



Reduce Environmental Impact and Improve Performance with Weather Optimized Routing

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Introduction to Weather Optimized Routing

Regardless of the good seakeeping abilities of modern seagoing vessels, their efficiency — and in some cases, the safety of their operation — depends significantly on weather conditions. For this reason, just like in the past, the choice of ship routes when planning and performing the voyage retains its importance.

No matter how sophisticated the weather forecasting is or how widespread the use of computers, satellite communications and novel informational technologies are onboard ships, the weather still plays havoc (at times with tragic consequences) with seafarers' plans.

Routing a vessel is a straightforward plan, but getting a ship from one port to another, while managing costs, keeping fuel consumption down, and minimizing the environmental impact is not easy.

Overcoming this hurdle is where weather optimized routing comes into play. It calculates the most effective route for a vessel, utilizing weather forecasts, sea condition data, and the insight on the ship's characteristics and cargo (both below and on deck).

An optimized route is not always the shortest. It maximizes the safety and comfort of the crew, while minimizing fuel consumption, managing time underway, ETA / Lay-can or any desired combination of these factors, all within the specific constraints the weather and sea condition limits on each voyage.

This guide explores why the shipping industry needs weather optimized routing now. It shares real-life examples of how other shipping businesses are innovating with weather optimized routing, and demonstrates how weather optimized routing helps reduce environmental impact and improve performance.

Why the Time for Action is Now

Whether you're a charterer, ship owner, or a vessel manager, it's no surprise that the weather impacts your work. This situation has always been the case for shipping companies. So, the question is, why now? What changes are happening that mean weather optimized routing is essential to help reduce your environmental impact and improve vessel performance. We've identified five trends that answer this question.

1. Climate change and more extreme weather conditions

Heavy rainfall, extreme temperatures, and hurricanes make it clear that our [climate is changing](#), and that the world's oceans are [becoming more stormy](#). Over the last 30 years, observations show increases in average wave height and wind speeds.

In the Southern Ocean, average wind speeds have increased by 8% or 1.5 meters per second, and average wave heights have increased by 5% or 30cm. While these increases might not sound massive, if the trend is sustained over time, it means that the weather would become more extreme and make conditions more challenging for shipping companies.

Alongside this, environmental awareness has increased among the general public, which, in turn, puts pressure on businesses to reduce atmospheric emissions and adopt a greener approach.

Impact: More extreme weather conditions, combined with growing environmental awareness, demand the shipping industry to become more sustainable and lower the impact on the environment. In the future, weather is more, not less likely to impact on operations.

2. Competition, mergers, and alliances

[Tight margins and growing competition have seen a trend of mergers and alliances in the shipping industry](#). This trend can be a real benefit because it leads to improved supply management and efficient fleet utilization. Shipping companies benefit by using their resources to decrease operating costs and sharing resources, like port calls.

[For smaller players in the industry, however, this development is a particular concern](#), as they will rely on competition authorities to remain vigilant to prevent them from being squeezed out. It's also a potential issue for countries served by a lower number of carriers, where mergers and alliances may further reduce the options.

Impact: Growing competition and pressure to remain cost-efficient means that some shipping companies are turning to collaborations, alliances, and mergers to stay competitive.

3. Legislation and environmental regulation

New regulation introduced this year by the International Maritime Organization is one of the most significant changes experienced by the shipping industry. Known as [IMO 2020](#), the new rules fundamentally alter the way ships are fueled by mandating vessels to reduce the sulfur levels in emissions. Starting January 2020, the allowed sulfur emissions cap reduced from 3.5% to 0.5% worldwide. The legislation continues IMO's commitment to reduce emissions generated by ships by at least 50% by 2050, compared with 2008 levels.

Major players in the industry, including the likes of [Maersk and MSC](#), report that IMO 2020 compliance is likely to result in additional costs of \$2 billion each. These increases are due to expected higher fuel costs or investments required by shipping companies to make vessels compliant with the regulation.

Impact: Tighter legislation on sustainability and emissions, with an increased risk of fines and reputational damage.

4. Consumer pressure to improve sustainability

Customer experience is not traditionally a high priority in shipping, compared to consumer-focused industries like retail or high-street banking, but customers expect it from every sector. In particular, growing consumer concerns around sustainability and environmental impact mean companies in all sectors must react and adapt.

Studies show that [customers are increasingly expect companies to have sustainability strategies and care about the environment](#). They want to spend their money and align with companies that meet these expectations. Using weather optimized routing is one way that shipping companies can demonstrate their commitment to environment and quantify their reduced-emission efforts.

Impact: Customers want and expect companies to improve their sustainability — even in industries that are not traditionally seen as 'consumer.'

5. Digitization

Digitization will help support collaboration between companies by streamlining information sharing. Technologies like autonomous ships, blockchain, and drones will potentially offer significant opportunities for the shipping industry. IoT technology is already supporting navigation in challenging conditions, such as adverse weather conditions or in congested waterways.

However, concerns remain regarding safety and cybersecurity. As well, there are worries about the negative impact of new technology on seafarer's jobs.

Specifically, with regards to weather data, digitization will mean APIs can be used to enable access to forecasts using in-house technology and systems — and could help drive forward more environmentally friendly technology. This advancement will also help create a complete view and will help to integrate forecasts into the decision-making process.

Impact: Integrating weather data into internal systems will help streamline communications and decision-making.

How Shipping Companies are Innovating with Weather Optimized Routing

Modern shipping companies work hard to maintain their competitive edge, however, not every business is aware of the value accurate weather data can bring. Here are three examples, showing innovative uses for weather data.

Arctic voyage: sailing challenging routes

Biggest challenge: driving efficiencies and reducing fuel consumption through new route

Weather challenge: extreme weather conditions

Sailing Arctic waters is demanding for both vessels and crews. The water is only free of ice for a short period (approximately three months each year), specific ships are needed, and there are many uncertainties and unknowns in the region. Opening routes through the Northeast Passage could bring potentially significant efficiencies, including fuel and time savings.

There aren't many ships that can sail in this part of the world. The vessel must be freeze tolerant and assigned a polar class, indicating how much ice pressure it can withstand. The insulation needs to be robust and the technical system onboard must be able to keep the fuel at the proper temperature to prevent it from freezing or becoming too viscous to pump. Additionally, a lot of ice can build up on deck and in the cargo hold, so the ship must remain stable despite this extra weight.

Weather experts are also aware of the difficulties and challenges specific to the Arctic, such as reduced visibility and ice floes. If the wind turns, perhaps right behind a low-pressure front, ice floes may be pushed together, and a large ice field could suddenly appear off the bow of a ship. Ships have to be able to anticipate that.

In 2018, the biggest container shipping company used onboard weather optimized routing technology as part of an experiment to determine the viability of routes through the Northeast Passage.

They used the journey to assess whether or not the ice that stays at sea in the 'warm months' obstructs shipping. If the route is deemed viable, it could translate into significant efficiency gains. Routing around northern Russia saves considerable fuel and time compared to using the Suez Canal. It could be the beginning of multiple shipments via this Arctic route.

Integrating weather optimized routing with in-house system

Biggest challenge: optimize for voyage conditions

Weather challenge: ensuring each ship runs at peak performance

At one of the largest shipping companies in the Netherlands, the crew, technical, and operational departments strive to minimize both fuel consumption and air emissions (sulfur, nitrogen, CO2). The company continually seeks new ways to optimize the efficiency of vessels' propulsion systems and facilitate economic sailing. Weather optimized routing is vital to ensure sustainability, help to save time, money, and, of course, fuel.

In-house-developed IT systems ensure smooth cooperation between fleet and office, providing the basis for full compliance. All vessels use advanced weather optimized routing systems to track and avoid bad weather and to optimize voyages based on conditions. Special attention is devoted to speed optimization.

Weather optimized routing helps to save time, money, and fuel. Pre-built ship models also assist master mariners to determine the best possible routing. A further innovation comes from the data itself, using it to verify weather forecasts, optimize fuel efficiency, and reduce environmental impact further.

Real-time results: weather optimized routing 2.0

Biggest challenge: getting integrated access to real-time data

Weather challenge: accessing real-time weather data

In the past, ship operators would have to send instructions for routing purposes to onshore weather teams. With the use of an API, ship operators can send their requests and updates directly through their system. APIs translate the gathered data into a uniform language, so different data sources can be combined and analyzed together on the platform — in real-time.

This technology includes, but is not limited to, creating new voyages, updating voyages' profile (such as speed and fuel prices), inserting new ship profiles, and nominating vessels for data monitoring. The experts create and monitor the vessel's route to provide the company with three different services:

- Routing based on charter party: Chartered vessels are guided and controlled based on the inputs from the charter party.
- Fixed estimated time of arrival: Ensures that ships sail the optimum speed and route based on the fixed arrival time.
- Optimum costs: The optimum route is based on a flexible time of arrival, speed ranges, and cost of fuel — ensuring the vessels sails at optimum costs.

Four Benefits of Weather Optimized Routing

The benefits of weather optimized routing sit in four main categories.

#1 Reduced environmental impact

What's the risk: There is a growing international focus on [sustainable business](#). It's no surprise that reducing fuel consumption remains at the top of the list for the shipping industry — ocean-going ships contribute [3% of global carbon dioxide emissions](#). While regulations like IMO 2020 help, shipping companies can implement other approaches to reduce their environmental impact.

How weather optimized routing can help:

[Studies](#) show the shipping industry can reduce emissions by up to 55% through measures to reduce fuel consumption. Specific techniques, like speed reduction and weather optimized routing, can reduce emissions by 17-34% and 1-4% respectively and save up to €280 per ton of fuel. Reducing emissions through speed reduction does have limitations because time is always a key consideration. However, full knowledge of circumstances can allow a vessel to slow down when necessary. For example, if adverse weather at a terminal means it cannot handle the cargo, relaying this information to the captain means he can reduce the speed. Otherwise, the vessel has to wait outside port until the weather improves. The same can also apply if the lay days and the canceling clause in a charter party allow.

#2 Improved vessel performance

What's the risk: Route planning for maximum efficiency, safety and minimizing the environmental impact is not easy. Whether managed onboard or onshore, teams need the right tools to help support their decisions and ensure they're sailing the optimal route for their voyage.

Onboard, captains have to manage safety, efficiency, fuel consumption, ETAs, speed ranges, and additional constraints, including trim and seakeeping. Onboard tools can give them more confidence in their decisions by helping them to calculate the route that will help them meet their KPIs.

Alongside this, charterers, owners, and vessel managers also want detailed weather information. They need it to pre-plan routes before a voyage, but also to adapt during the passage and analyze post-voyage.

By recalculating the optimal route using the latest weather forecasts, onshore teams can help captains save time, fuel, and reduce emissions.

How weather optimized routing can help:

Accurate weather data and advances in technology mean that captains can have more data onboard than ever before. The variable speed algorithm can be used to lock in the appropriate speed to arrive on time, avoiding severe weather. Other tools, such as voyage trim optimization, specifically help reduce fuel consumption and increase the utilization of your fleet.

Adverse weather alerts can let you know if conditions are changing on your planned route. This insight enables you to plot an alternative route before it affects the performance of the voyage or becomes a safety risk.

#3 Increased voyage safety

What's the risk: Adverse weather poses a safety risk to the crew and the ship itself from excessive ship motion, slamming or seas washing over the decks. When ships enter gale force or higher wind fields, this strongly impacts the ability of the captain to maneuver the vessel.

While shipping companies want vessels to take the optimal route, to save time and money, they need to know that their vessel will withstand the conditions along their chosen route and ensure the safety of your crew and cargo.

How weather optimized routing can help:

Avoiding adverse weather conditions are vital to keeping crew and assets safe. Confidence in the weather forecast helps to make the right calls, at the right time and ensure safety throughout.

Seakeeping also helps to protect vessels from synchronic roll and avoid heavy vessel rolling.

#4 Cost-saving and improved operational efficiency

What's the risk: Fuel costs are one of the most significant expenses for each voyage. Sailing inefficient routes inevitably use more fuel, which increases the costs.

There are many variables, which makes it hard to compare two journeys. However, the choice of route can make a massive difference to the profitability of a voyage. For example, when master mariners are passing Skagerrak on their way to the east coast of the United States, they will typically ask for advice on the next part of the route. They can either pass just above the British Isles or sail through the English Channel. In theory, a master can knock 35 hours off the journey by not going through the English Channel. But the weather can be worse on the alternative route, mitigating the time saved. Knowing which route is best will vary depending on conditions, which is why accurate weather data is essential.

The goal is not to avoid all adverse weather but to find the best balance. It's about minimizing the time of transit and fuel consumption, without placing the vessel at risk. The savings in operational costs come about by reducing transit times, reducing fuel consumption, and minimizing cargo and hull damage.

For example, vessels that are not taking advantage of dynamic speed routing to sail efficiently can end up navigating around bad weather, rather than slowing down or speeding up. This approach uses more fuel and, consequently, increases emissions.

How weather optimized routing can help:

Weather optimized routing, either onboard or onshore, ensures that the benefits of reducing fuel consumption and saving costs does not compromise on efficiency — or sustainability.

Taking into consideration the voyage's KPIs, the optimal route means you can reduce fuel consumption without missing ETAs, break charter party agreements, or impact safety. Weather optimized routing can [offer fuel savings](#) between 2- 5%, depending on the type of vessel, the season, and the conditions. Taking a fuel saving of 5% and a bunker price of \$5000/ton, a ship burning 50 tons of fuel per day would see savings over \$8500 on fuel costs during a seven-day transit.

Forecast accuracy and trust in this accuracy are vital for decision-makers.

Conclusion

Sailing the shortest distance between two ports isn't always the quickest or most fuel-efficient route. Instead, forward-thinking charterers, owners, and vessel managers use weather optimized routing to enhance their routes based on voyage KPIs — fuel consumption, ETAs, and other charter-party conditions — while ensuring they reduce the environmental impact of voyages.

Charterers, shipping companies, and ship owners can elect to use weather data both onboard and onshore:

- Onboard routing systems enable captains to calculate the optimum route without compromising on safety.
- Onshore monitoring systems use aggregated vessel data to provide fleet operators, operations managers, and performance managers performance analysis.
- Onshore dedicated-routing teams can offer optimal route guidance with vessels thanks to the expertise of experienced master mariners.

Weather optimized routing is the art and science of developing the “best route” for a ship based on the current weather forecasts, ship characteristics, and cargo requirements. It can be an active driver for cost-savings. These gains come from the interaction with the weather forecast and the weather experts. Working collaboratively with an experienced team can unlock insight that isn't apparent from a free or basic weather service. And that's what it's about: seeking out those extra savings to ensure profitability and peak vessel performance — without compromising on sustainability.