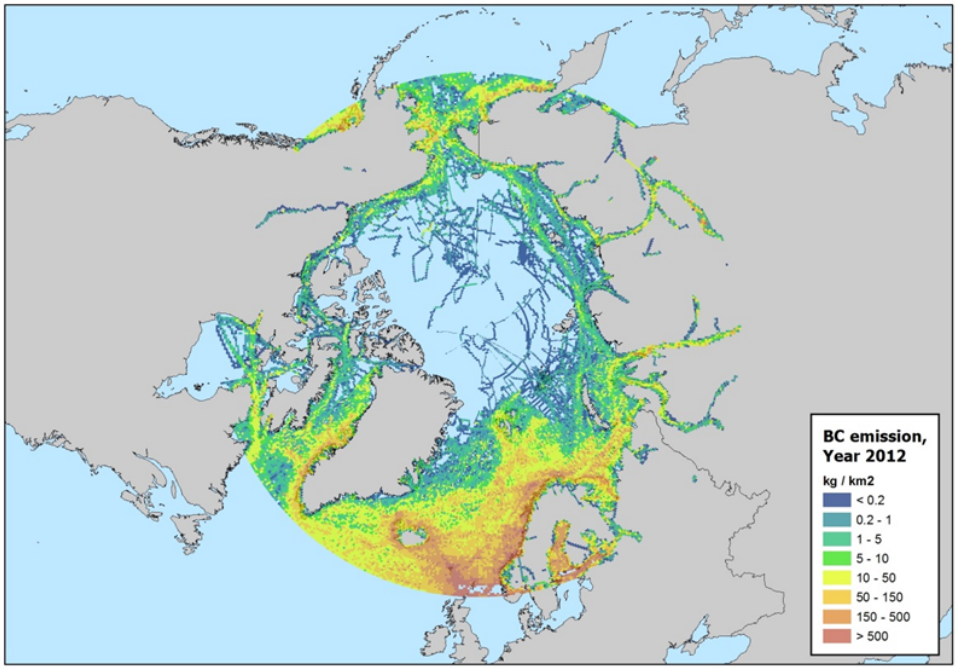
Arctic inventory

Vessel type	Distance Km x 10^3	Fuel ktonnes	Fuel TJ	BC tonnes
Crude oil tanker	1496	101	4135	35
Oil products & chemical tanker	9714	291	11918	102
Ro-ro passenger ship[c]	14968	614	25213	215
Gas tanker	888	35	1438	12
Container ship	6858	236	9633	82
General cargo ship	26916	346	14153	121
Bulk carrier	4329	176	7194	62
Ro-Ro cargo ship	3259	145	5917	51
Passenger ship	9589	293	12109	102
Fast ferry	273	2	91	1
Support ship	13715	164	6922	57
Fishing ship	33491	2020	86261	707
Other ship	8039	106	4480	37
All vessels	133535	4528	189465	1585

LPP interval (m)	
0-25	200-225
25-50	225-250
50-75	250-275
75-100	275-300
100-125	300-325
125-150	325-350
150-175	350-375
175-200	375-400
	> 400





Current level of AIS data/opportunities to support a global inventory

- A global data set can be produced by the Danish Maritime Authority (DMA) based on satellite sampled AIS data
  - Huge work; the area is roughly ten times bigger than Arctic
  - Global satellite coverage; Sampling frequency is between 5-10 hours outside polar areas; could also be lower, all depends on satellite trajectories
  - Access to land based signals around most of Europe, USA, Australia and China
  - No access to land based signals from the following high intensive traffic areas: Mediterranian Sea, North Sea, Japan, and parts of Asia and Caribia.

Ways to apply AIS data in a global inventory

- The following inventory input data is generated from AIS
  - Average sailing speed and sailed distance per grid cell, per ship type/ LPP combination
  - 14 ship types and 16 LPP intervals

Ways to apply AIS data in a global inventory

- Fuel consumption (FC) is estimated using:
  - Vessel speed based engine power functions (Ship type/LPP specific)
  - Constant engine load for fishing vessels, makes estimates less certain
  - Specific fuel consumption curves (g/kWh, per engine type and year)
  - Sailing time (hours)
  - Assumptions: Engine type and engine life time per ship type

Ways to apply AIS data in a global inventory

- Emissions: BC EF (g/kg) x FC (kg)
  - BC EF independent of fuel sulfur; is this true?
  - Other BC EF uncertainties?

Thank you for your attention!