

Ship Energy Performance Framework

Case Study: Optimum Weather Routing, Evaluation of Fuel Savings

Tier 4: Improvement Evaluation



Case

An owner who hired the services of a weather routing provider tasked ABS with reviewing the optimum path the vessel followed and estimating the fuel savings.

Methodology

Applying its in-house experience in vessel performance monitoring and analysis, ABS created a computational model of the vessel's propulsive performance. In addition, a vessel-specific seakeeping model was created to respond to different conditions. Utilizing Automatic Identification System data and Hindcast weather data, ABS determined the propulsion energy requirements for the entire voyage and discussed the choice of an alternative path. Safety constraints were also incorporated by excluding routes with wind speeds or significant wave heights above user-defined limits, as well as weather conditions associated with unsafe vessel responses.

Deliverables

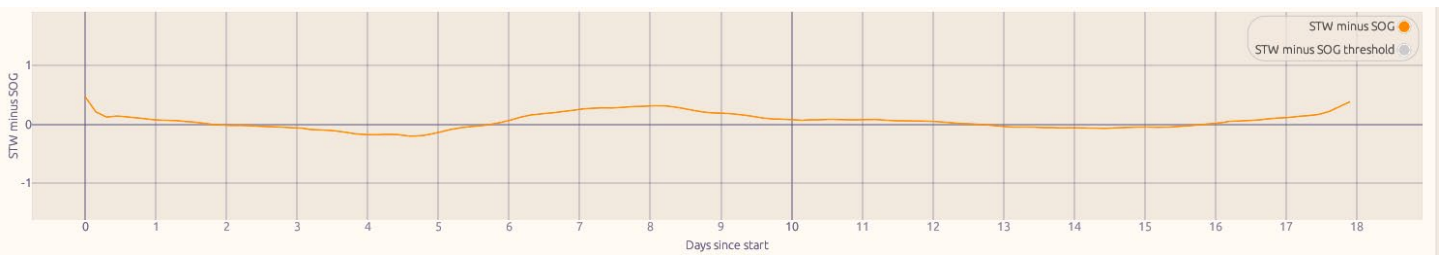
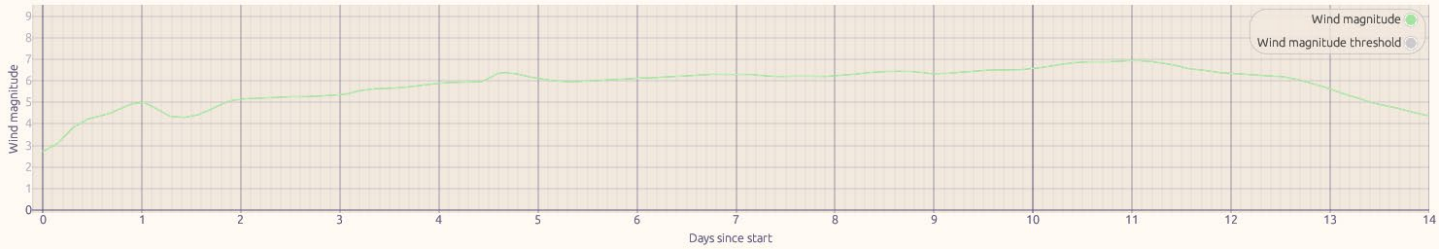
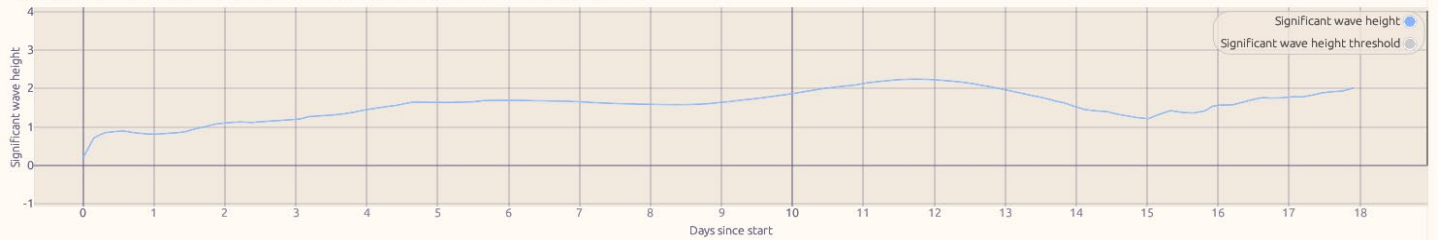
ABS delivers a report with the estimated fuel savings and voyage time series for the orthodrome, actual and optimum paths analyzed.



Figure 1: Orthodrome (blue) vs. Actual (orange) vs. Optimum (green).

Charter Party Timeseries

Smoothed Hs, wind, and STW-minus-SOG series. Red points indicate bad-weather intervals under the active thresholds.



Speed And Draft Timeseries

Smoothed speed and draft series. Red points are bad weather. Yellow points are low speed under good weather.

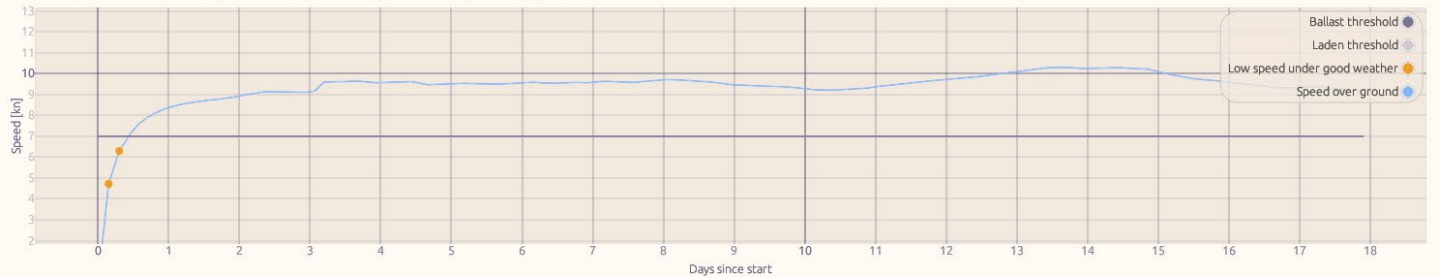


Figure 1: Time series

Voyage Time = 430 hours	Actual	Orthodrome	Optimum
Distance, nm	4,197	4,117	4,135
Propulsion Fuel, tonnes	726	646	595
Fuel Savings from Orthodrome, %	-12.0%	-	+8%

Table 1: Paths Comparison.

Conclusion and Recommendations

- Advanced algorithms integrate forecast models (wind, wave height, swell, currents, tropical storm tracks) with a vessel-specific performance model to avoid resistance-heavy conditions and keep engines operating in efficient load ranges.
- For optimal results, it is imperative to continuously adapt the vessel's track to weather conditions.
- Through a seakeeping analysis model, criteria relating to safety and human comfort can be incorporated in the selection of the optimum route solution.
- Emission Control Area zones can be incorporated in the selection of the optimum route solution for minimum fuel cost.
- As vessels also seek to reduce regulatory emissions penalties, optimized routing becomes a strategic tool for commercial and environmental performance.
- Vessels with unacceptable CII Rating should evaluate past voyages for improvement potential, aligning with SEEMP Part III self-evaluation and improvement framework.
- Masters and operators need training to interpret routing recommendations, balance commercial constraints (laycan windows, charter party clauses) with weather-driven deviations, and understand when to adjust the proposed route.
- Aligning incentives between owners and charterers is needed to maximize routing benefits.

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