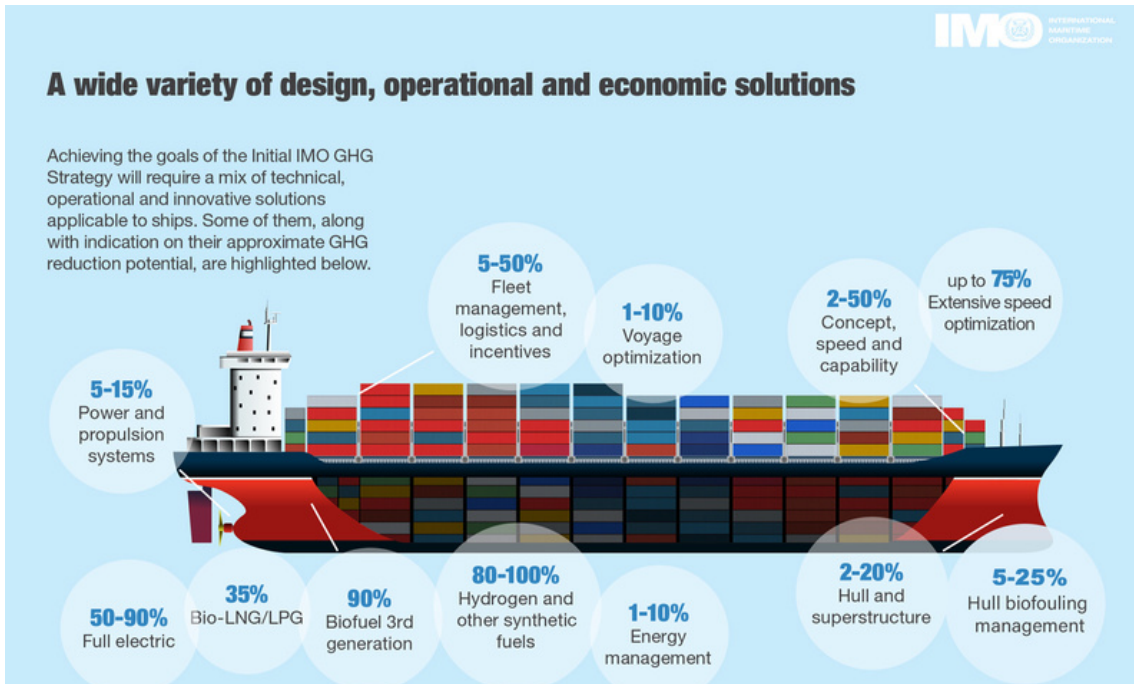




Evaluation, control and Mitigation of the EnviRonmental impacts of shippingG Emissions



Source: IMO's work to cut GHG emissions from ships

- In This Issue*
- Project Updates
- News
- Publications
- Future Events

PROJECT UPDATES

The project is heading towards the end and all EMERGE partners have been working hard to ensure that the project's objectives are met according to the original plan.

As the project is coming to an end, a stakeholder workshop was organized where the partners presented and discussed the project's final research findings and results.

Series of EMERGE Project videos are now ready and will be soon all available into our YouTube channel.

Also, a policy stakeholder event will be organized towards the end of the project.

NEWS

PROJECT MEETING

A face-to-face project meeting took place at the International Institute for Applied Systems Analysis (IIASA), in Vienna, Austria between 18th-19th of October 2023. During the meeting partners addressed the remaining issues that required immediate attention such as gaps identified in the health impact assessment and the deliverable D6.1- "Baltic and North Sea report." This meeting enabled the partners to work collaboratively towards resolving these issues and ensuring the successful completion of the project.



Photo with partners during the EMERGE meeting on 18-19 October 2023

SUB-COMMITTEE ON POLLUTION PREVENTION AND RESPONSE

The project coordinator, Dr. Jukka-Pekka Jalkanen and two other partners of the project Ph. Lic. Anna Lunde Hermansson and Associate Professor Erik Ytreberg participated in the meeting for the Sub-Committee on Pollution Prevention and Response, 11th session (PPR11), which held at IMO (International Maritime Organization) Headquarters in London, between February 19 and 23, 2024.

During the PPR11 meeting, they presented EMERGE project's results for the Baltic Sea and received questions regarding the 6-page document* from other participants of the meeting.

*The 6-page document (which was written by selected EMERGE partners for the PPR11 meeting) described the comprehensive efforts of the EMERGE project team over the past four years, primarily focusing on identifying and quantifying the impacts of EGCS effluents on the marine environment in the Baltic Sea and the North Sea.



Associate Professor Erik Ytreberg, presenting EMERGE project during the PPR11



Ph.Lic. Anna Lunde Hermansson during the PPR11

EMERGE STAKEHOLDER WORKSHOP

On February 29th, 2024, at 09:30 CET, we hosted our final Stakeholder Workshop online. In just 3 hours, our incredible partners delivered an informative, engaging, and highly productive session. We were thrilled to see participants from industry, academia, and policymaking circles joining us, all of whom shared glowing feedback on the workshop's success.

A huge shoutout to all our presenters for their invaluable insights and expertise that made the workshop truly enriching!

Did you miss out on the action? Don't worry! The recording of the EMERGE Stakeholder Workshop is now live on our YouTube channel (@emergeeuproject6547)! 📺 Go check it out here: <https://lnkd.in/gN55Hu8G>

You can visit the EMERGE website for comprehensive information: <https://emerge-h2020.eu/>

STAKEHOLDER WORKSHOP



FEB 29 2024 | 09:30-12:30 CET

Agenda

- 09:30-09:40 Welcome and Introduction**
Ian Williams (University of Southampton)
- 09:40-09:50 Overview of the EMERGE project**
Jukka-Pekka Jalkanen (Finnish Meteorological Institute), Project Coordinator
- 09:50-10:05 Characterization of waste stream to the water**
Mira Petrovic (ICRA) and Maria Granberg (IVL)
- 10:05-10:20 Characterisation of post-scrubber exhaust emissions to the atmosphere**
Leonidas Ntziachristos (Aristotle University of Thessaloniki)
- 10:20-10:35 Water modelling at the regional and case study scale**
Vassilis Kolovoyiannis (University of Aegean)
- 10:35-10:45 Short Break**
- 10:45-11:00 High-resolution modelling of shipping impact in Europe**
Sofiev Mikhail (Finnish Meteorological Institute)
- 11:00-11:15 Integrated assessment of shipping emissions on the marine and atmospheric environments: highlights from an EMERGE case-study**
Elisa Giubilato (University of Venice)
- 11:15-11:30 Integrating economic considerations in efforts to minimize environmental impacts of shipping**
Wilfried Winiwarter (IIASA)
- 11:30-12:30 Stakeholder open discussion**



 This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 874990

Agenda of the EMERGE final Stakeholder workshop

SERIES OF EMERGE PROJECT VIDEOS

During the last face-to-face meeting in Vienna, we had the opportunity to film our project partners and coordination team.

The videos are now available and will be soon all released on our Youtube channel.

Stay tuned...



Filming the project manager of the EMERGE project, Dr. Androniki Maragkidou (Finnish Meteorological Insitute)

INTERNATIONAL TRANSPORT AND AIR POLLUTION CONFERENCE

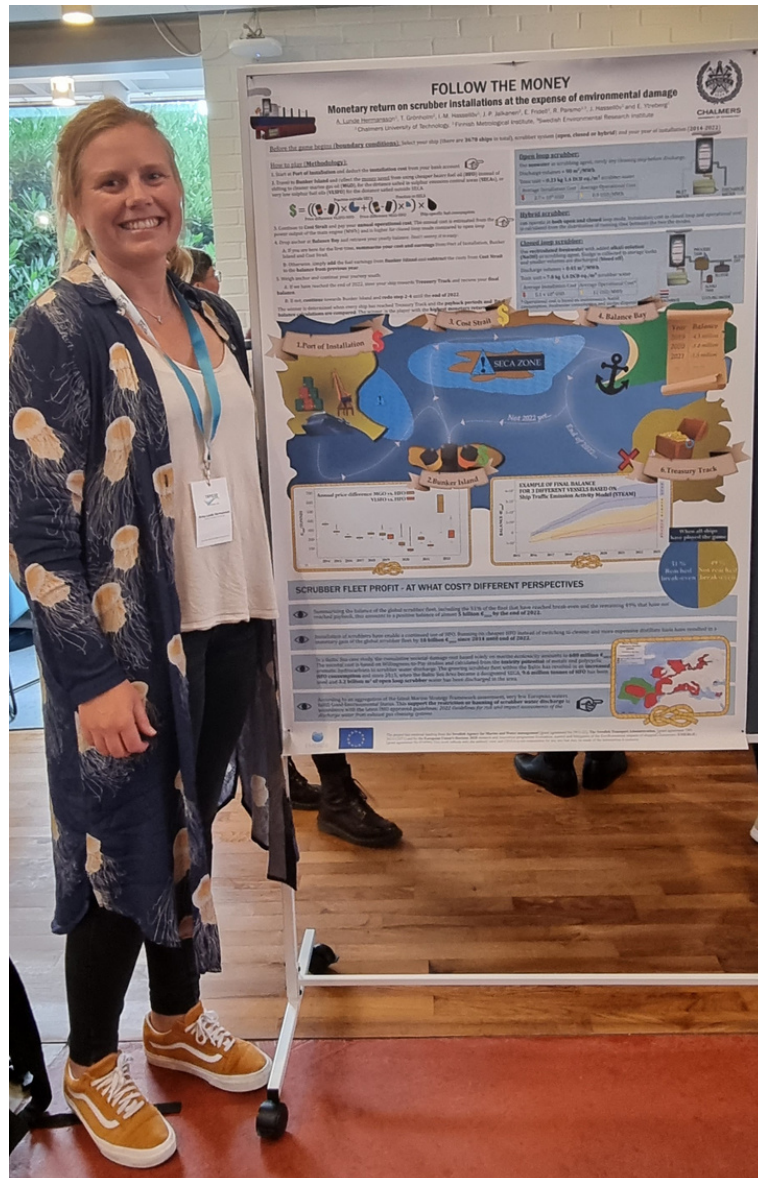
Our EMERGE project partners from Finnish Meteorological Institute, Chalmers University of Technology, IVL Swedish Environmental Research Institute, Creative nano, Aristotle University of Thessaloniki, International Institute for Applied Systems Analysis, University of Aveiro and University of Venice attended the 25th International Transport and Air Pollution and 3rd Shipping and Environment Conference which took place on 25-28 of September at Gothenburg, Sweden where they presented their work in EMERGE.

Also, two representatives from our Scientific Advisory Board, Prof. Huan Liu (School of Environment, Tsinghua University) and Mr. Volker Matthias (Hereon) delivered a presentation about their work and shared their views with the audience.



EMERGE project partners during the 25th International Transport and Air Pollution and 3rd Shipping and Environment Conference

In addition, we would like to congratulate Ph.Lic. Anna Lunde Hermansson (Chalmers University of Technology) for securing the 1st place for her exceptional poster presentation!



Ph.Lic. Anna Lunde Hermansson from Chalmers University of Technology, for securing the 1st place for her exceptional poster presentation

SCRUBBERS: THE END OF AN END OF PIPE SOLUTION?

Our project partner Ph.Lic. Anna Lunde Hermansson from Chalmers University of Technology, participated at the webinar which was organized by Clean Arctic Alliance (<https://cleanarctic.org/>) on the 21st of November, entitled: Scrubbers: The end of an end of pipe solution?.

The topic of her presentation was "Risk and Impact assessment of scrubber water discharge" and focused on some of the highlights from EMERGE Deliverable 6.1 with connection to the impact assessment of the MEPC guideline document (MEPC.1/Circ.899).

You can download all the presentations and watch the webinar video here: <https://cleanarctic.org/2023/11/02/webinar-on-scrubbers-the-end-of-an-end-of-pipe-solution/>

PARTICIPATION IN EVENT PRESENTING THE EMERGE PROJECT

Our project partner Achilleas Grigoriadis from the Aristotle University of Thessaloniki, participated at the International Conference on Postgraduate Research in Maritime Technology (PostGradMarTech 2023), hosted by the distinguished Hellenic Institute of Marine Technology - HIMT on November 29th, 2023 and he presented his work, entitled " Onboard particulate and gaseous emission measurements from slow-speed marine engines equipped with open-loop scrubbers under real-world operation". The research was aimed at showcasing the emissions of particulate matter and gases from a real 300-meter container ship equipped with a slow-speed 2-stroke engine and an open-loop scrubber during a comprehensive 7-day measurement campaign in actual operational conditions. This initiative was undertaken to deepen our comprehension of emission behavior downstream of scrubbers, a critical factor in evaluating the shipping industry's impact on air quality and human health."

DELIVERABLE 6.1: BALTIC AND NORTH SEA REPORT AND DELIVERABLE 6.2: MEDITERRANEAN SEA REPORT

Two very important deliverables, the Deliverable 6.1: Baltic and North Sea report and Deliverable 6.2: Mediterranean Sea report, have been accepted by the EC and are available for public.

The aim of the deliverables were to develop a holistic framework to evaluate the impacts of shipping emissions, particularly those related to scrubbers, on the marine environment, human health, climate, and economy in the Baltic and the North Sea (including the English Channel) and the Mediterranean Sea.

The structure of both deliverables follow the well-established DAPSIR (Driver-Activity-Pressure-State-Impact-Response) framework, under which information, findings and conclusions from previous work packages are synthesized and integrated, including experiments of direct emissions from shipping to the marine environment (WP2) and the atmosphere (WP3), assessment of marine environmental impacts (WP2, WP4 and WP6), as well as human health and climate change impacts (WP5 and WP6). Finally, the deliverables provide recommendations and guidance for stakeholders and policymakers.

In case you wish to have access to these deliverables, please contact Dr. Androniki Maragkidou at androniki.maragkidou@fmi.fi.



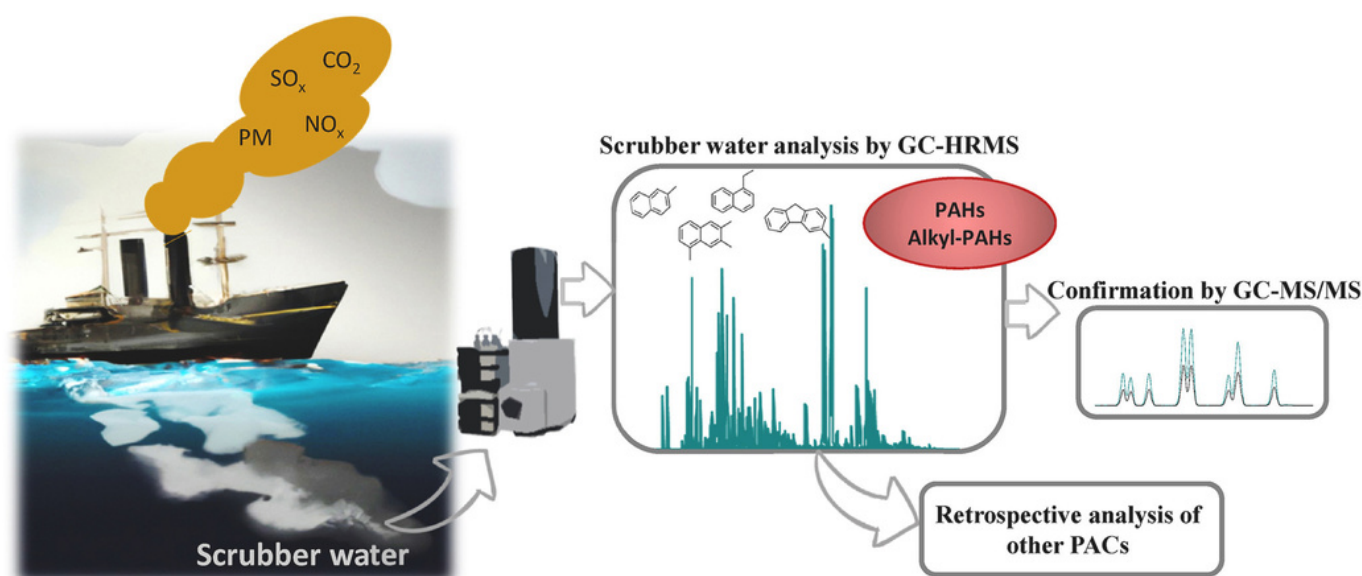
Illustrative description on how the DAPSIR framework has developed in EMERGE to assess pressures from shipping and impacts on air quality (health), climate and the marine environment

- García-Gómez E, Gkotsis G, Nika MC, Hassellöv IM, Salo K, Hermansson AL, Ytreberg E, Thomaidis NS, Gros M, Petrović M.

Characterization of scrubber water discharges from ships using comprehensive suspect screening strategies based on GC-APCI-HRMS, *Chemosphere.* 2023 Sep 26;343:140296. doi: 10.1016/j.chemosphere.2023.140296. Epub ahead of print. PMID: 37769908.

Read [here](#)

An extended suspect screening approach for the comprehensive chemical characterization of scrubber discharge waters from exhaust gas cleaning systems (EGCSs), used to reduce atmospheric shipping emissions of sulphur oxides, was developed. The suspect screening was based on gas chromatography coupled with high-resolution mass spectrometry (GC-HRMS) and focused on the identification of polycyclic aromatic hydrocarbons (PAHs) and their alkylated derivatives (alkyl-PAHs), which are among the most frequent and potentially toxic organic contaminants detected in these matrices. Although alkyl-PAHs can be even more abundant than parent compounds, information regarding their occurrence in scrubber waters is scarce. For compound identification, an in-house compound database was built, with 26 suspect groups, including 25 parent PAHs and 23 alkyl-PAH homologues. With this approach, 7 PAHs and 12 clusters of alkyl-PAHs were tentatively identified, whose occurrence was finally confirmed by target analysis using GC coupled with tandem mass spectrometry (GC-MS/MS). Finally, a retrospective analysis was performed to identify other relevant (poly)cyclic aromatic compounds (PACs) of potential concern in scrubber waters. According to it, 18 suspect groups were tentatively identified, including biphenyls, dibenzofurans, dibenzothiophenes and oxygenated PAHs derivatives. All these compounds could be used as relevant markers of scrubber water contamination in heavy traffic marine areas and be considered as potential stressors when evaluating scrubber water toxicity.



Graphical abstract

- Jukka-Pekka Jalkanen, Erik Fridell, Jaakko Kukkonen, Jana Moldanova, Leonidas Ntziachristos, Achilleas Grigoriadis, Maria Moustaka, Evangelia Fragkou, George Tsegas, Androniki Maragkidou, Mikhail Sofiev, Risto Hänninen, Tiia Grönholm, Julia Palamarchuk, Elisa Majamäki, Wilfried Winiwarter, Samuel Gueret, Ranjeet S. Sokhi, Saurabh Kumar, Ummugulsum Alyuz Ozdemir, Vassilis Kolovoyiannis, Vassilis Zervakis, Aikaterini-Anna Mazioti, Evangelia Krasakopoulou, Ida-Maja Hassellöv, Anna Lunde Hermansson, Erik Ytreberg, Ian Williams, Malcolm Hudson, Lina Zapata Restrepo, Lars Robert Hole, Manuel Aghito, Oyvind Breivik, Mira Petrovic, Meritxell Gross, Sara Rodriguez-Mozaz, Maria Neophytou, Alexandra Monteiro, Michael A. Russo, Fotis Oikonomou, Andreas Gondikas, Antonio Marcomini, Elisa Giubilato, Loris Calgaro, Jouni J. K. Jaakkola, Ivy Shiue, SimoPekka Kiihamäki, Göran Broström, Martin Hassellöv, Joni. Kaitaranta, Maria Granberg and Kerstin Magnusson

Environmental impacts of exhaust gas cleaning systems in the Baltic Sea, North Sea, and the Mediterranean Sea area,

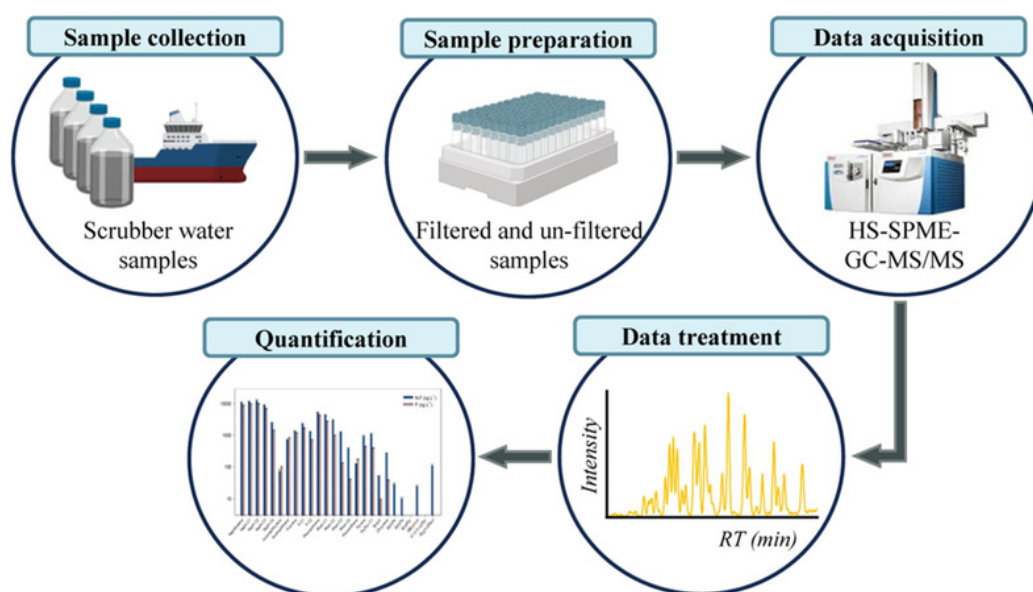
Read [here](#)

- Elisa García-Gómez, Sara Insa, Meritxell Gros, Mira Petrović

Rapid and sensitive method for the simultaneous determination of PAHs and alkyl-PAHs in scrubber water using HS-SPME-GC-MS/MS, *MethodsX*, Volume 12, 102589, 2024

Read [here](#)

Scrubber water, a waste stream generated by ships exhaust gas cleaning systems, may pose a threat when released into the marine environment due to potential contamination with polycyclic aromatic hydrocarbons (PAHs) and their alkyl derivatives (alkyl-PAHs). This study aims to develop a reliable analytical procedure combining headspace solid-phase microextraction (HS-SPME) with gas chromatography coupled to triple quadrupole tandem mass spectrometry (GC-MS/MS) to simultaneously separate and determine target compounds in aqueous samples. Method validation demonstrated good linearity up to 200 ng L⁻¹ ($r^2 > 0.996$) and low limits of detection (0.33 to 1.67 ng L⁻¹, except for naphthalene at 3.3 ng L⁻¹). The method shows good precision (RSD < 20%) and satisfactory analytical recoveries. The methodology was successfully applied to scrubber water samples collected from a container ship and the results highlight the prevalence of naphthalene, phenanthrene, and their alkyl derivatives. •Rapid and reproducible HS-SPME-GC-MS/MS method for the analysis of PAHs and alkyl-PAHs in scrubber water. •The capacity of SPME to analyze both filtered and unfiltered samples was assessed, showing that the more hydrophobic PAHs may be lost during filtration.



Graphical abstract

- Mikko Heikkilä, Tiia Grönholm, Elisa Majamäki, Jukka-Pekka Jalkanen.

Effect of ice class to vessel fuel consumption based on real-life MRV data, *Transport Policy*, Volume 148, Pages 168-180, March 2024,

Read [here](#)

Only around half of the ice-classed vessels that reported to MRV sailed in ice during 2018–2022. Ice-classed ships have more light ship mass, larger main engines and less cargo capacity than non-ice-classed vessels. Ice classification does not predict increased fuel consumption for all vessel types.

- Genitsaris, S., Stefanidou, N., Hatzinikolaou, D., Kourkoutmani, P., Michaloudi, E., Voutsas, D., Gros, M., García-Gómez, E., Petrović, M., Ntziachristos, L. and Moustaka-Gouni, M.

Marine Microbiota Responses to Shipping Scrubber Effluent Assessed at Community Structure and Function Endpoints, *Environmental Toxicology and Chemistry*, 00:1–18. © 2024

Read [here](#)

- Aghito, Manuel and Pampanin, Daniela M. and Nepstad, Raymond and Hole, Lars Robert and Breivik, Øyvind

Modelling and Validation of Polycyclic Aromatic Hydrocarbons Emissions from Offshore Oil Production Facilities

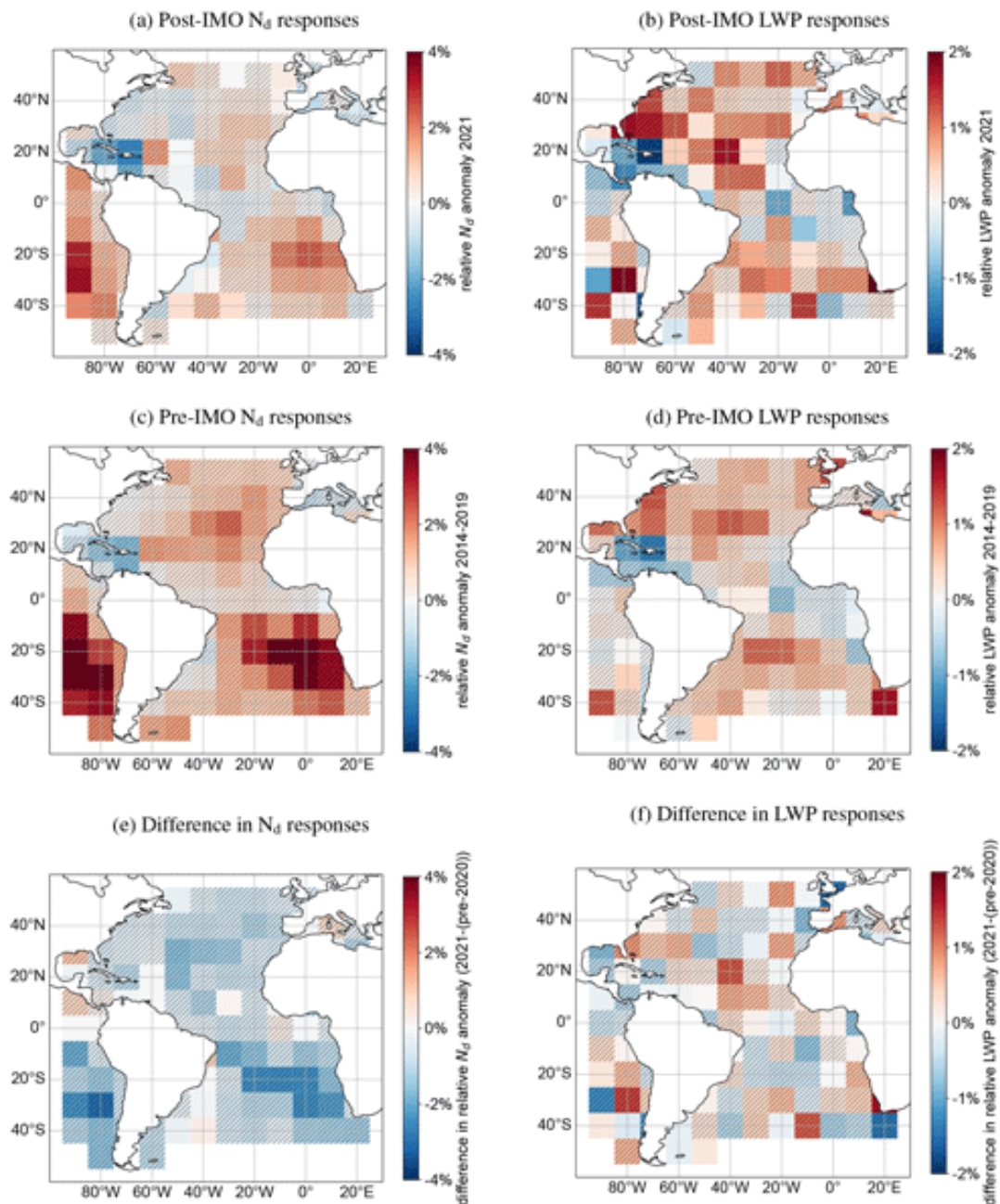
Read [here](#)

• Manshausen, P., Watson-Parris, D., Christensen, M. W., Jalkanen, J.-P., and Stier, P.

Rapid saturation of cloud water adjustments to shipping emissions, *Atmos. Chem. Phys.*, 23, 12545–12555, <https://doi.org/10.5194/acp-23-12545-2023>, 2023.

Read [here](#)

Human aerosol emissions change cloud properties by providing additional cloud condensation nuclei. This increases cloud droplet numbers, which in turn affects other cloud properties like liquid-water content and ultimately cloud albedo. These adjustments are poorly constrained, making aerosol effects the most uncertain part of anthropogenic climate forcing. Here we show that cloud droplet number and water content react differently to changing emission amounts in shipping exhausts. We use information about ship positions and modeled emission amounts together with reanalysis winds and satellite retrievals of cloud properties. The analysis reveals that cloud droplet numbers respond linearly to emission amount over a large range (1–10 kg h⁻¹) before the response saturates. Liquid water increases in raining clouds, and the anomalies are constant over the emission ranges observed. There is evidence that this independence of emissions is due to compensating effects under drier and more humid conditions, consistent with suppression of rain by enhanced aerosol. This has implications for our understanding of cloud processes and may improve the way clouds are represented in climate models, in particular by changing parameterizations of liquid-water responses to aerosol.



Comparison of regional patterns of N_d and LWP responses before and after sulfur emissions regulation. Heatmaps show the responses in N_d and LWP averaged over 10 h after emissions for N_d and 24 h for LWP. Panels (a) and (b) show the post-regulation responses, panels (c) and (d) the pre-regulation responses, and panels (e) and (f) the differences. Note that the color bar ranges are different for N_d and LWP. Hatching in (a)–(d) indicates statistically significant differences ($p < 0.1$ in a two tailed Student's t test) from the null experiment (see Methods). In (e) and (f) we test for significant differences between the pre- and post-IMO anomalies. The bottom row has too little ship traffic to collect data.

FUTURE EVENTS

INTERNATIONAL CONFERENCE ON AIR QUALITY

The 14th International Conference on Air Quality will be held for the first time in Finland, in Kumpula, Helsinki on 13–17 May 2024.

This conference series is one of the most distinguished and one of the oldest active regularly arranged (bi-annual) international conference series in the field of air quality science. The number of international participants in this conference series has usually been approx. 200–300 persons.

EMERGE POLICY STAKEHOLDER WORKSHOP

The EMERGE Policy Stakeholder Workshop will take place in Brussels on 21 May 2024

HARMO 22

The 22nd International Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes (HARMO 22) will take place from 10 to 14 June 2024 in Tartu (Estonia)

EGU General Assembly 2024

The General Assembly 2024 of the European Geosciences Union (EGU) will take place 14–19 April 2024 in Vienna, Austria.

The purpose of the EGU General Assembly 2024 will bring together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary and space sciences. It aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of geoscience.

Visit <https://www.egu24.eu/> website to learn more about the event.

Join online 🗨️ <https://lnkd.in/dfASwvgG>

Join the EMERGE Information Network!

EMERGE is open to all stakeholders globally with an interest in marine and maritime technologies, research and innovation as well as environmental protection.

By becoming part of our Information Network you are joining one of the most Innovative projects in the marine and maritime field.



EMERGE project under the Policy Area Ship was granted a Flagship status



Follow us!



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 874990

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