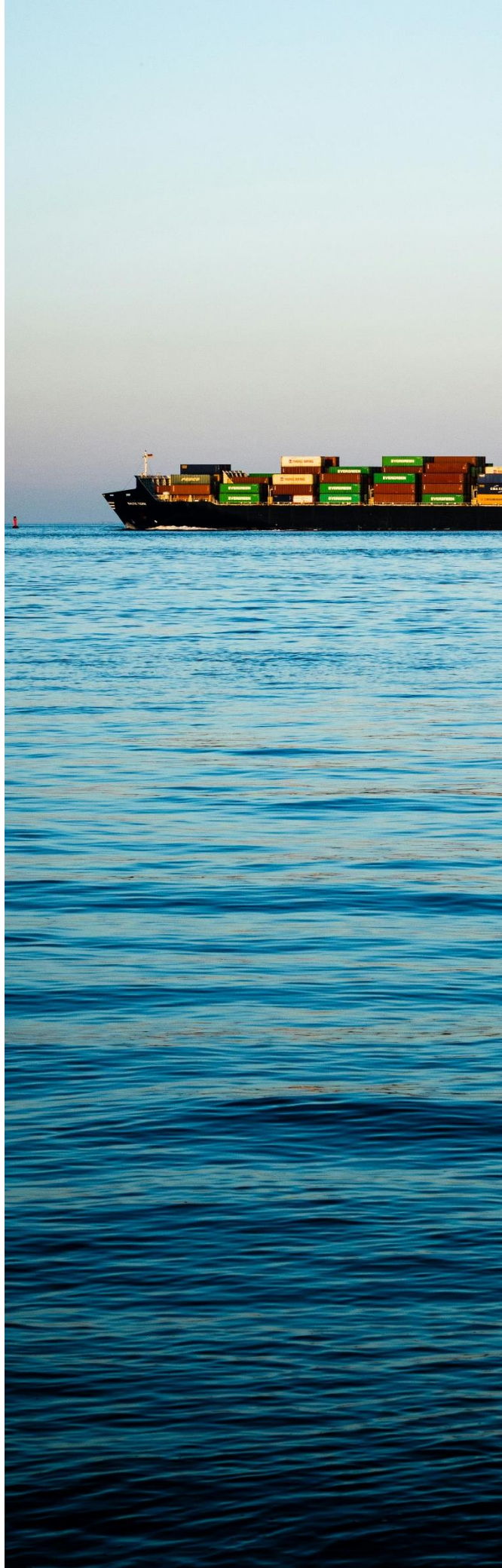# Unlocking **trust and impact** in **Marine Weather Forecasting**

A **White Paper** on achieving **safer**, **greener** and **more efficient** voyages with AI-driven precision in forecasts

AlongRoute

April 2025

Contents

The industry's weakest link
Why marine weather forecasting is failing shipping

Shipping is the **backbone of global trade**, but it comes at a cost; roughly **3%** of **Global Greenhouse Gas (GHG) emissions**.

With regulatory bodies like the **IMO** mandating **net-zero GHG** by 2050 and the **EU ETS** tightening compliance terms, the pressure is mounting on the industry to optimize operations. But there's a fundamental flaw standing in the way: **inaccurate marine weather forecasts**.

Marine weather forecasting is the **weakest link**, with **50% of 7-day forecasts failing** to predict **critical sea-state conditions**.
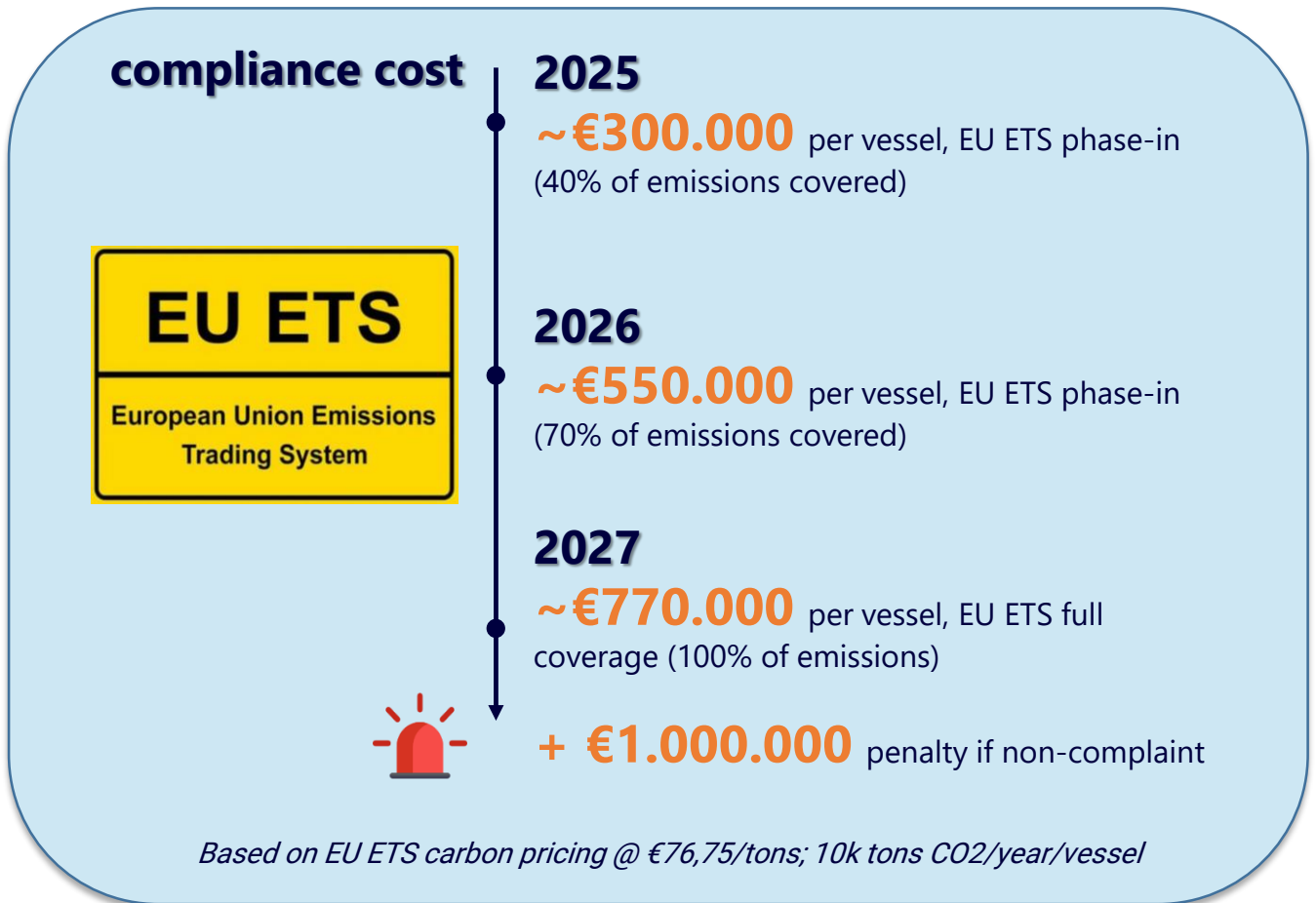
This **inaccuracy fuels distrust** in weather-based ship routing systems, **leaving captains reluctant** to follow optimization instructions.

Instead of achieving promised fuel and emissions savings of up to **20%**, **ships are left with just about 3% improvements**, missing significant opportunities for **efficiency.**

Without accurate marine weather forecasts, **ships navigate blind** — risking safety, wasting fuel, and facing fines and penalties.

The cost of doing nothing
Why inaction on the quality of marine weather data is no longer an option for shipping

compliance cost

EU ETS
European Union Emissions Trading System

2025
~€300.000 per vessel, EU ETS phase-in (40% of emissions covered)

2026
~€550.000 per vessel, EU ETS phase-in (70% of emissions covered)

2027
~€770.000 per vessel, EU ETS full coverage (100% of emissions)

+ €1.000.000 penalty if non-complaint

Based on EU ETS carbon pricing @ €76,75/tons; 10k tons CO2/year/vessel

Most **commercial vessels still rely on marine weather systems that fail to predict real sea conditions**. Inaccurate forecasts lead to **inefficient routes**, **wasted fuel**, and **rising financial penalties**.

With the **EU ETS phase-in**, the cost of inaction is skyrocketing; reaching up to **€770.000 per vessel, per year by 2027**, with additional penalties exceeding **€1 million if emissions are not accurately accounted for**. In this new reality, reliable marine weather intelligence is no longer optional; **it's a regulatory and financial necessity**.
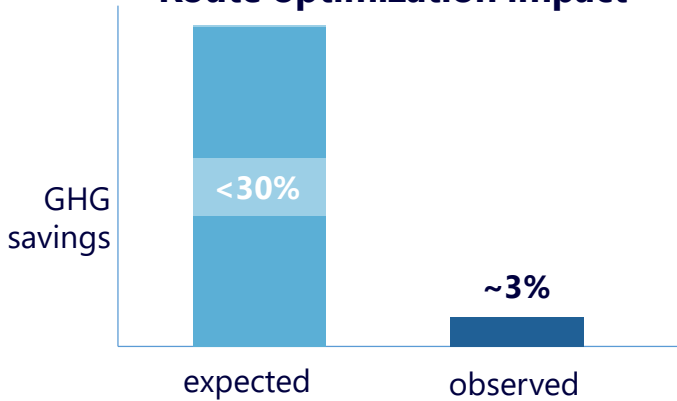
In today's shipping industry, **the ability to plan**, **document**, and **defend every nautical mile** is the foundation of **profit** and **safety**.

The hidden impact of marine weather uncertainty
How inaccurate marine weather forecasts erode savings, safety and sustainability

Even with routing optimization tools onboard, **shipping companies continue to fall short of their decarbonization and efficiency targets**; largely due to **unreliable marine weather forecasts**.

Poor marine forecasts can increase ship resistance by up to **220%**, causing **fuel waste**, **hull stress**, and **routing failures**.

A single transoceanic voyage can burn **64** extra tons of fuel — **€48.000** lost — and **emit avoidable CO$_2$**.

Despite promises of **30%** savings, real-world results deliver just **~3% due to weather inaccuracy**.

With **EU ETS penalties rising**, this shortfall now costs **€230.000+** **per vessel, per year**.

Route optimization impact

GHG savings

<30%

~3%

expected

observed

Trust in voyage optimization is deteriorating. Without **forecasts that reflect real ocean conditions**, **systems go unused**, **captains revert to manual judgment**, and **emissions targets slip further out of reach**.

Forecast: **calm seas**
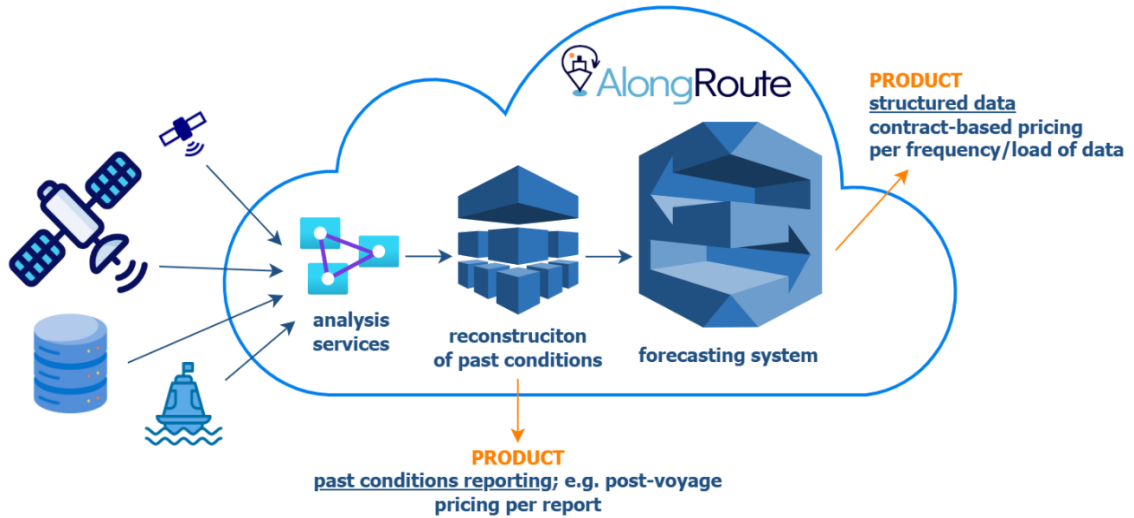
Reality: **rough seas**
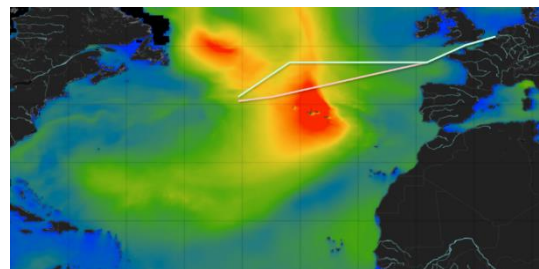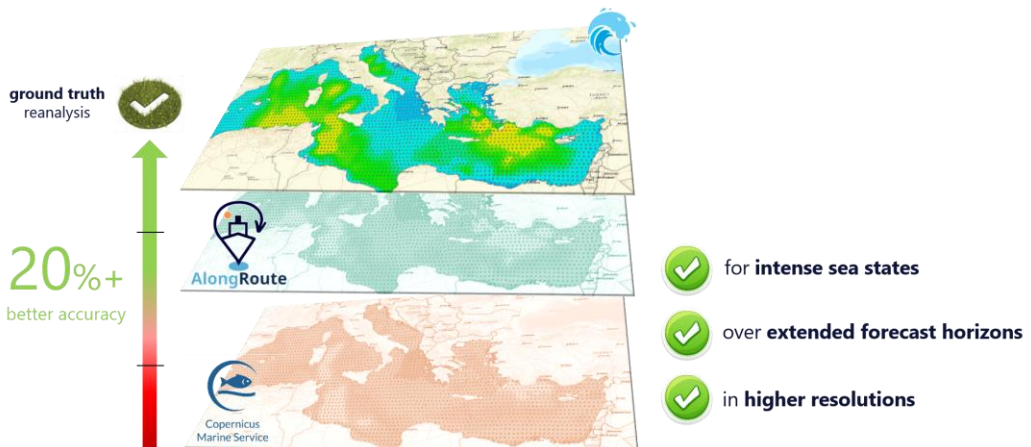
fuel burn   **emissions**   **trust**

The breakthrough
AI-powered marine weather intelligence that operators can trust

AlongRoute delivers the **high-accuracy marine weather forecasts** and **trusted insights** that routing systems need to reach their **true potential**; empowering captains to **trust**, **optimize**, and **sail smarter**.


Multi-sourced historical data from reliable sources, in combination with the most appropriate **AI set-ups** can **capture correlations** between ocean processes that human applied physics and math **could never catch**.

With up to **20%+** more accurate, high-resolution, predictions for **intense sea-states** and **over long forecasting horizons**, **AlongRoute eliminates uncertainty**, allowing operators to confidently plan their voyages.

Validated performance
How AlongRoute's data stand out

Mean metrics over prediction depth for VHM0 (Significant Wave Height)
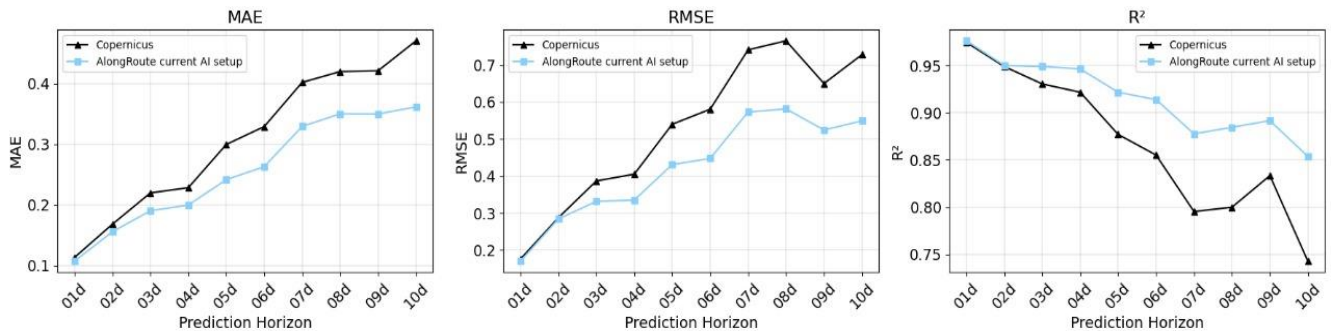
AlongRoute's approach sets the **industry benchmark** from the outset. Using advanced AI technologies our system delivers **unprecedented accuracy in predicting oceanographic parameters**.

Our current products' **performance metrics** - Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and an outstanding Coefficient of Determination (R^2) of **0,85** – **significantly exceed industry standards**, such as Copernicus' **0,73**.

Our strategic R&D roadmap aims to further refine our forecasting technologies by **incorporating a wider range of data inputs and cutting-edge tools, improving our AI algorithms and enhancing our accuracy rates**.

Indicative benchmarking of **Significant Wave Height** as compared to reanalysis data (ground truth) for a 10-day forecast


R^2

0,85

0,73

forecast
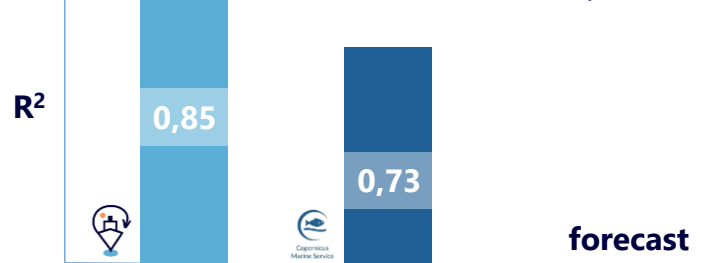
The results of an external validation performed for our Mediterranean prototype have already been **published in the peer-reviewed journal** Procedia Computer Science, underlining the solid foundation on which our current developments are built.

This demonstrates the **immense future potential.** The early success of our models is just the beginning, demonstrating what is possible and foretelling **a future of continued excellence and innovation**.

Industry and environmental impact
Turning forecast certainty into measurable gains

130%+

15%-25%

10%-23%
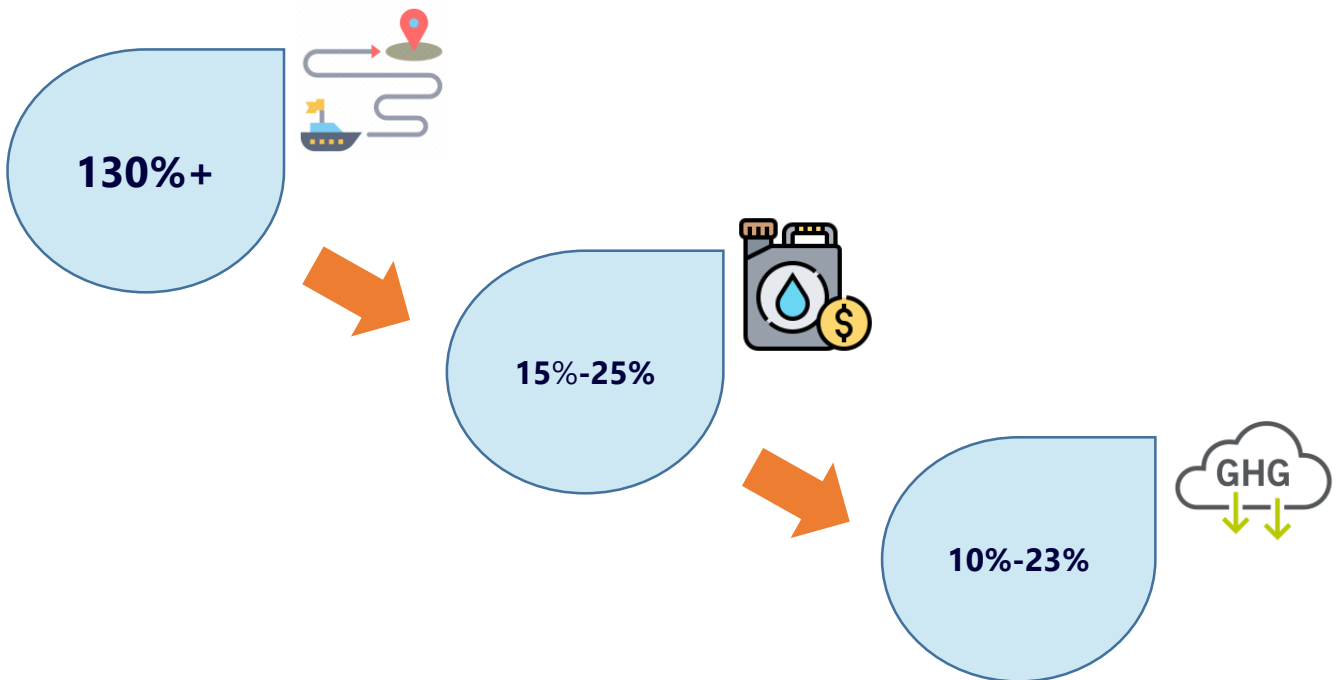
Trust in route optimization starts with **accuracy**. Better forecasts reduce uncertainty, allowing systems to make smarter routing decisions that crews can rely on. **AlongRoute's validated models not only improve prediction accuracy but restore confidence, unlocking performance that routing systems were designed to deliver.**

In **real-world scenarios**, this leads to significant operational impact.

A single vessel burning 100 tons of fuel per day over a 10-day voyage can save up to 15–25% with accurate routing, amounting to €112.500 in direct fuel savings. That same fuel savings prevents over 3.000 tons of CO_2 emissions annually, translating into €240.000+ in avoided EU ETS costs.

Whether measured in **trust**, **tons**, or **euros**, the outcome is the same: **smarter forecasts pay off**.

AlongRoute
Meet us, trust us

AlongRoute, established in Greece in 2022, **focuses on overcoming forecast uncertainty**; a key obstacle limiting vessel optimization, environmental performance, and operational safety. The team brings more than **90 years of combined experience** in business, innovation, oceanography, geomatics, AI, remote sensing and data science.

Georgia Kalantzi, **CEO**, brings a strong background in physical modelling, oceanography, earth observation, data science business, and innovation.

Oceanographer, PhD

Vasileios Alexandridis, **CTO**, offers deep knowledge in geomatics, remote sensing, data science, GIS and machine learning.

Engineer, PhD (c)

Stergios Diamantopoulos, **Entrepreneur in Residence**, contributes extensive experience in environmental sciences, management, and entrepreneurship.

Environmentalist, MSc

Apostolia Papadoudi, **CFO**, has a solid track record in environmental sciences, financial coordination, project management, and human resources.

Environmentalist, MSc

Pavlos Patsonis, **Executive AI Engineer**, brings deep expertise in physics, strong programming capabilities and hands-on experience with space data.

Physicist, MSc

Our journey
From vision to reality

The idea is born: recognizing the impact of the marine weather forecast **uncertainty** to maritime operations

2020

est. 2022

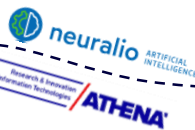**Early development:** validation begun, bringing **PoC** and Mediterranean **prototype** to life

2021

Recognition: selected for **ESA BIC Greece** and **synergistEIC** Accelerator, we received funding and support for space data integration, testing and **confirmation of significant accuracy improvements**, sparking industry interest

2023

External validation: our **product was validated** by research institutes and fellow deep-tech companies leading to our first peer reviewed publication and establishing initial **early adopter relationships**

2024

Piloting and market confidence: our first pilot converted to a **paying customer early on**, marking the transition to commercial implementation

2025

Scaling for global impact: we are targeting a wider industry adoption towards being a global leader in **marine weather intelligence**

2026
and beyond

We have the team, we have the knowledge and we have the solution.

We are AlongRoute and we are set to guide every mile.

Team@AlongRoute.com