Interreg North Sea Region Jomopans
European Regional Development Fund

EUROPEAN UNION

JOMOPANS

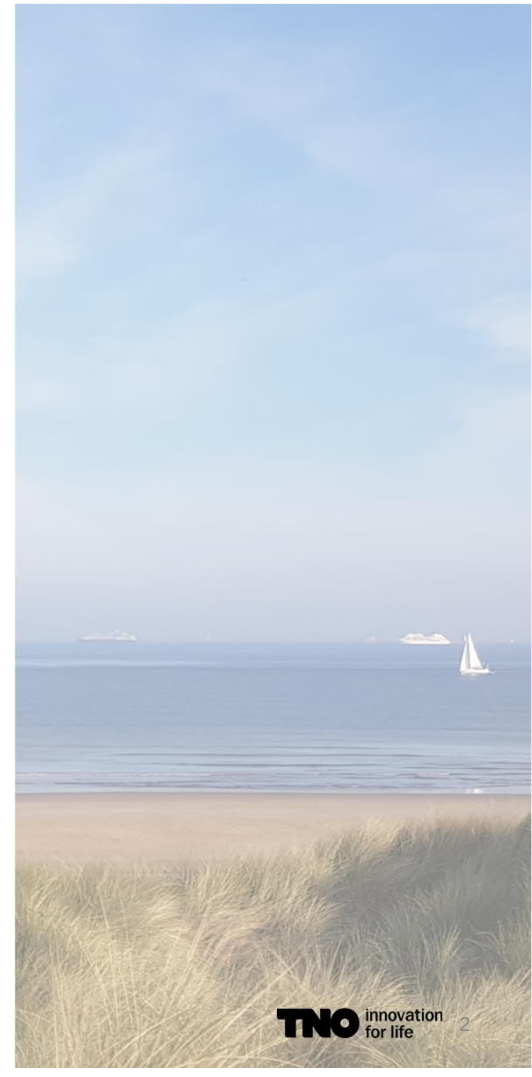
JOINT MONITORING PROGRAMME FOR AMBIENT NOISE IN THE NORTH SEA

WP4 - SOUNDSCAPE MODELLING

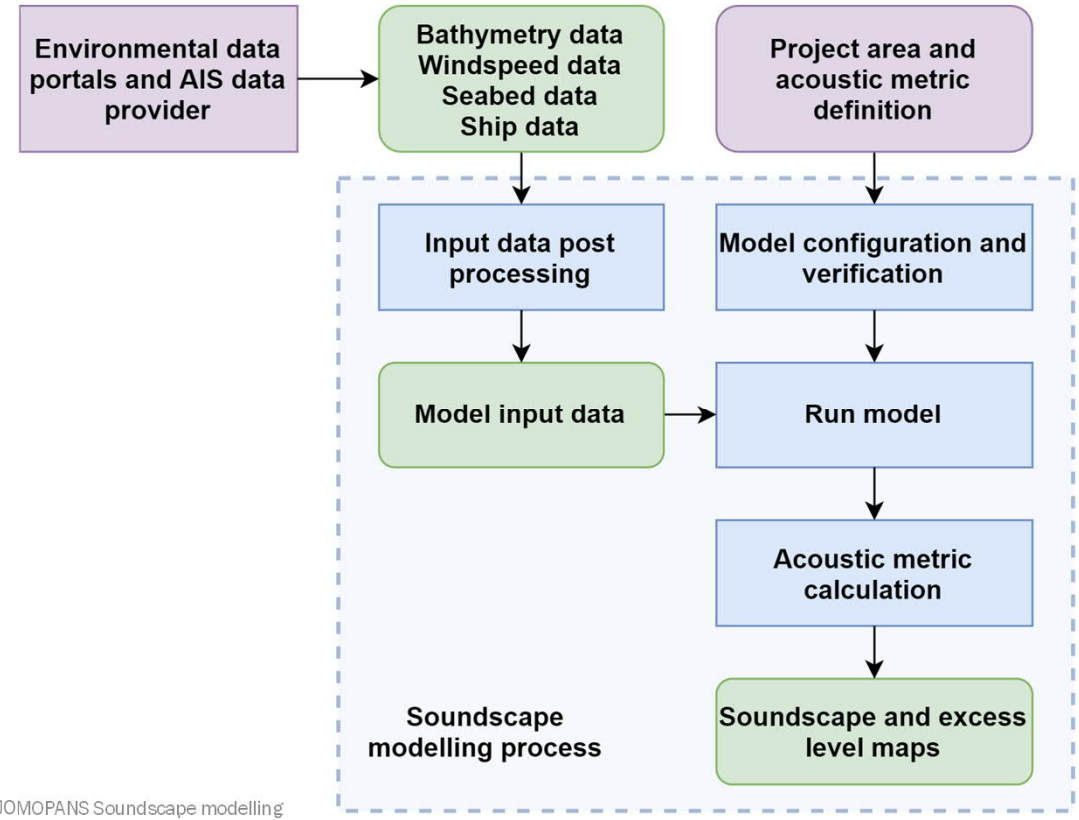
AARHUS UNIVERSITY
BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE
Cefas
FFI Forsvarets forskningsinstitutt
Norwegian Defence Research Establishment
FOI
INSTITUTE OF MARINE RESEARCH
Scottish Government
Riaghaltas na h-Alba
gov.scot
marinescotland
Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat
NPL National Physical Laboratory
Institut royal des Sciences naturelles de Belgique
museum
TNO

UNDERWATER AMBIENT SOUND MONITORING

- Underwater sound pressure:
  - varies with location, time and frequency
  - generated by multiple (anthropogenic and natural) sources
- Modelled sound maps:
  - two-dimensional representations of the soundscape
  - for a defined depth, time period, and frequency range
- Assess individual source (type) contributions
- Execute scenario studies



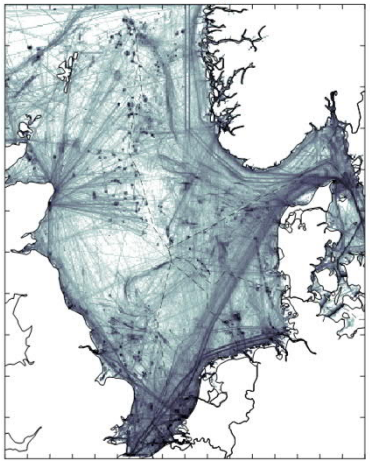
JOMOPANS NORTH SEA SOUNDSCAPE MAPPING



- North Sea area
- SPL_{1s} temporal percentiles
- Depth average
- 10 Hz – 20 kHz
- Shipping and wind noise

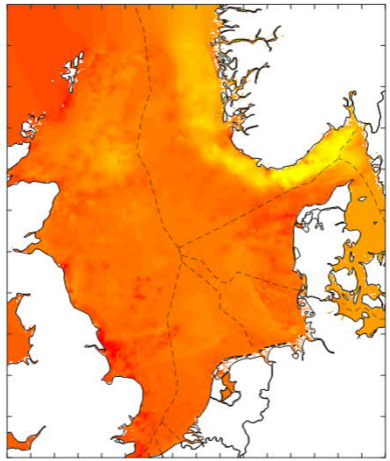
MODEL INPUTS

AIS/VMS - May 2019



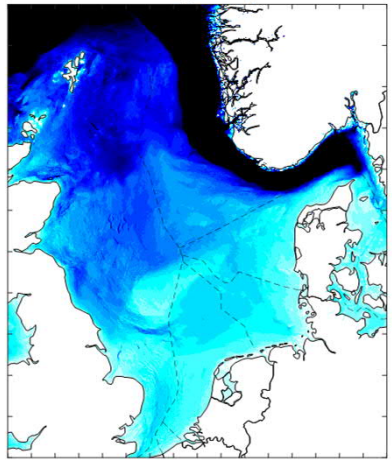
Raw AIS data cleaned and trajectory interpolated to 10 min resolution

Sediment Grain Size



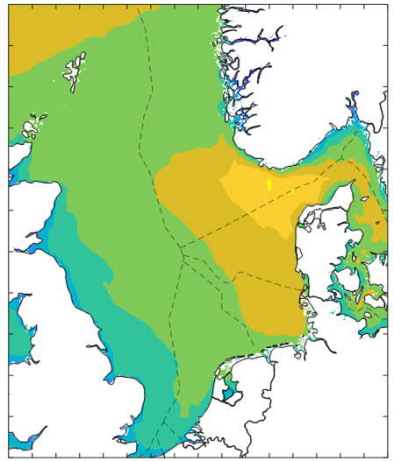
WDC Climate 'Median grain size of North Sea surface sediments'

Bathymetry



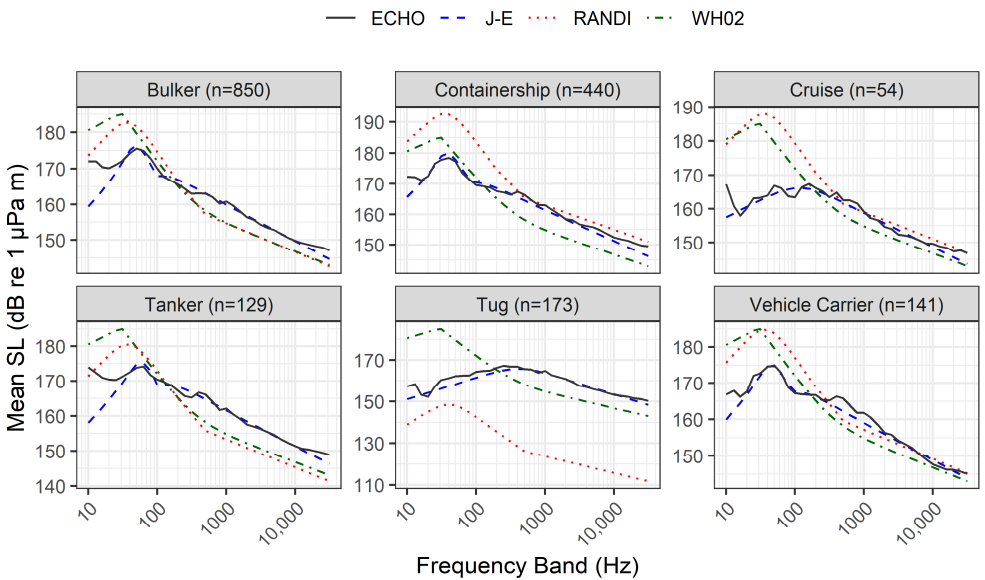
EModNet (1/8'×1/8')

Mean Wind Speed - May 2019



Copernicus Marine Environment Monitoring Service

NEW SHIP SOURCE LEVEL MODEL



Journal of Marine Science and Engineering
MDPI
Article

A Reference Spectrum Model for Estimating Source Levels of Marine Shipping Based on Automated Identification System Data

Alexander MacGillivray [1,*] and Christ de Jong [2]

[1] JASCO Applied Sciences, Victoria, BC V8Z 7X8, Canada
[2] Netherlands Organisation for Applied Scientific Research (TNO), 2597 AK The Hague, The Netherlands; christ.dejong@tno.nl
* Correspondence: alex.macgillivray@jasco.com; Tel.: +1-250-483-3300

- Source level depends on
  - Ship type
  - Ship length
  - Ship speed
- Parameters from AIS

Collaboration with ECHO programme

PORT of vancouver

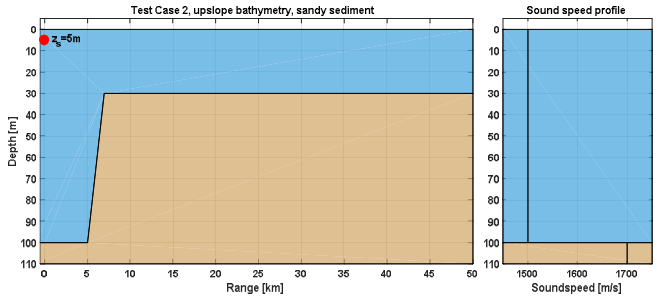
JASCO APPLIED SCIENCES

See UACE 2019 paper
Binnerts et al

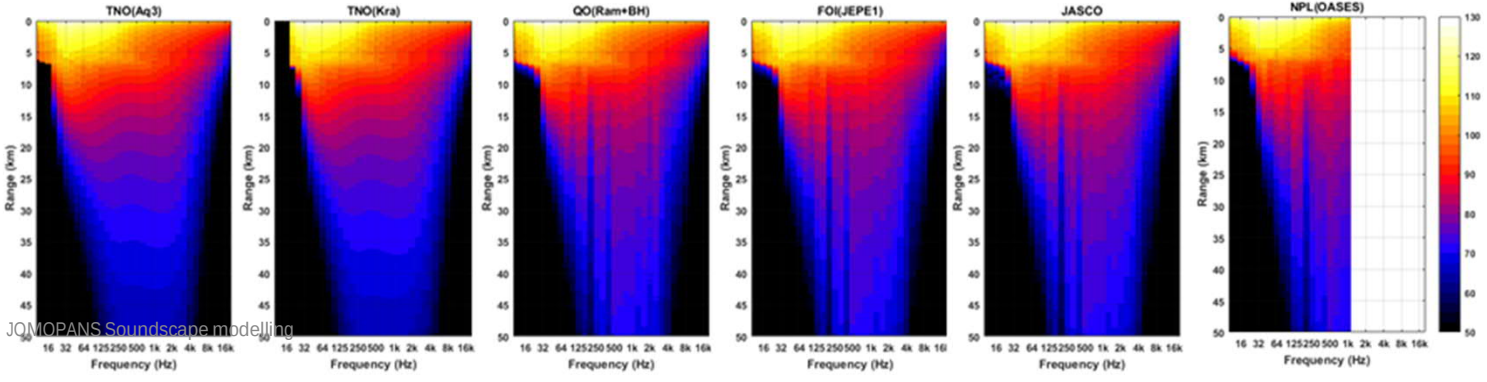
PROPAGATION MODEL BENCHMARKS

Two well-defined scenarios

- broadband SPL differences < ~2 dB (beyond 1 km)
- one-third octave band SPL differences < ~5 dB (>~32 Hz and beyond 500 m)



Incoherent normal modes | Parabolic equation | Wavenumber integration

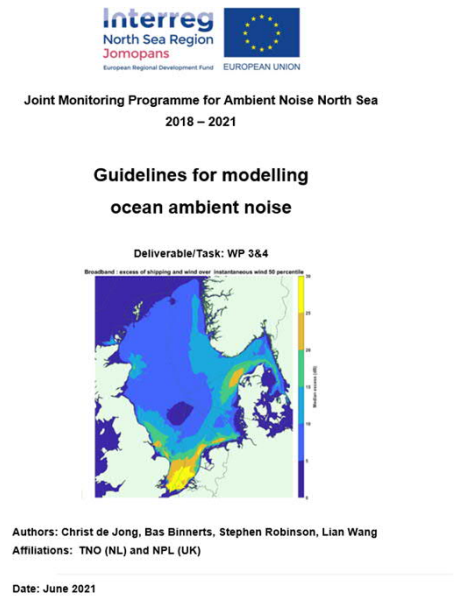


MODEL IMPLEMENTATION (TNO)

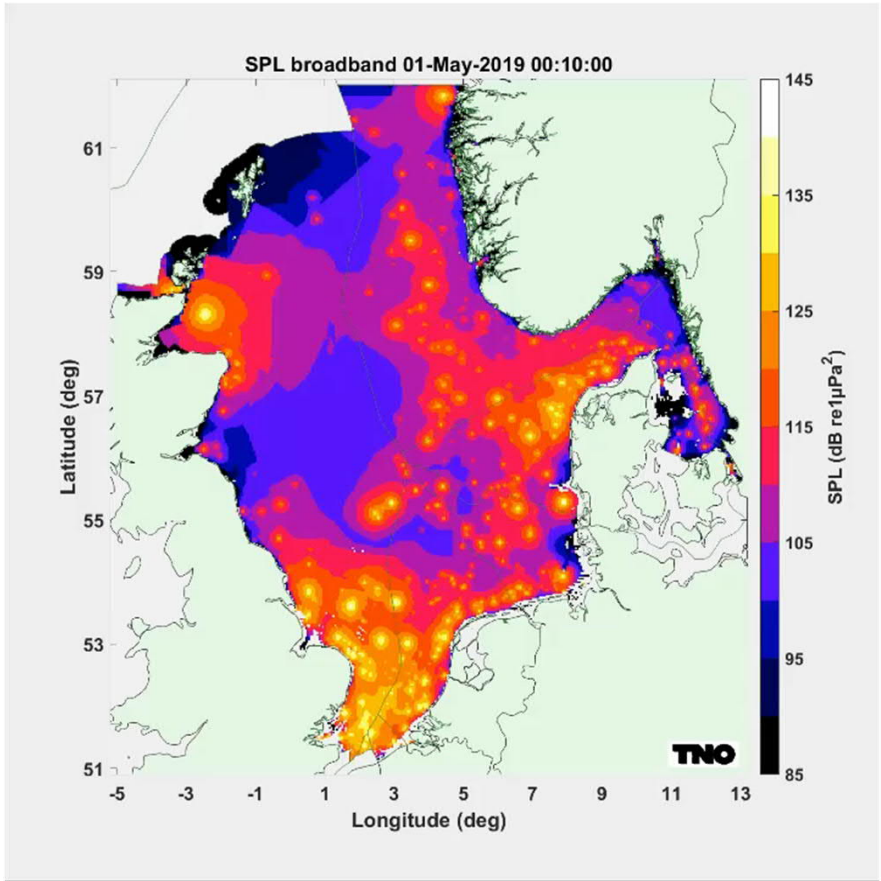
	Computation time	Data size
Calculate propagation loss	7 days	Prop loss database 768 GB
Calculate snapshots of SPL levels for 12 months	12 * 9 days	wind 2250 GB ships 4800 GB
Reshuffle snapshots into areas	7 days	4800 GB
Calculate month statistics	12 days	50 GB
Calculate year statistics	12 days	6 GB
Total	146 days	13 TB

- Assumptions:
  - Ignore sound speed profile
  - Ignore surface waves (for ship noise)
  - Precompute propagation loss between source and receiver grids

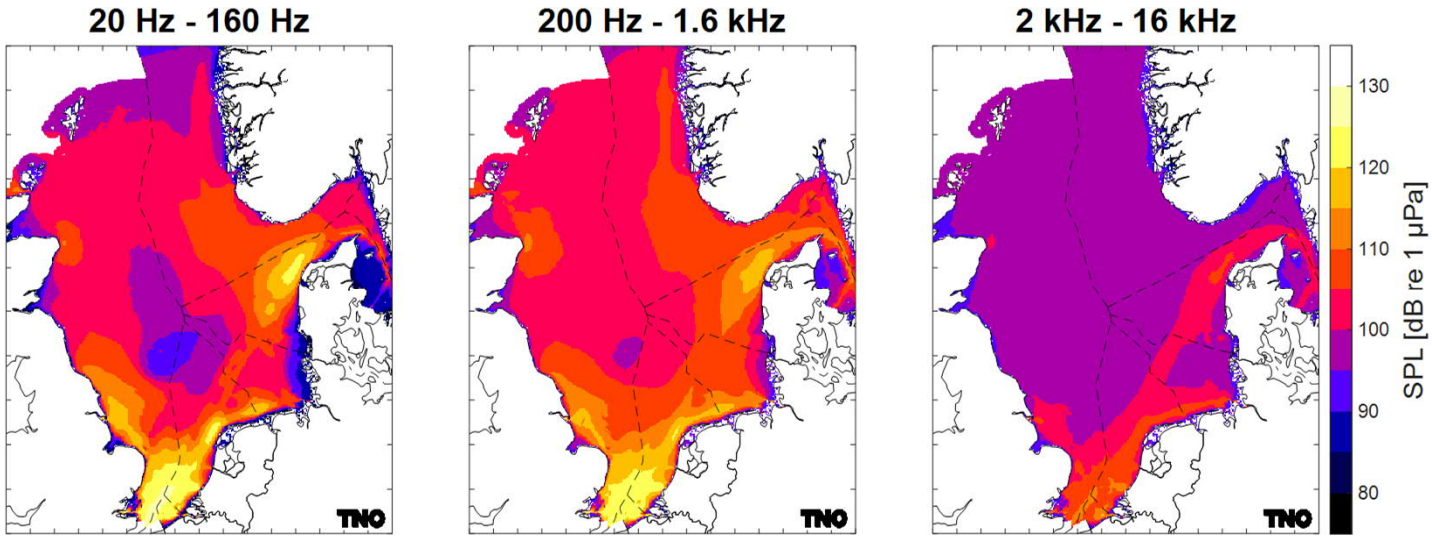
- Guidelines for soundscape modelling



MAPS OF SHIPPING AND WIND NOISE IN MAY 2019



SOUNDSCAPE MAPS: SHIPPING + WIND (ANNUAL MEDIAN)



1248 maps: including different versions of excess level and dominance, and SPL contributions of individual ship types and wind, for 6 frequency bands and for the 12 months of 2019

CONCLUSION

- JOMOPANS sound maps provide an unprecedented insight in the relevance of shipping for the North Sea sound scape
- Still many remaining issues to be solved to be able to quantify and possibly reduce uncertainties in the modelled soundscape maps.
- Main issues to be addressed:
  - incompleteness (missing sources) and uncertainty in the input data
  - limited spatial coverage of measurement sites
- Sound particle motion mapping:

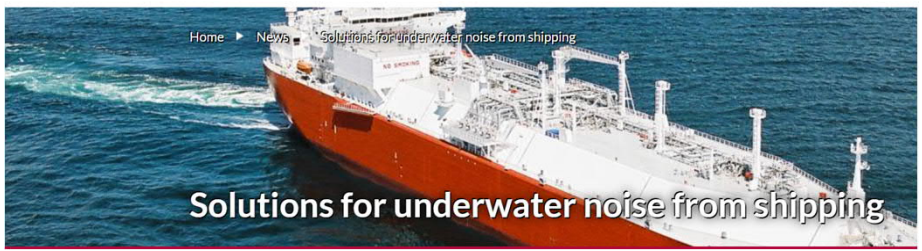
Saturn
Developing Solutions for Underwater Radiated Noise

https://www.marei.ie/project/saturn-solutions-at-underwater-radiated-noise/

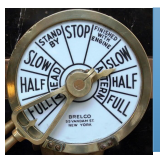
STUDY: NOISE REDUCTION BY “SLOW STEAMING”

federal public service
HEALTH, FOOD CHAIN SAFETY AND ENVIRONMENT

Online Seminar 30-03-2021



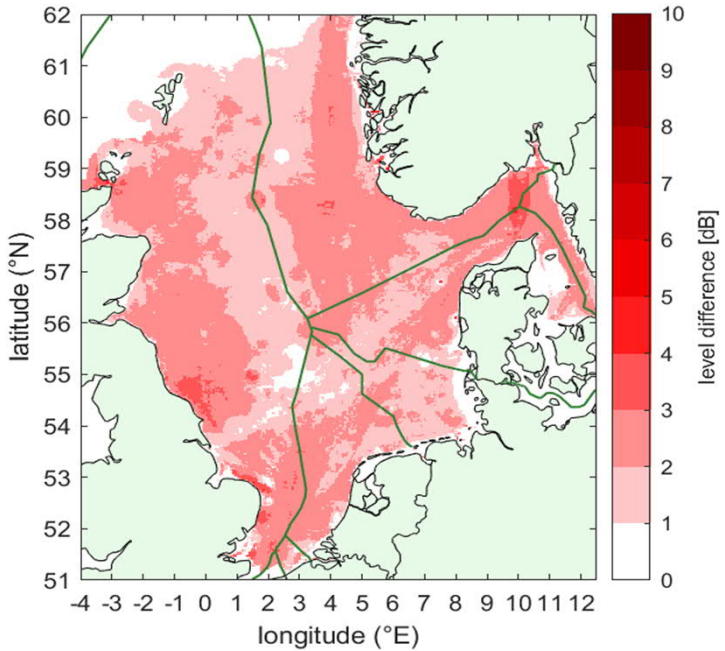
https://www.health.belgium.be/en/news/solutions-underwater-noise-shipping



Scenario:
Limit speed to maximum
75% of design speed

JOMOPANS sound maps

Maximum reduction of broadband SPL, 90% of the month



THANK YOU FOR YOUR ATTENTION

TNO innovation for life

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christ.dejong@tno.nl