

EMERGE Update

PA SHIP meeting, Nov 2022

Jukka-Pekka Jalkanen

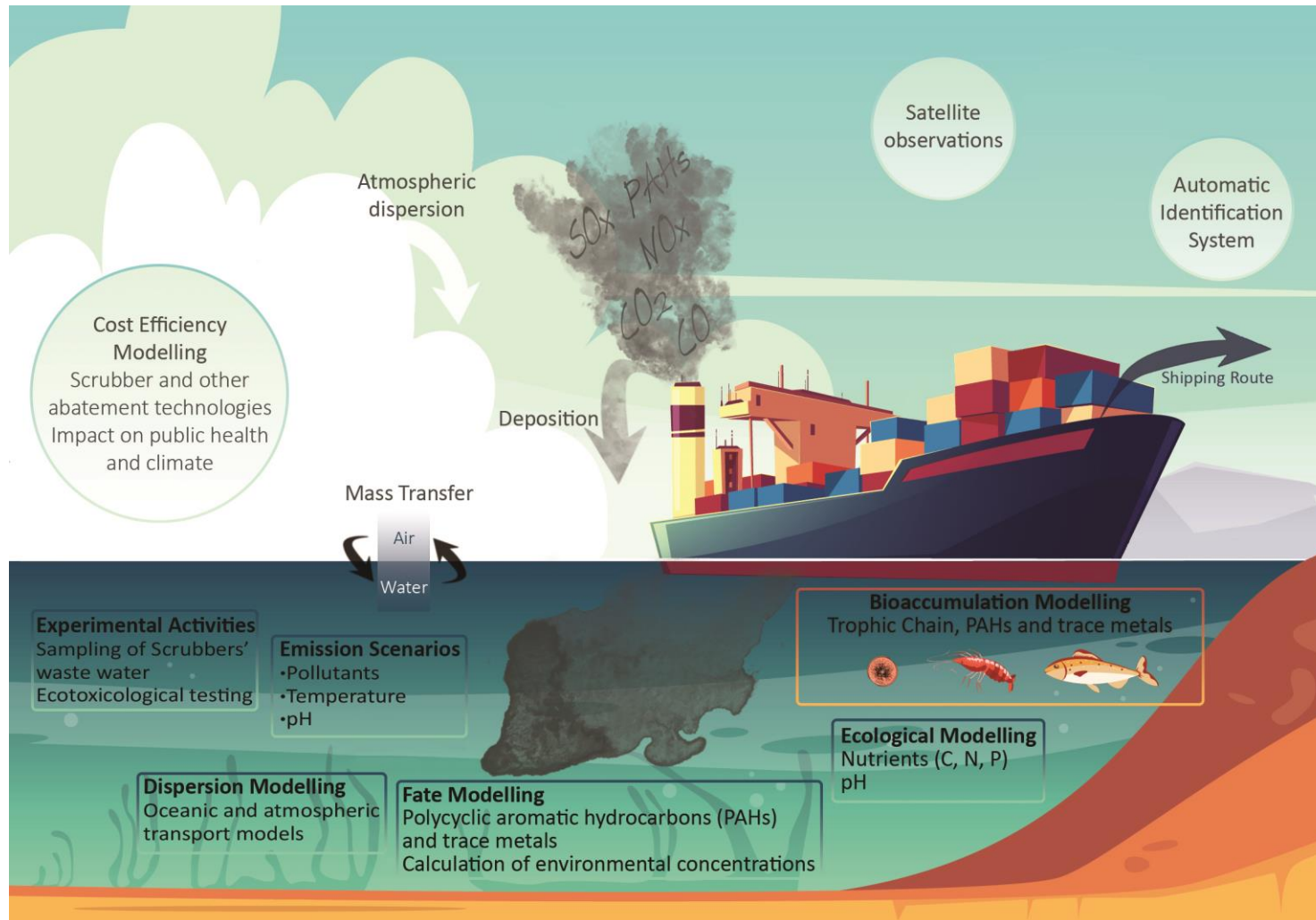
Finnish Meteorological Institute



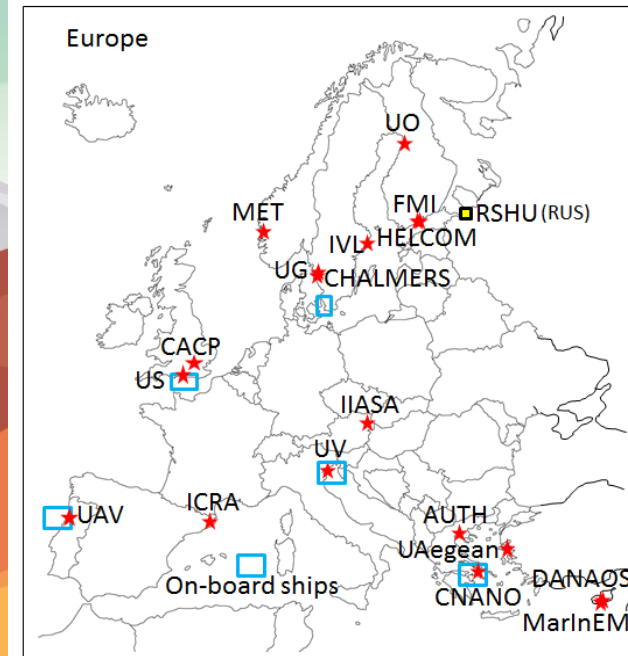
EMERGE



EMERGE project (Evaluation, control and Mitigation of the EnviRonmental impacts of shippinG Emissions)

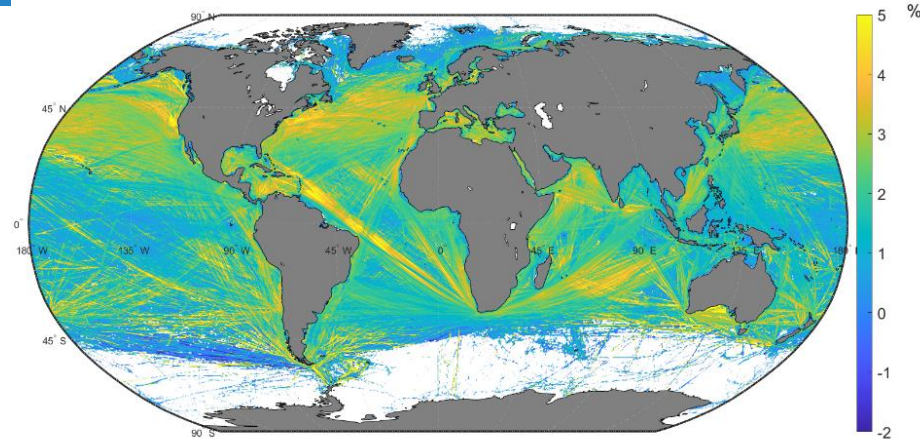


Started in Feb 2020
Currently at M34/48



Recent developments in EMERGE

- Emission modeling
 - Addition of ambient effects (Ice, Wind, Waves, Currents)
- Atmospheric modeling
 - Chemistry module for polyaromatic hydrocarbons, some of which cannot be treated as passively spreading substances because they are chemically active
- Water modeling
 - Water chemistry module for regional drift model, which enables studies of polyaromatics/heavy metals in oceans
- Ecotoxicological experiments
 - Several marine organisms, whole effluent testing to identify concentrations where impacts start to appear
- Onboard measurements
 - Simultaneous measurements of water discharges and air emissions onboard a container ships
- Case studies
 - Piraeus, Venice, Aveiro, Solent/Southampton, Öresund, Onboard



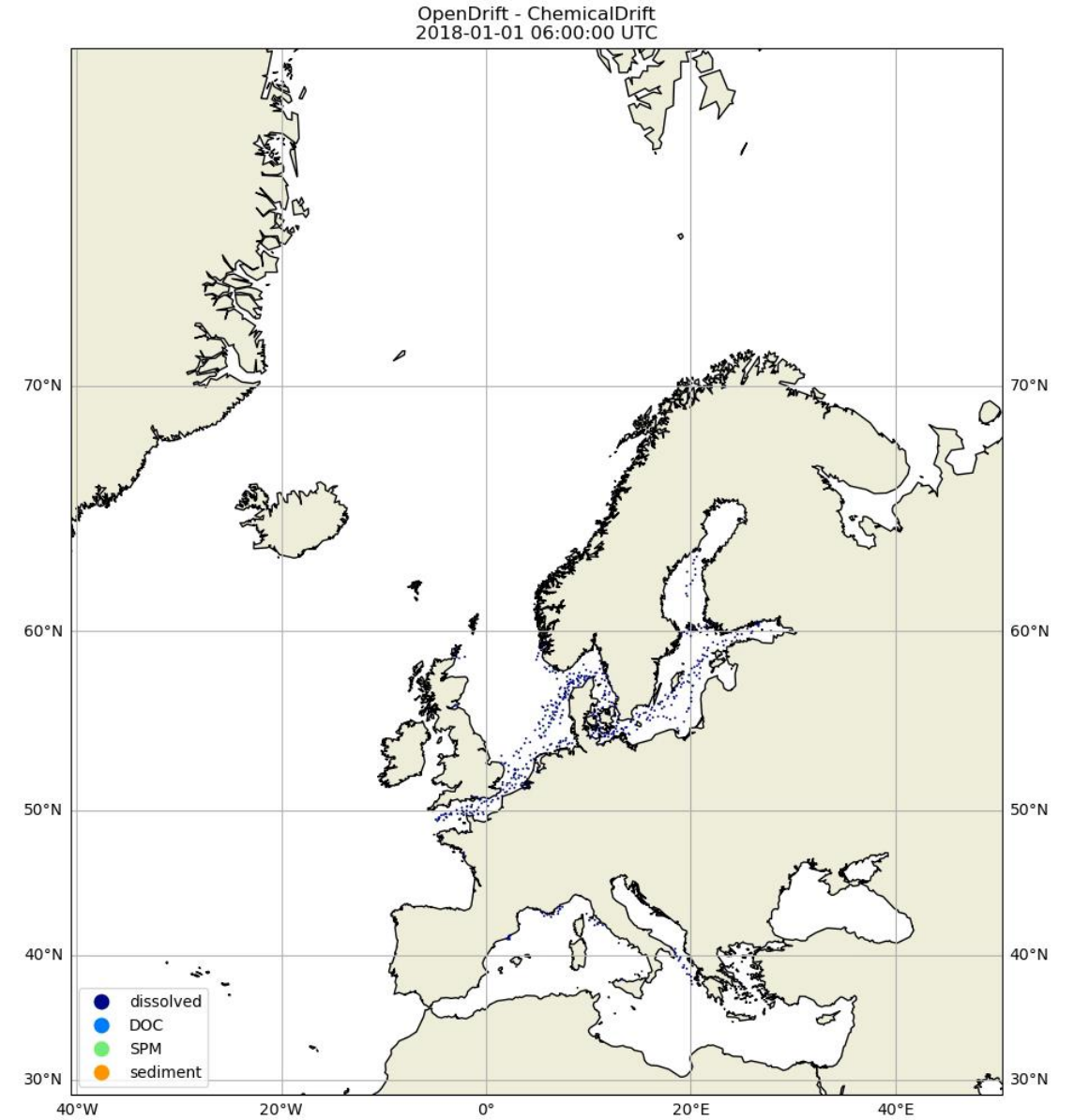
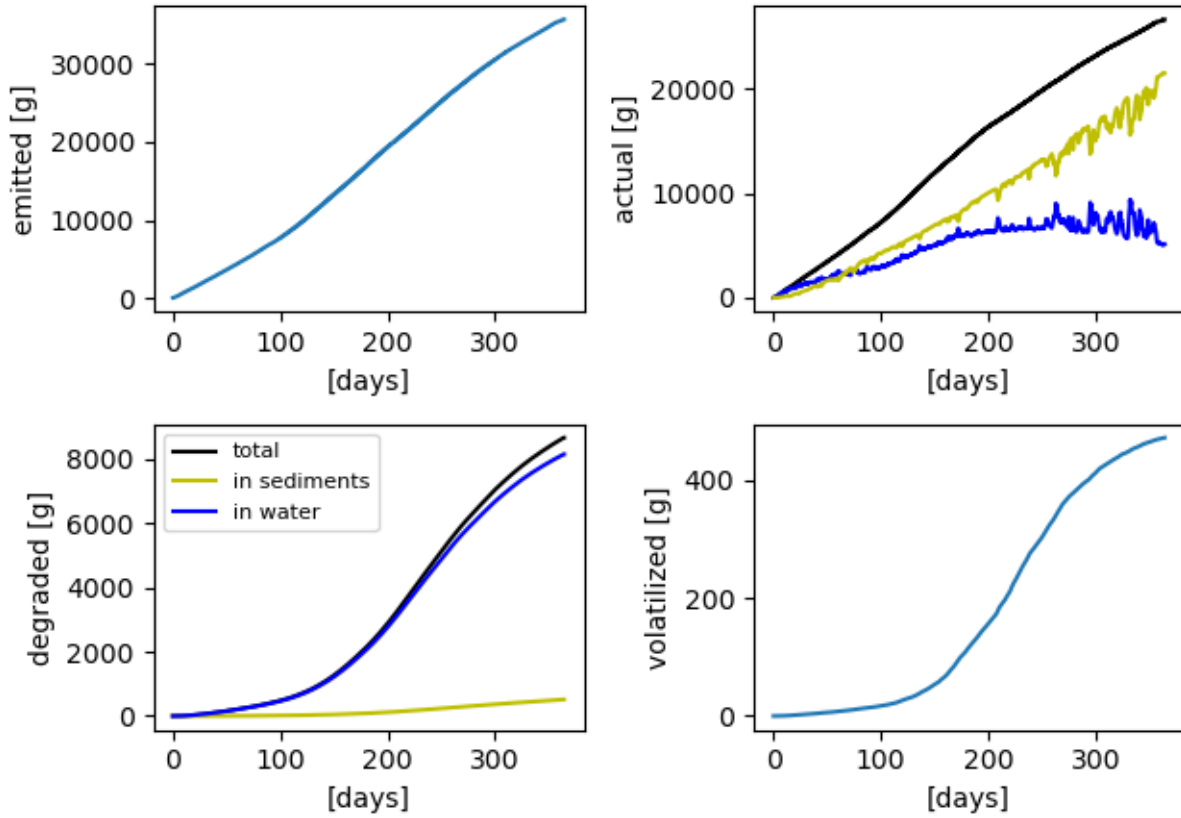
© FMI STEAM: Impact of wind to vessel fuel consumption



Fuel consumption when travelling in 100g. Cell area at center: 1.235 km²

Water model update; BaP example

Benzo-a-pyrene mass



Images from Manuel Aghito (met.no)

Ecotox experiments

- Whole effluent testing: dilution series (50%, 25%, 12.5%...)
- Adults < juvenile < larvae/eggs
 - "The most sensitive of the analysed endpoints was fertilisation of sea urchin eggs...disturbance was observed already at concentrations of 0.0001% scrubber water"
 - "Scrubber water at concentrations of 0.001% was found to cause significant malformations of larvae of species from three large groups of animals; sea urchins, segmented worms and mussels."
 - "Effects on copepod egg production was observed at 0.01% scrubber water and larval development at 0,01-0.1% scrubber water"
- "Two endpoints commonly included in standardised protocols for ecotoxicological tests are mortality of adult individuals of some specified invertebrate species and growth inhibition of microalgae."
 - Mortality was a relatively insensitive endpoint, whereas juveniles were affected at fairly low concentrations.**
- "The large difference in sensitivity to scrubber water...**highlights the importance of executing experiments on a variety of species and life stages to identify the sensitive parts of the marine ecosystems.** This requires ... profound biological and ecotoxicological knowledge rather than limiting the scope to only a set of routine standard protocols, using a limited set of species and endpoints."

Hannah Robinson



Biodiversity Heritage Library

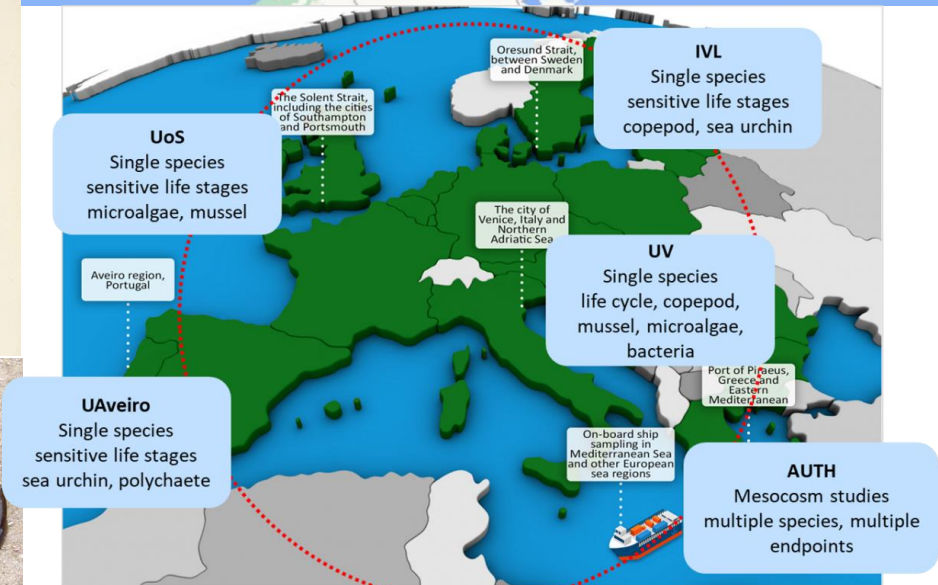


Andrew Butko



Plymouth Marine Lab

Containership case study



Immediate dilution at the wake

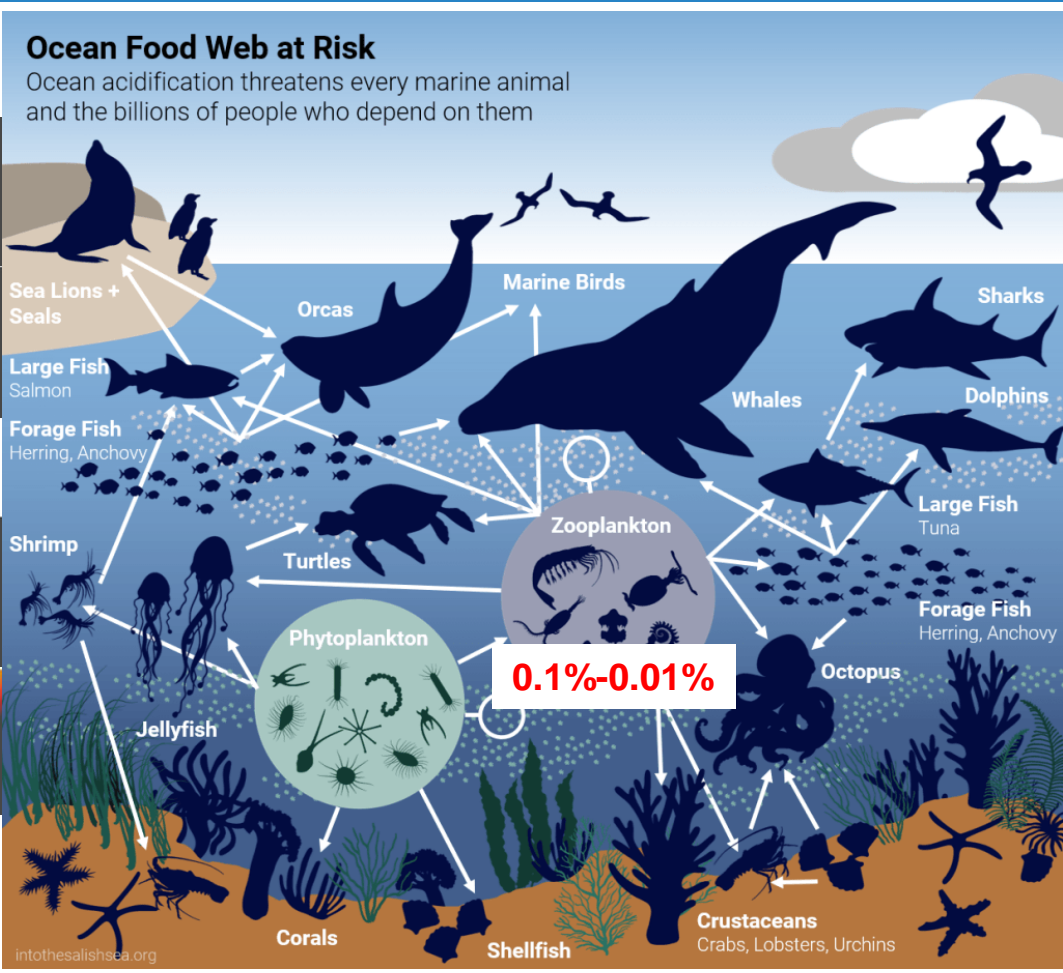
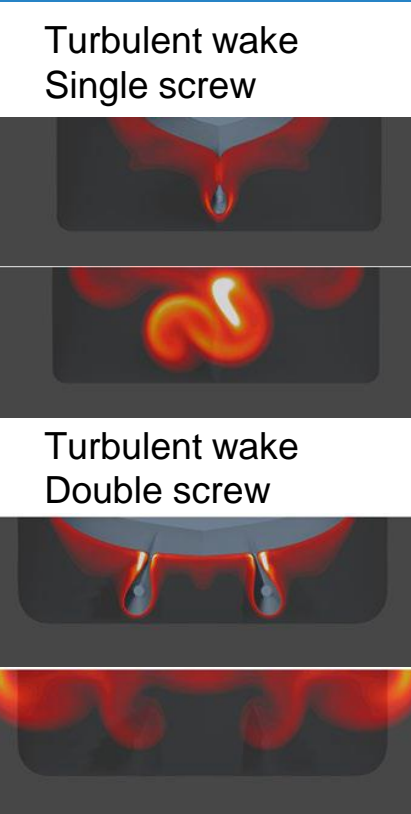
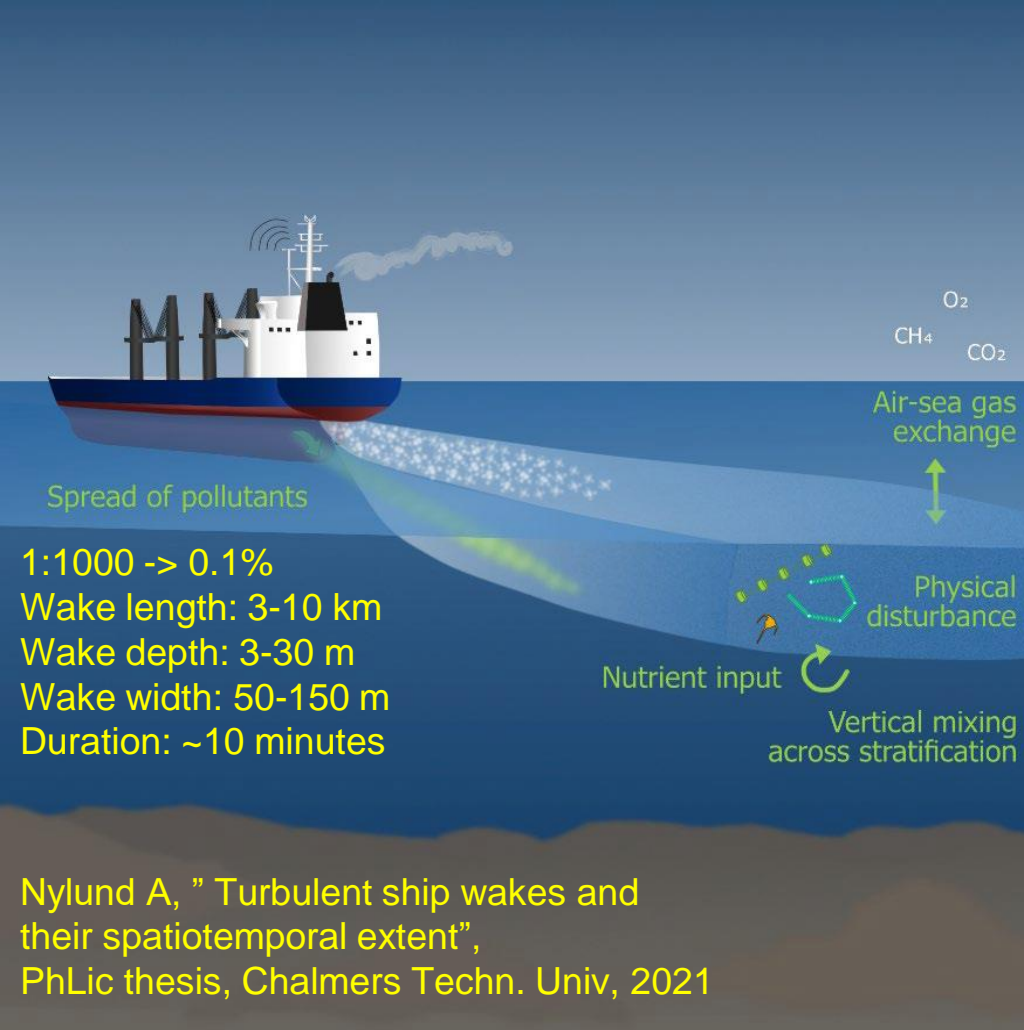
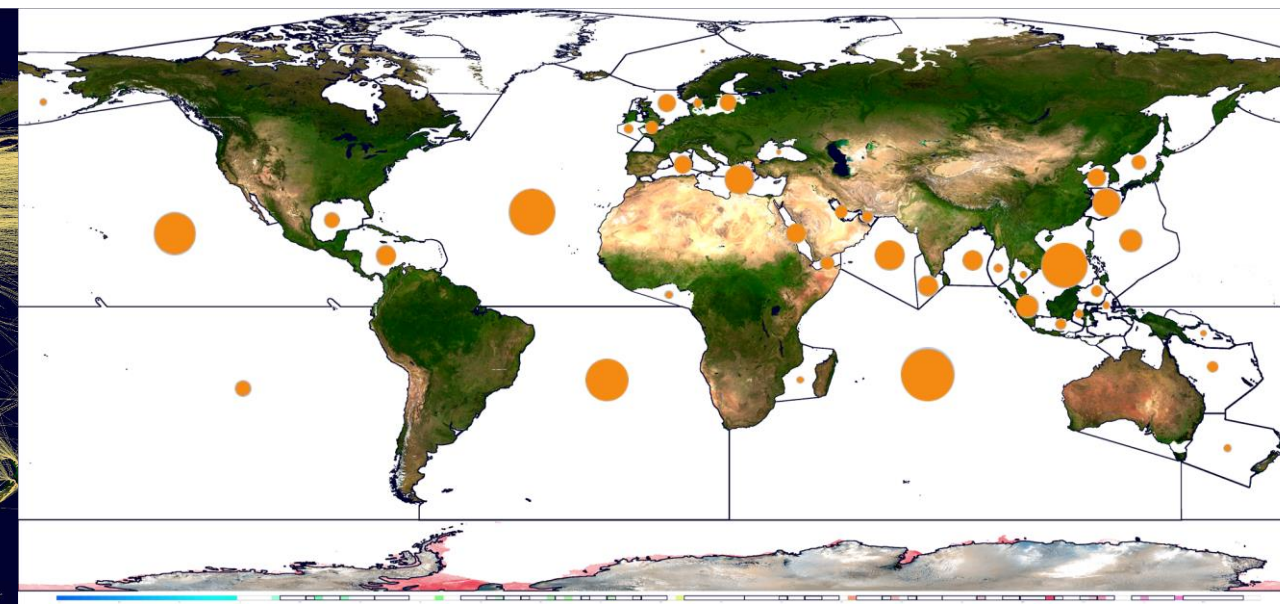
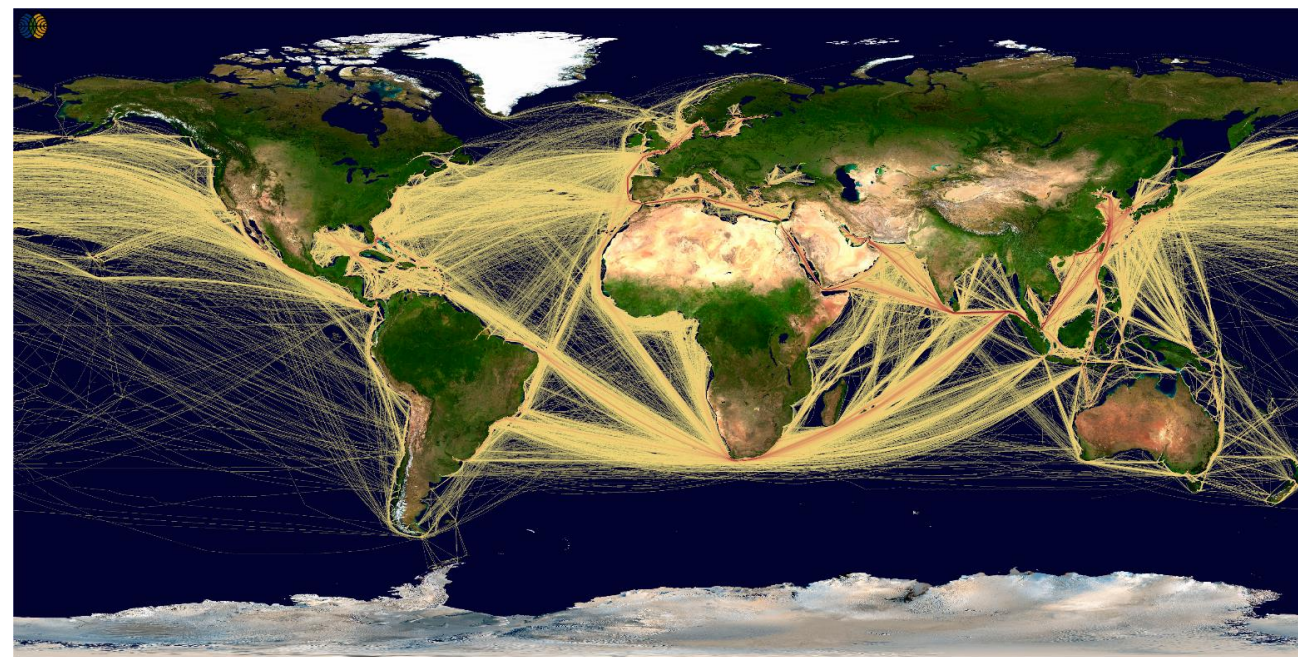


Image from Into the Salish Sea, adaptation from an illustration by Jerry Russell

EGCS Open Loop effluent discharge in 2020



Jalkanen, Grönholm, Hassellöv, Discharges from Exhaust Gas Cleaning Systems in the OSPAR Marine area, Report for OSPAR EIHA

Work connected to HELCOM Maritime, OSPAR EIHA/MIME, ICES WGSHP, Copernicus Atmosphere -> European Environment Agency & European Maritime Safety Agency

Thank you