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Shipping Contributions to Inland Pollution Push for the Enforcement of Regulations

In-port air quality impacts of vessels

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AtmoSud

Professor Leonidas Ntziachristos
Christos Boikos
Aristotle University of Thessaloniki

AtmoSud
Inspirer un air meilleur

ARISTOTLE UNIVERSITY OF THESSALONIKI

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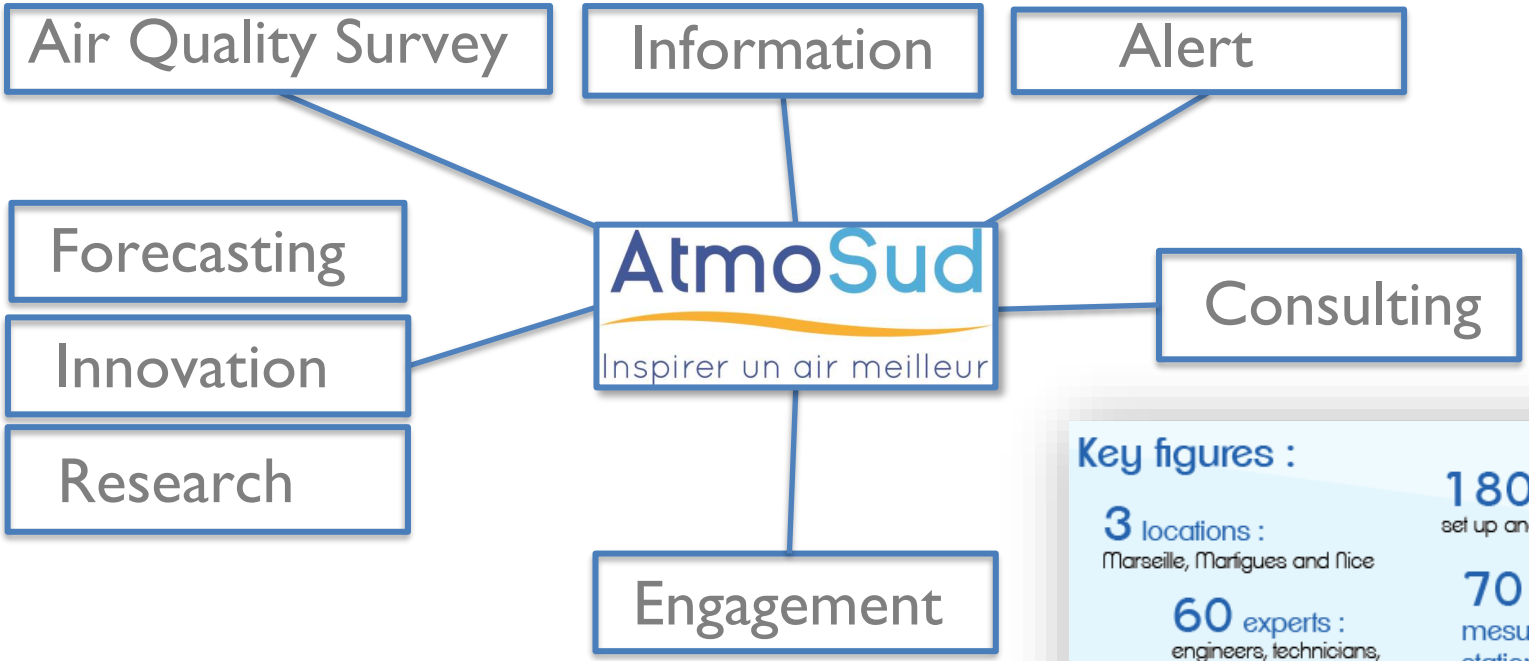
Missions of the Observatory



Key figures :

3 locations :
Marseille, Martigues and Nice

60 experts :
engineers, technicians, communication, chimistes, project managers, ….

180 analysers
set up and fixed

70 mesurement stations Spread all the territory

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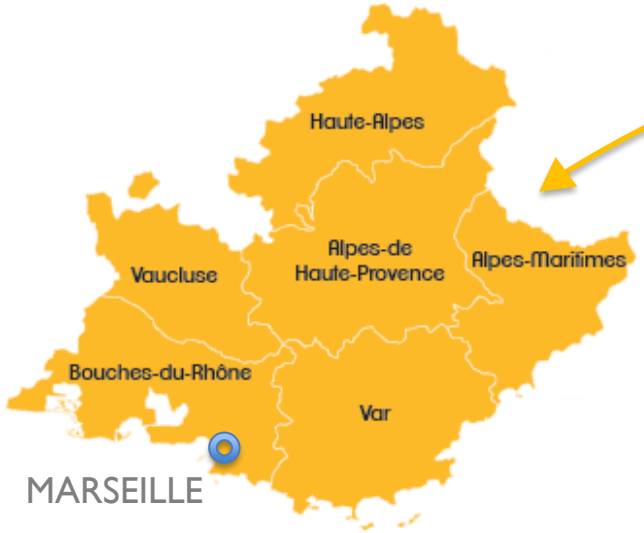
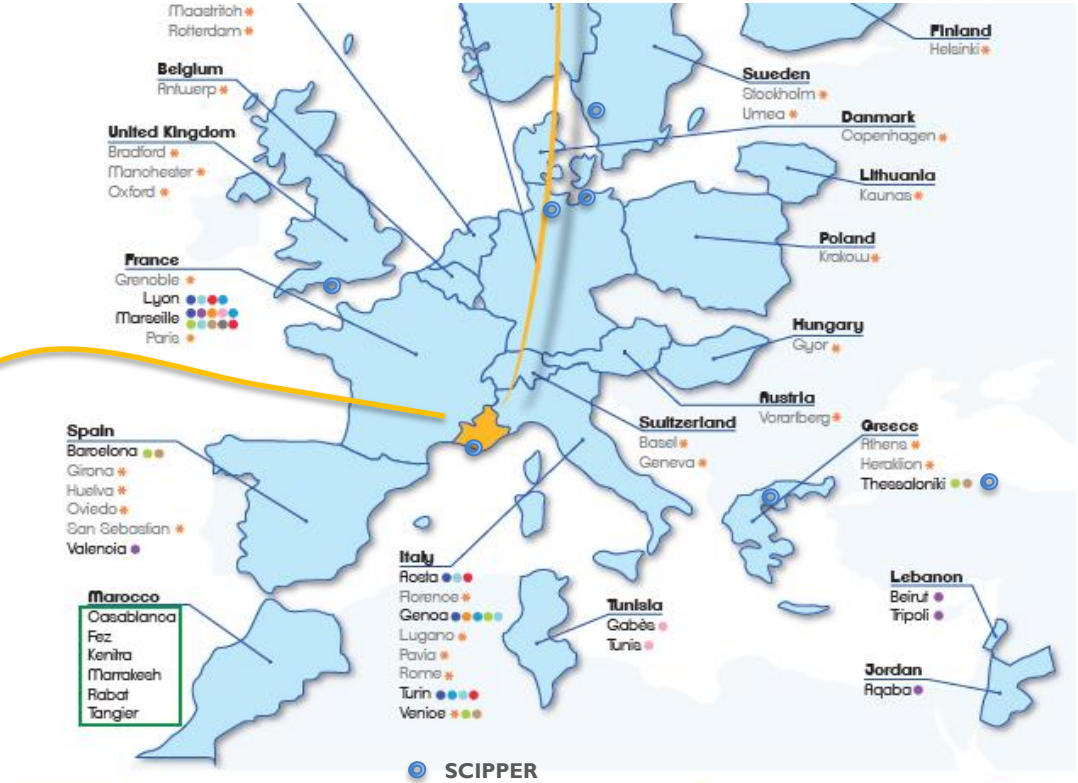
International cooperation





Projects have benefited from European funds

AtmoSud Qualité de l'Air Provence • Alpes • Côte d'Azur

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Marseille
Campaigns 2019, 2020, 2021

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Harbour supersite

Network of µ-sensors

Urban Background aerosol supersite
Marseille Longchamp

Cruise terminal

regular passenger lines

2ND ARR.

1ST ARR.

Marseille

6TH ARR.

Domain of the examples of plumes dispersion

UAS

Sniffer measurements

Harbour supersite

on board sniffer

Château d'If

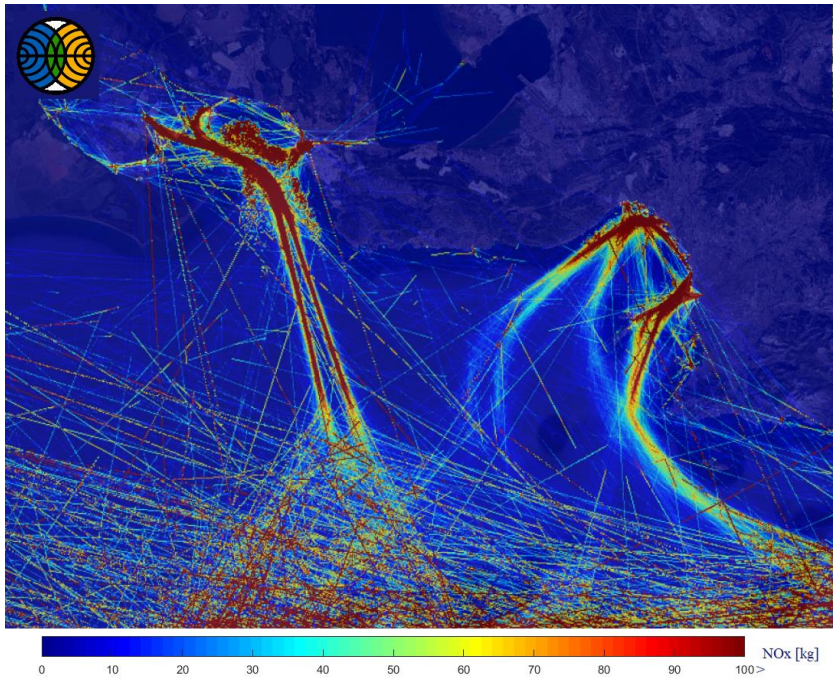
Assessment of the impact of ship emissions on Marseille

I - Obs with AQ Campaigns

II - Obs Emissions & cadasters

III – Modeling – reference (2021)

IV – Modeling – Scenarios mitigations



Impacts Maritime mitigation Sol. On Air Quality

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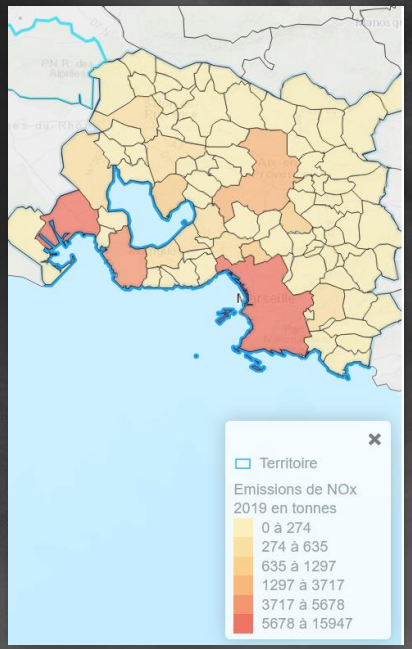
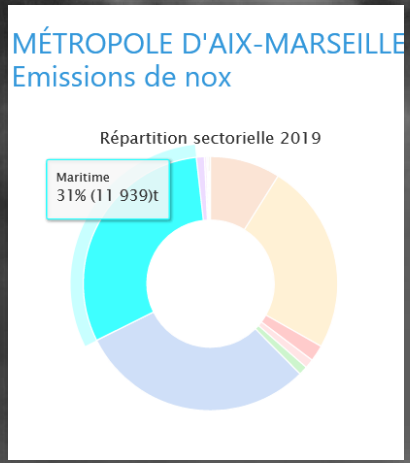
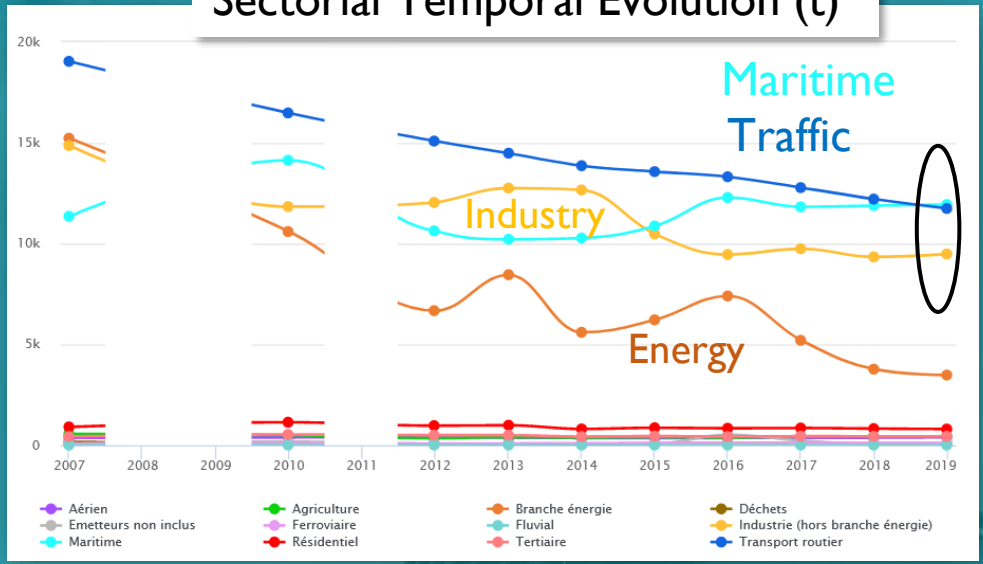
Marseille
Maritime Emissions Tendencies

AtmoSud's Emissions Inventory





Sectorial Temporal Evolution (t)



https://cigale.atmosud.org/

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Marseille
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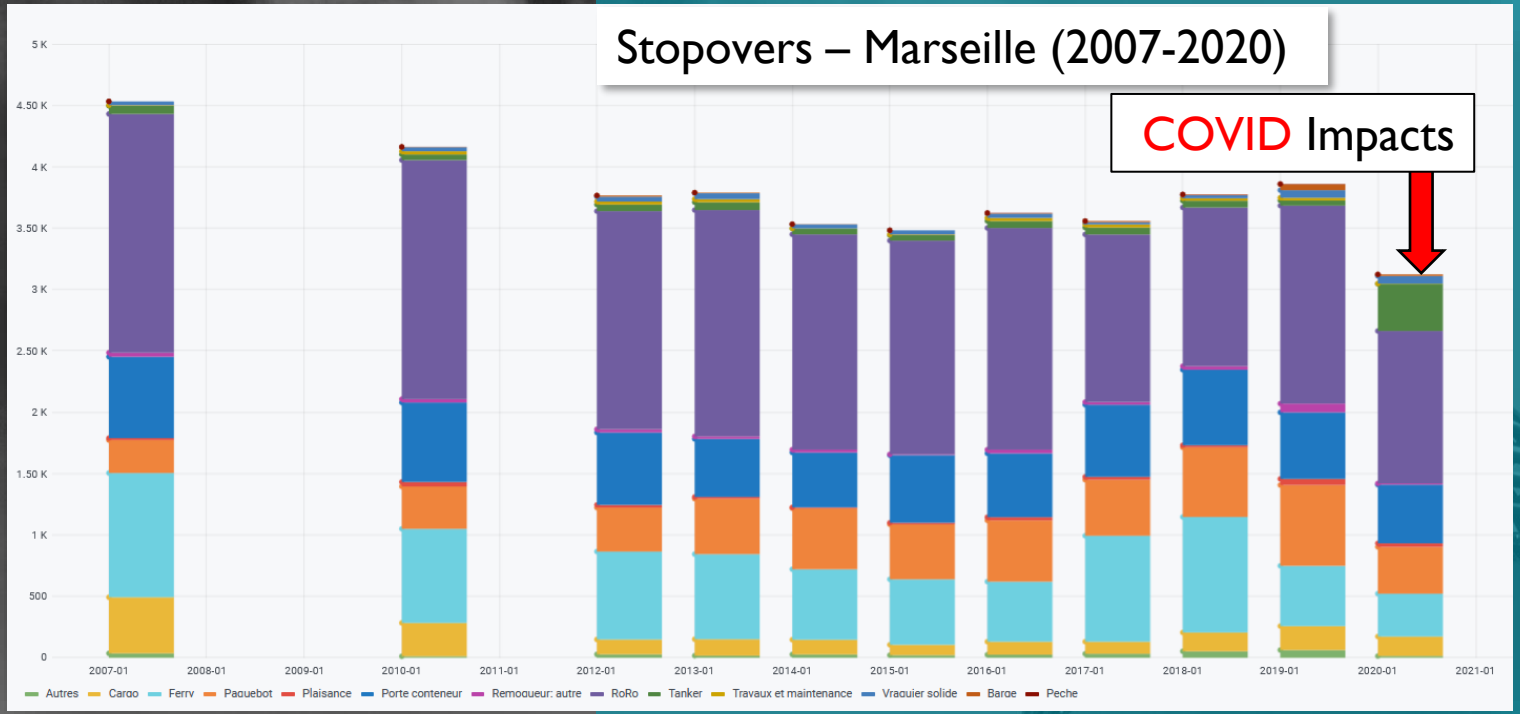

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Marseille
Maritime Emissions Tendencies

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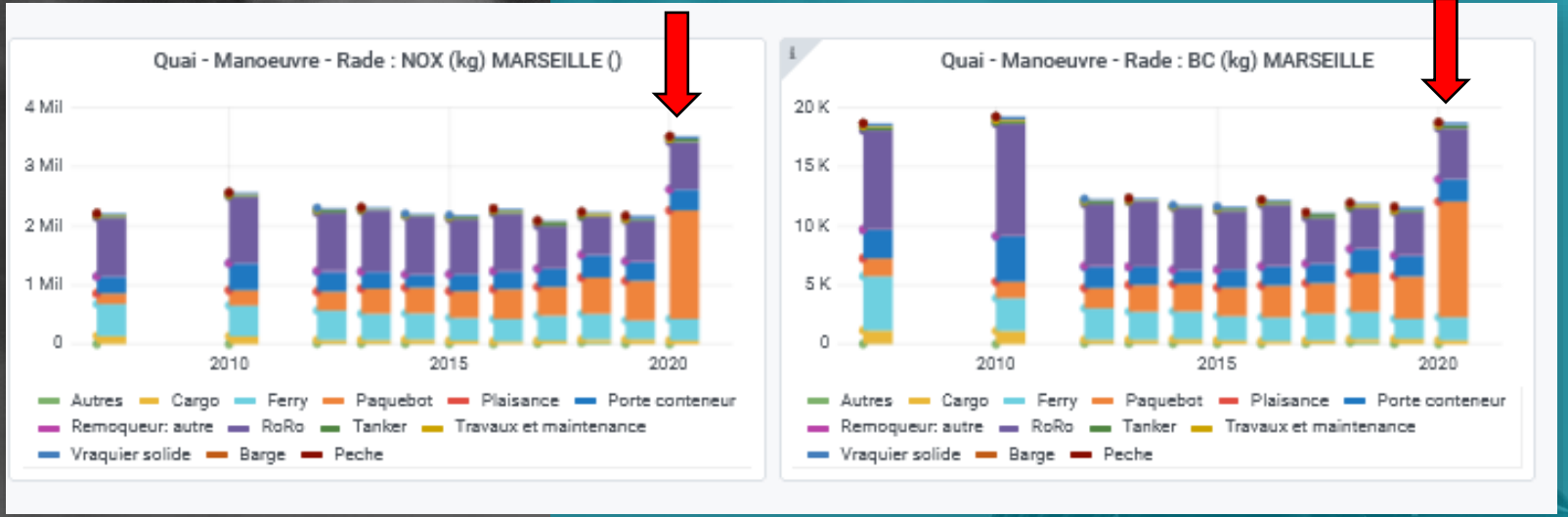
AtmoSud's Emissions Inventory

COVID Impacts



Many cruise ships stuck in port during the COVID Crisis

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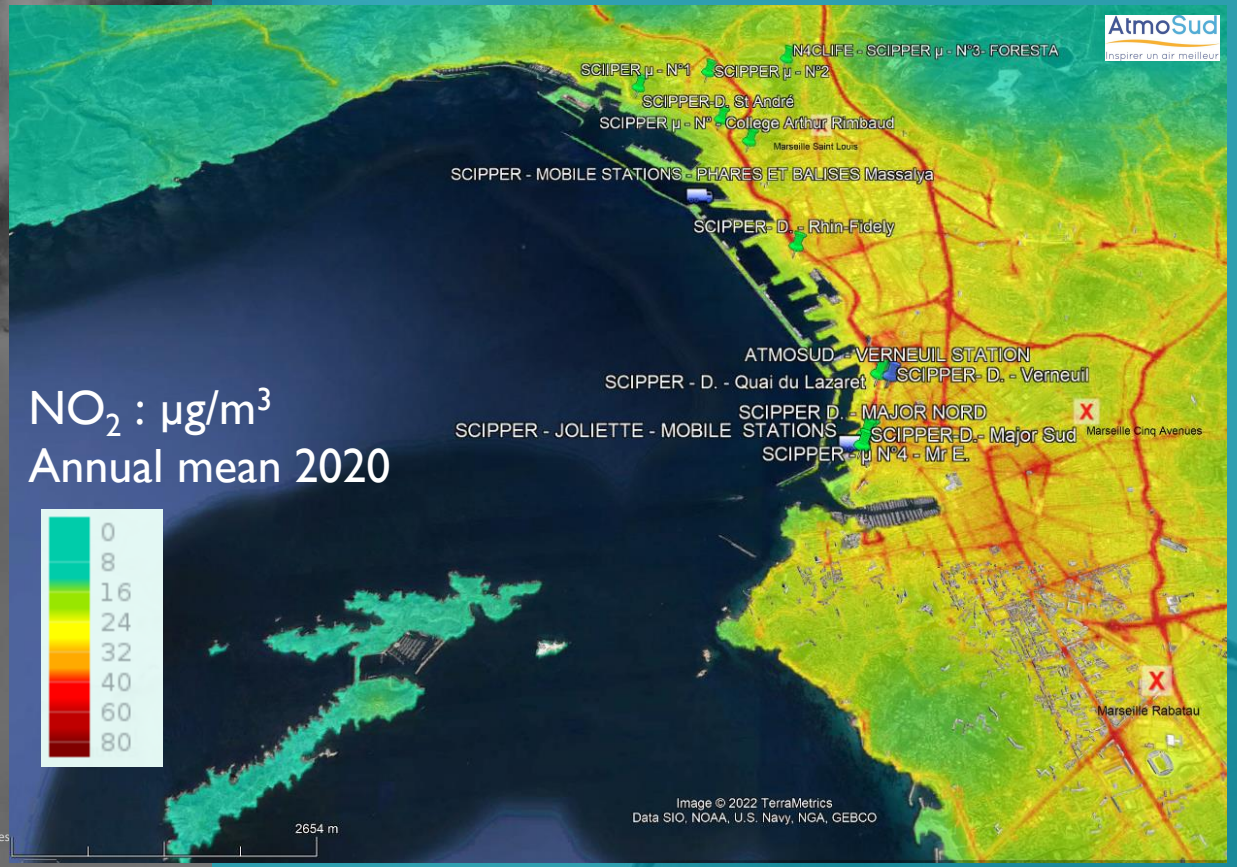
Marseille
Air Quality background

AtmoSud's AQ operational forecasting systems need to be confronted with models from academic research

Before SCIPPER Maritime Emissions were underestimated



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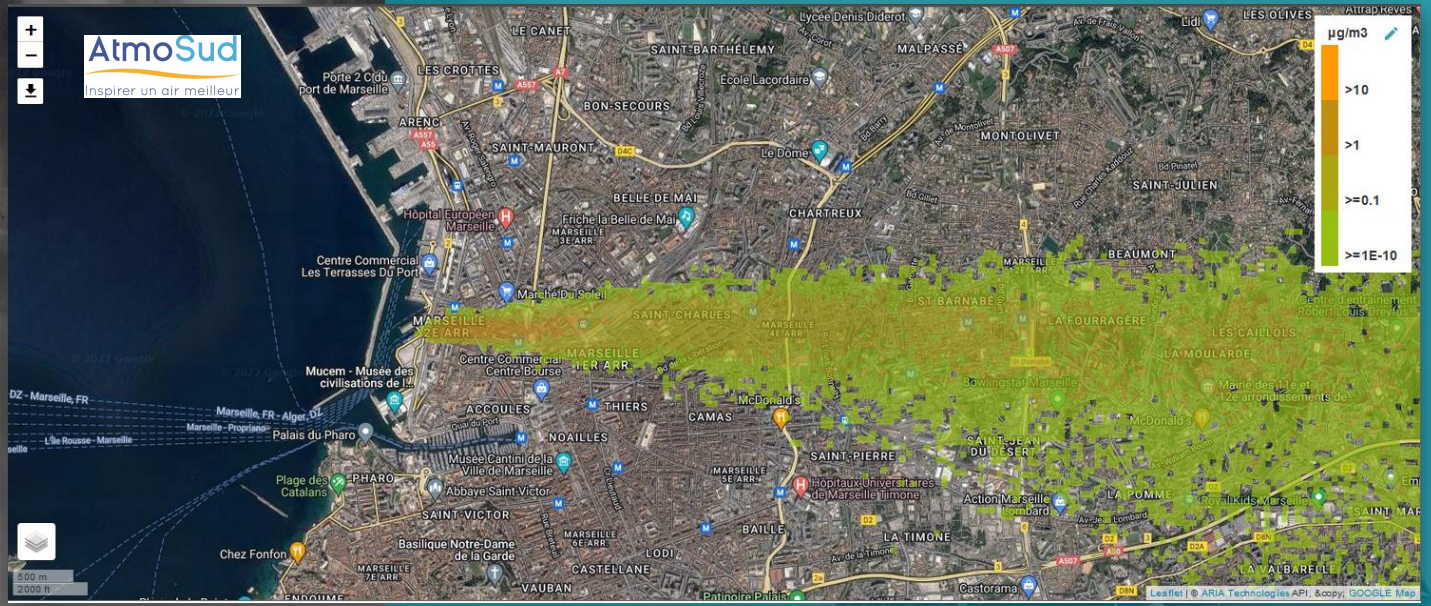

July 2021, Parallel Modeling Spray System (PMSS) Plume Modeling SO_2 : µg/m^3

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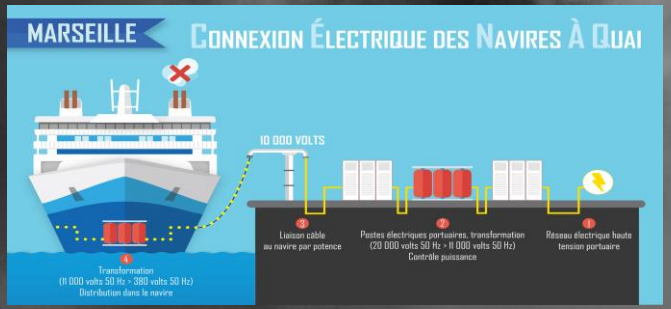
Solutions : link with French Maritimes Companies

Port of Marseilles

Electrical connection of ships



2022 : 3 ships connected La Méridionale

3 ships connected CORSICA linea

2026 : 8 additional docks will equipped with electric jibs

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Solutions : link with French Maritimes Companies

Port of Marseilles

LNG

2022 : 1st ship A GALEOTA

CORSICA linea 160 M€

2024 : 44 LNG powered ships

CMA CGM 2 B€

- 99% SOx & PM,
- 85% NOx,
- 20% CO_2

Expected

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Solutions : link with French Maritimes Companies

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Port of Marseilles

PARTICLES FILTER

2022 : 1st ship PIANA

La Méridionale 20 M€

CORSICA linea 5 ships equipped

30 M€

2024 : 80 ships will be equipped

CMA CGM 800 M€

12 to 15 times less particulate matter and sulfur oxide expected

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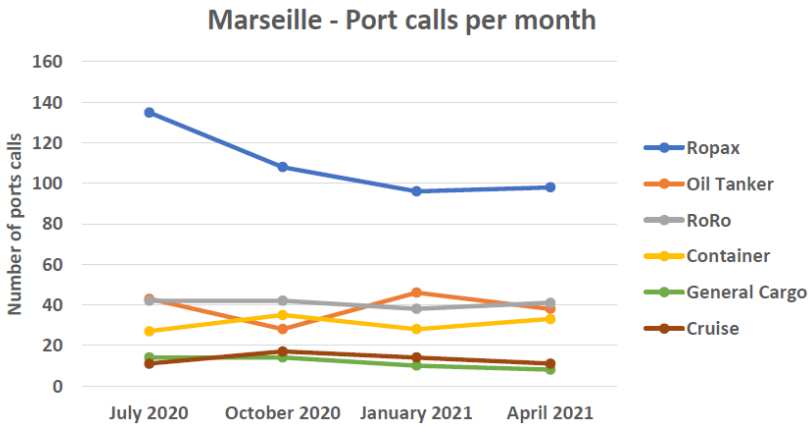
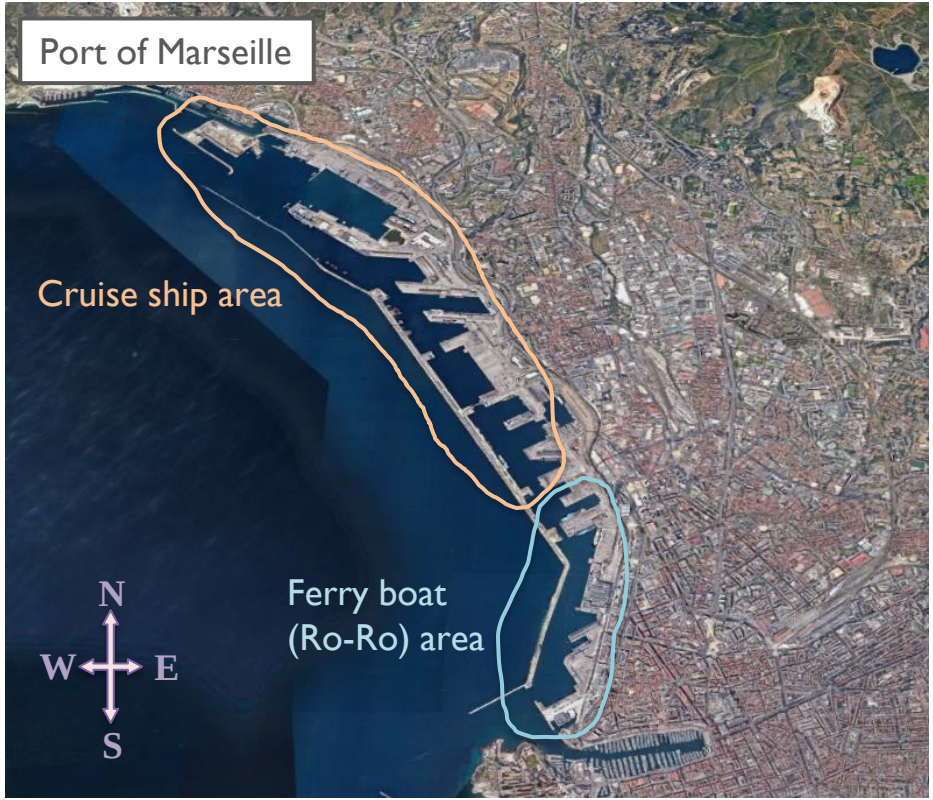
Port of Marseille

In 2019

- 2nd port in the Mediterranean
- 3.1million passengers
- 9917 ship stopovers





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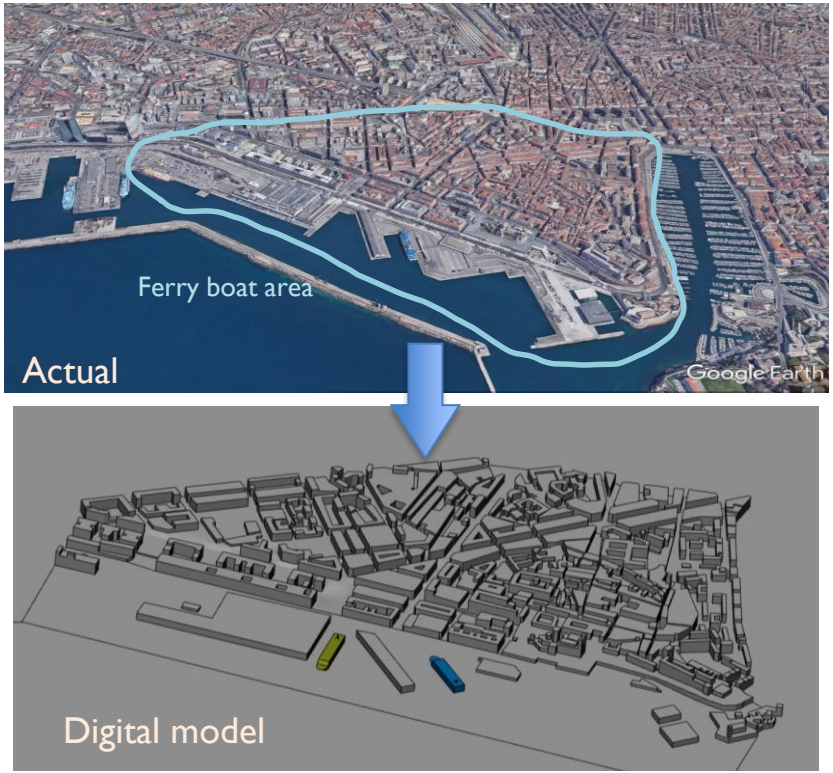
Details of high-resolution model

- Passenger port of Marseille
- Ferry boat area
- La Major Cathedral area (2x1.3 km^2)
- Study of ship emissions effect on urban area
- Measurement campaign timeframe (July 2021)



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Demonstration of a real case study

1. Le Champlain (small cruise vessel) - MSD
2. Northwest wind
3. Departure phase (Main Engines start)
4. Distillate (MDO, MGO)
5. Effect on coastline (La Major Cathedral)
6. Effect in the city (650m from the vessel)

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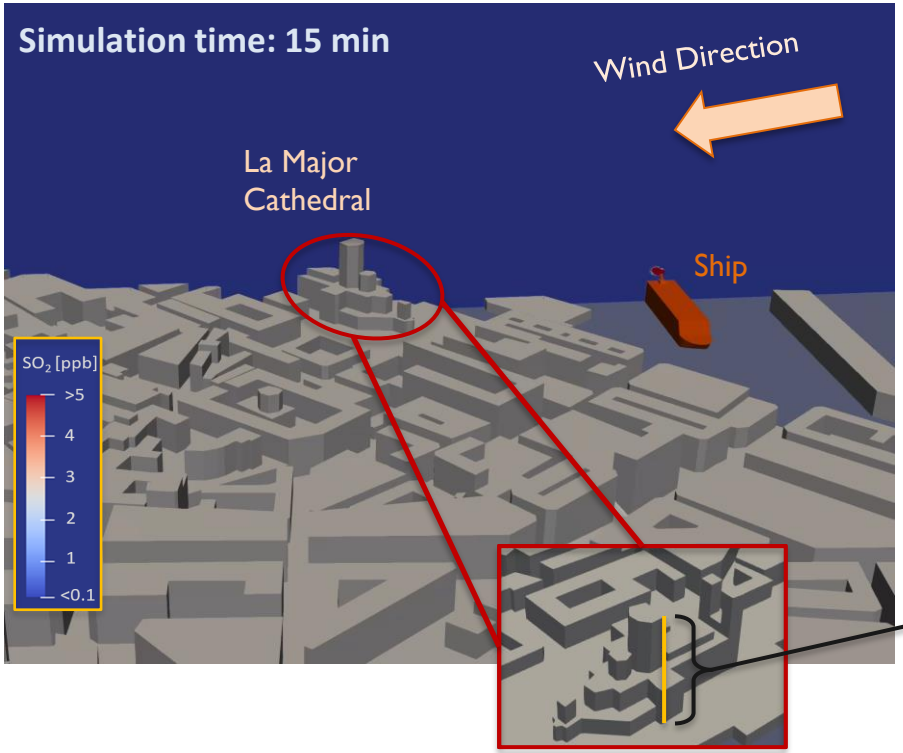
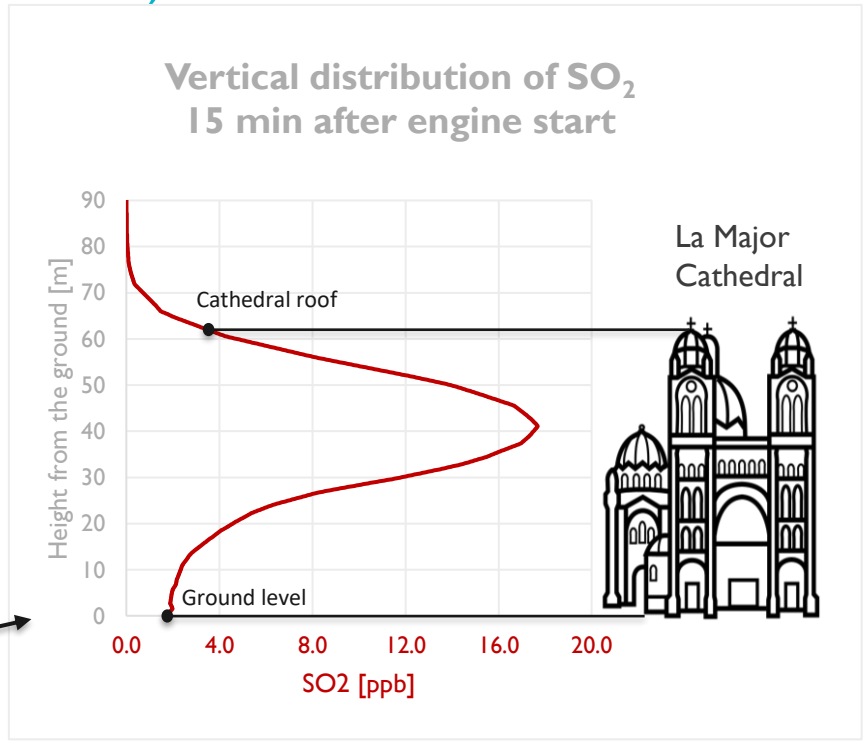
Effect on coastline (La Major Cathedral)





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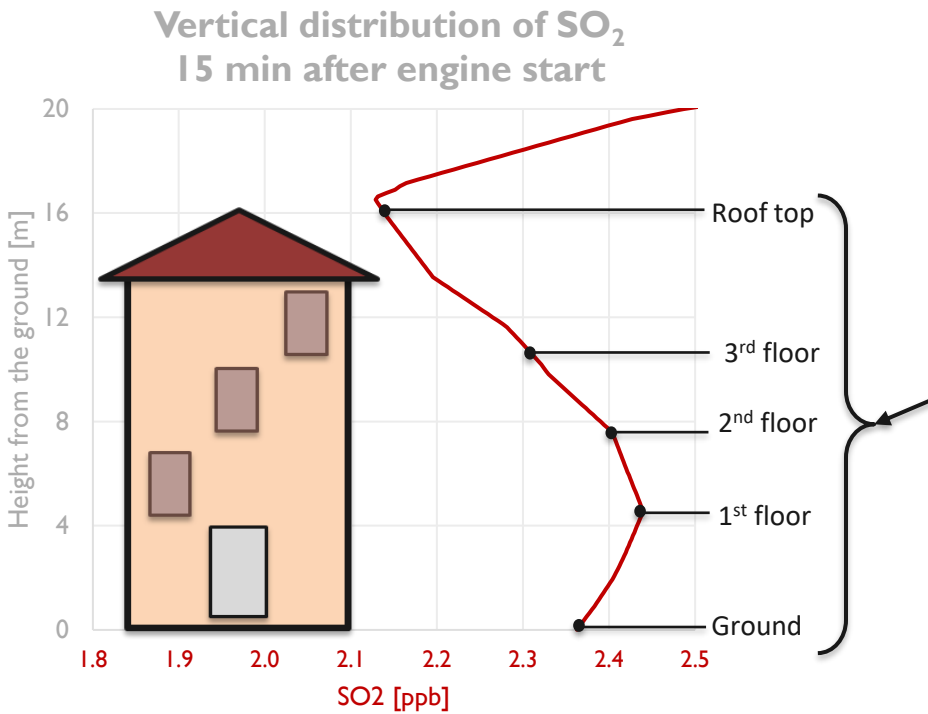
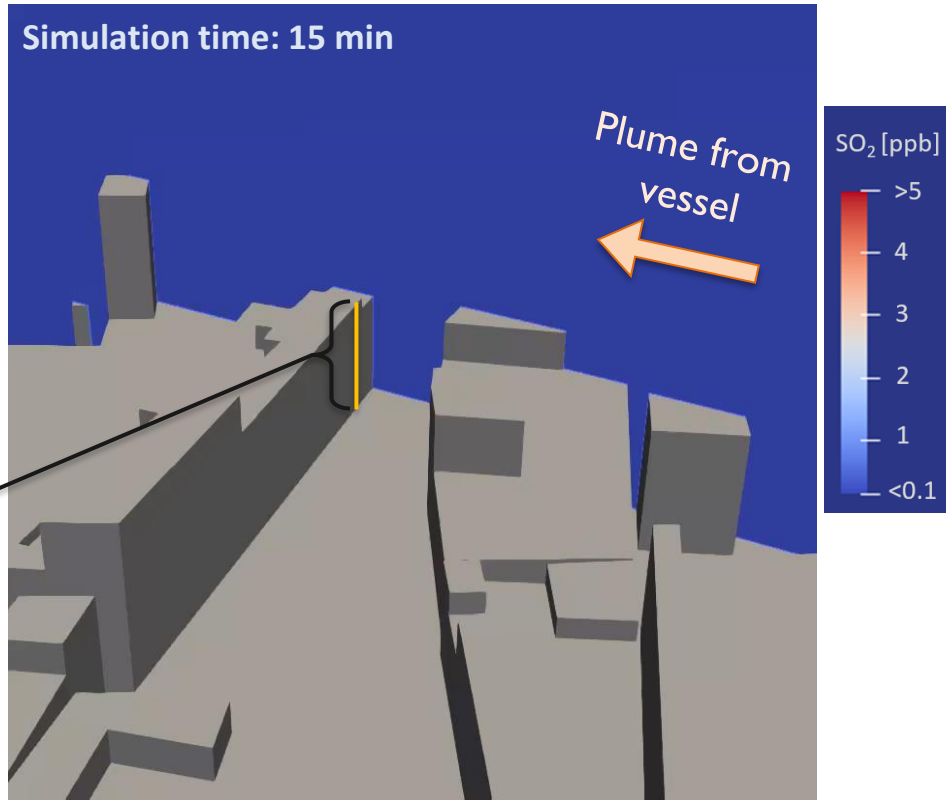
Effect on a dense built area





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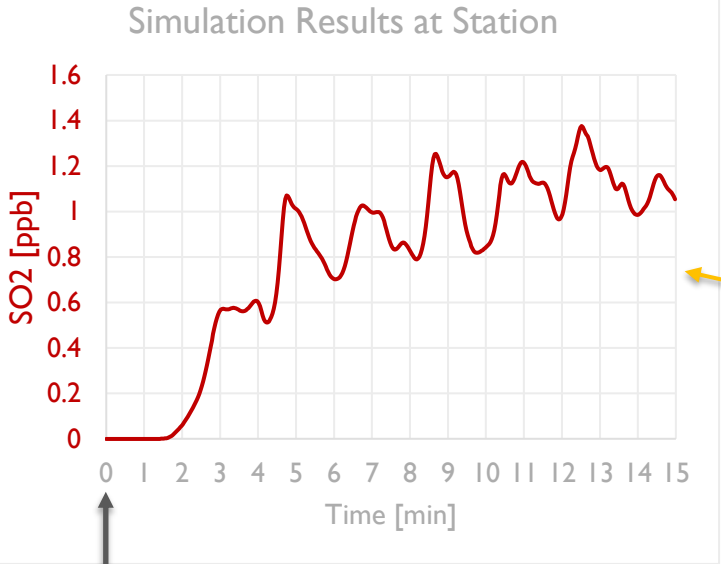
Prediction of concentration during an Engine Start event



Time = 0s
Main engines start

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Simulation results rendered on Google Earth

Dispersion time: 5 min

Next steps

II - Campaign data analysis (2019, 2020 and 2021)

II – Modeling July 2021

- Reference run : Meteorology, emissions and observations of July 2021
- Intercomparison between operational system and academic research
  - PMSS versus FLUENT

III – Mitigations Scenarii Modeling

- LNG
- Electric connection
- Particles filters

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Thanks
Σας ευχαριστώ

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Tampere University
ivl Svenska Miljöinstitutet
CHALMERS
TNO innovation for life
FMI
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PML Plymouth Marine Laboratory
exactEarth
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BSH – Bundesamt für Seeschifffahrt und Hydrographie
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