

# Green Ports – Vessel Emission Modelling, Tracking and Reduction in Ports

## Introduction

Emissions of air pollutants from transport have been a cause for concern due to their impact on environment degradation and public health.

Pollutant emissions from vessels may lead to local air quality degradation and threaten human health especially in the coastal cities. It is essential to quantify the impacts of shipping emissions on urban air quality, capture its spatial-temporal dynamics and develop optimal strategies to mitigate the emission generated in ports due to marine traffic & operation.

The MAREMIS consortium formed by an international team from Germany and Singapore proposed to develop big data-driven and machine learning-based solutions for measuring, tracking, and optimising maritime traffic for reducing emission. The research and development of this study mainly focuses on air pollution in harbour cities, where the degree of impact by ships on air quality will be fully investigated and recommendations will be made to improve air quality. The technologies developed are employed for both Singapore and Hamburg ports and are applicable for other international ports.



**An International Collaboration Between Singapore and Germany, Teaming Up Academia And Industry**

### Partners from Germany:

- Institute of Communications and Navigation, Aerospace Center (DLR)
- BM Bergmann Marine
- FleetMon, Jakota Cruise Systems GmbH

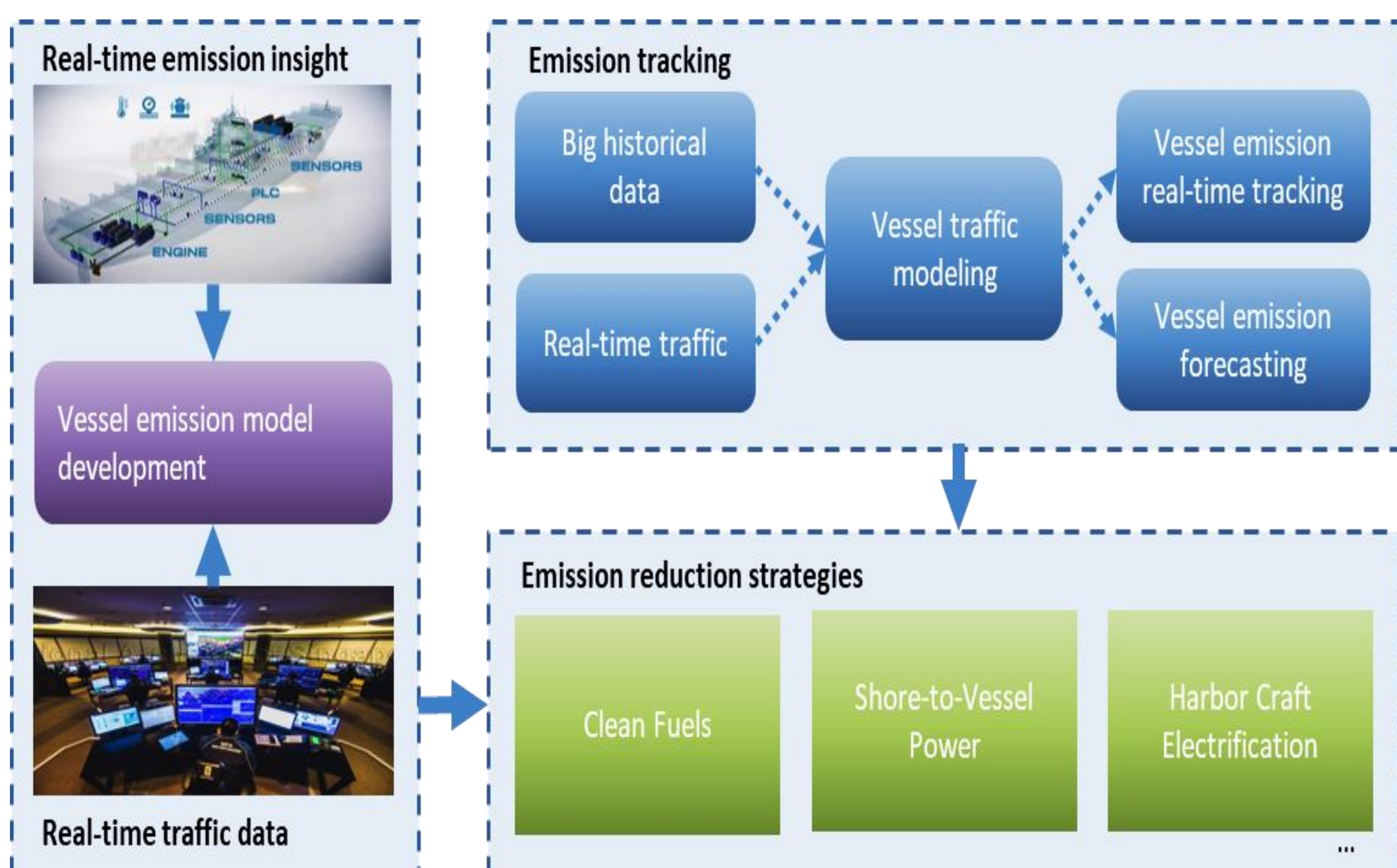
### Partners from Singapore:

- Institute of High Performance Computing, A\*STAR
- ShipsFocus Group
- Faurecia

## The Technologies Behind

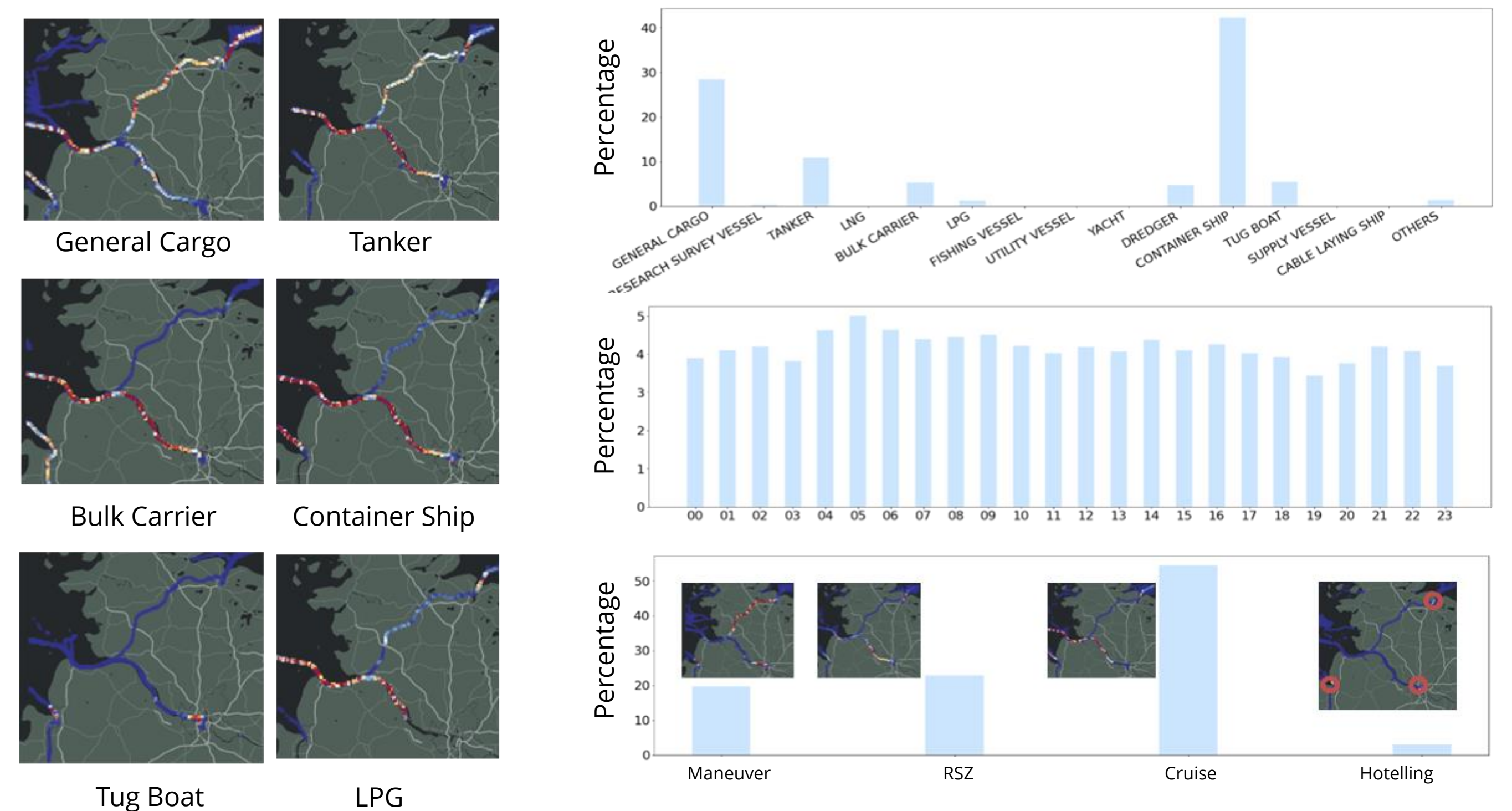
The consortium established big data driven and machine learning-based traffic pattern extraction solutions and vessel emission models to automatically measure, track, and validate emissions-related aspects of vessel traffic and operation to reduce emissions from vessels in ports and improve local air quality in coastal cities. The port emission model reflects spatial-temporal emission dynamics and distribution of vessel traffic emissions.

The emission patterns and insights, together with other practical aspects are taken into consideration when deciding the potential scenarios and strategies like clean fuel replacement, shore power supply and more to reduce emission in ports. The technical components and models are packaged as application programming interface (APIs) and accessible through a user-friendly demonstrator.

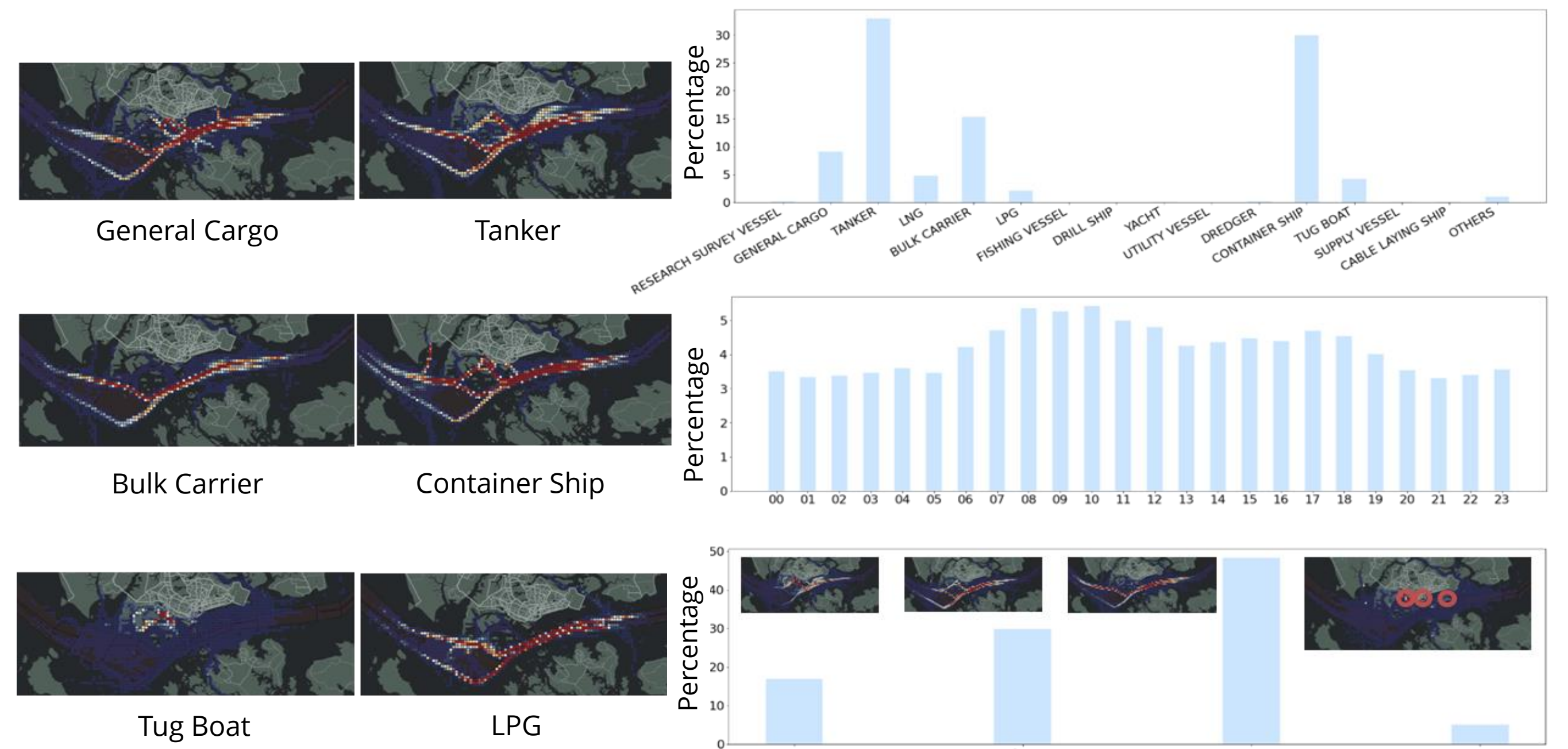


## Insights on Port Emissions

The emission patterns are extracted based on the vessel traffic data collected for Singapore and Hamburg ports.



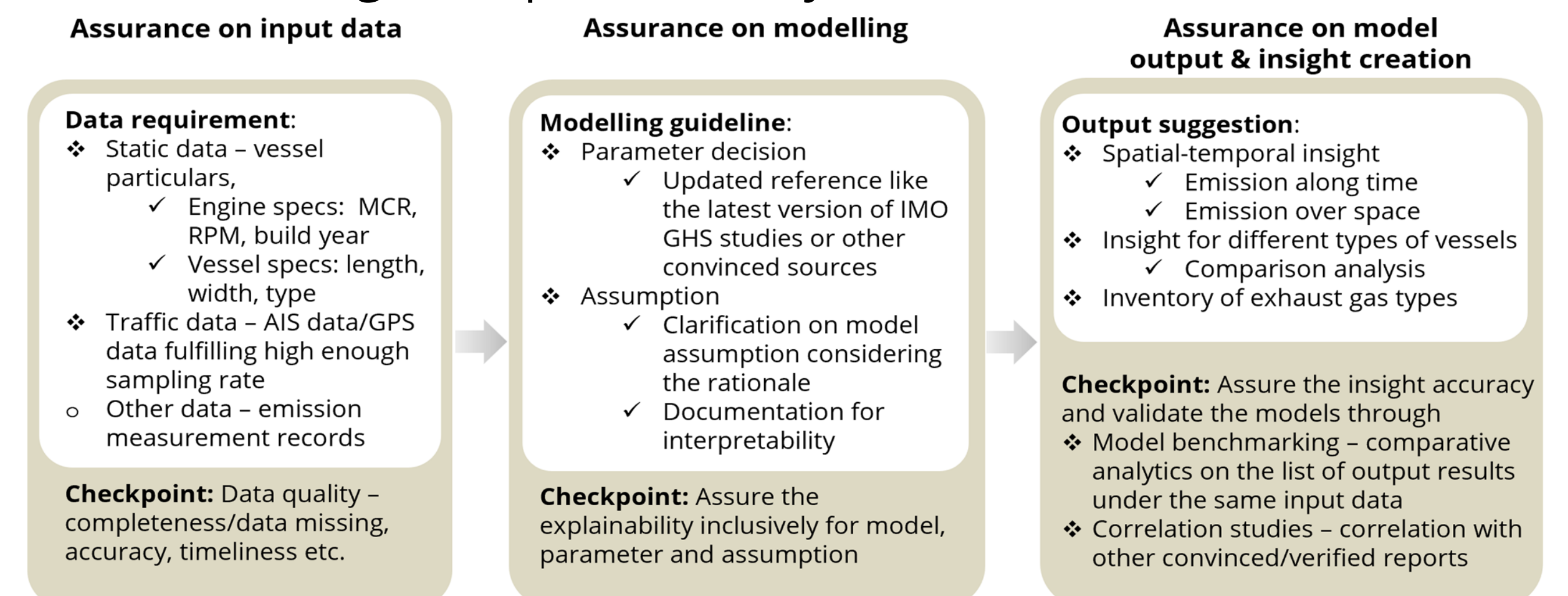
Emission patterns for the port of Hamburg



Emission patterns for Singapore port

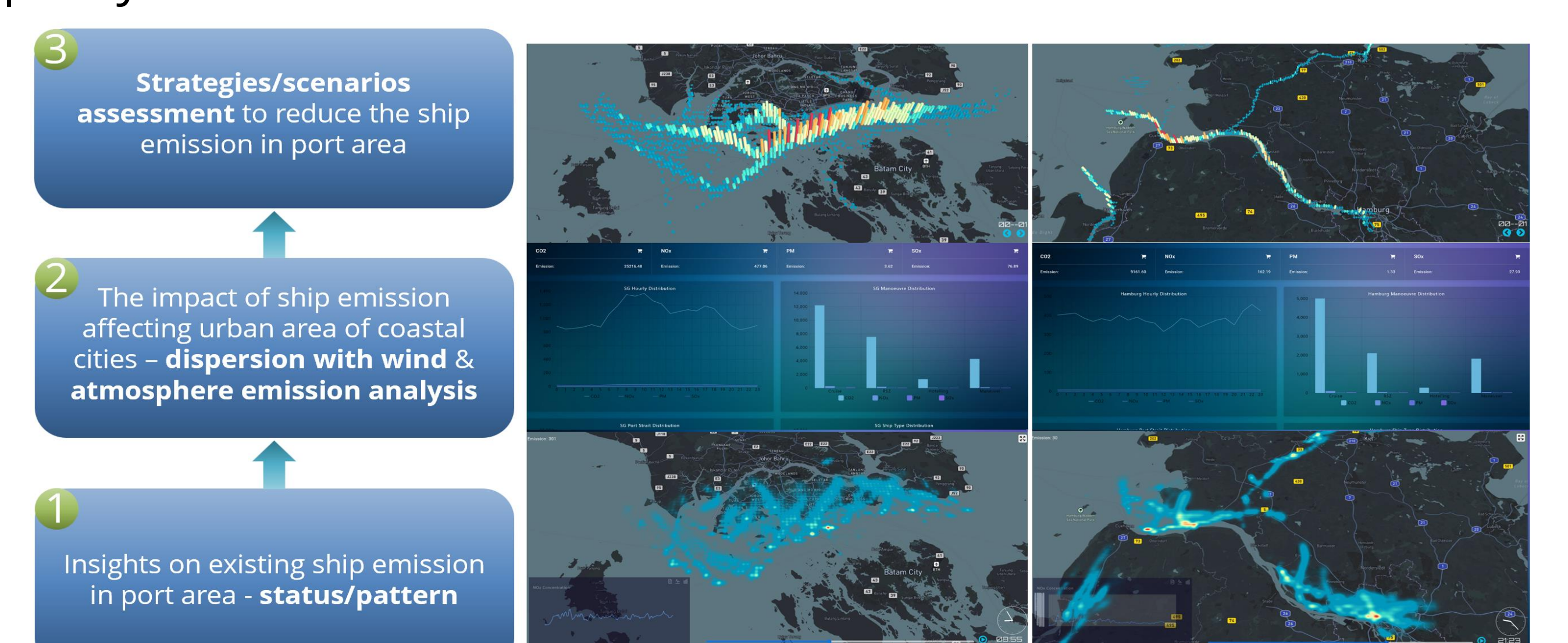
## Baseline Port Emission Validation Framework Proposed

The validation framework will provide basis for generating trustable emission measuring outputs and enable relevant organisations to compare and steering emission reduction targets optimally in short, medium and long-term period over years.



## Summary

MAREMIS is a bilateral project that supports the collaboration between Germany and Singapore in maritime technology towards maritime emission reduction, based on big data and machine learning-based models to automatically measure, track, and validate emissions-related aspects of maritime transport to reduce emissions (exhaust, no ballast water or waste) from ships and improve local air quality.



Dashboard design & key research components