



Maritime Route Risk Analysis and Vessel Tracker

AN OPEN-SOURCE GLOBAL SHIP RISK AND TRACKER PROJECT

Author: Vishal Bharadwaj

[Maritime Route Risk Analytics](#)

Introduction

The Maritime Route Risk Analysis and Vessel Tracker project is an integrated platform designed to enhance maritime safety and operational efficiency through real-time vessel monitoring and comprehensive risk assessment. This system combines two powerful applications that work together and provide users with critical information for decision-making in maritime operations.

The platform serves as a comprehensive solution for monitoring cargo ships and tankers worldwide while simultaneously assessing natural disaster risks that may impact shipping routes. By integrating real-time vessel tracking with global disaster monitoring systems, users can make informed decisions about route planning, vessel deployment, and emergency response coordination.

System Overview and Capabilities

The system consists of two integrated applications that complement each other to provide comprehensive maritime intelligence:

Regional Vessel Tracker focuses on real-time monitoring of vessel movements within specific geographic regions. This application enables users to identify, track, and gather detailed information about cargo ships and tankers operating in areas of interest. The tracker provides comprehensive vessel data including position, speed, destination, physical specifications, and operational status.

Maritime Route Risk Analysis provides sophisticated route planning capabilities combined with natural disaster risk assessment. This application enables users to calculate optimal sea routes between ports while simultaneously identifying potential hazards along the proposed path, including active natural disasters and their impact zones.

Core Capabilities

The system provides several key capabilities that address critical needs in maritime operations:

- **Real-time vessel tracking** allows users to monitor the current position and status of cargo ships and tankers across global waters. The system processes Automatic Identification System (AIS) data to provide accurate, up-to-date information on vessel locations, movements, and operational parameters.
- **Comprehensive risk assessment** integrates global disaster monitoring data to identify natural hazards that may impact maritime operations. The system tracks earthquakes, tropical cyclones, floods, volcanic activity, droughts, and wildfires, providing detailed information about their location, intensity, and potential impact on shipping routes and ports.
- **Route optimization** enables users to calculate efficient sea routes between any two ports while considering various factors including distance, typical weather patterns, and current disaster conditions. The system provides route visualization and detailed analysis of potential risks along the calculated path.

Regional Vessel Tracker – User Operation Guide

1. Initial System Access and Navigation

- Upon accessing the Regional Vessel Tracker, users encounter a full-screen satellite map interface that provides a global view of maritime operations. The interface is designed for intuitive navigation with professional mapping capabilities that support both strategic overview and detailed inspection of specific areas.
- The primary control panel is located on the left side of the screen and serves as the main interaction hub for all tracking operations. This panel contains region selection tools, vessel filtering options, and system controls. The control panel can be collapsed when screen space is limited or when users prefer an unobstructed map view.
- Map navigation controls are positioned in the bottom-left corner, providing zoom in/out functionality and a reset view option that returns the map to its default global perspective. These controls ensure users can easily navigate between different zoom levels and geographic areas.

2. Region Selection and Vessel Filtering

- The vessel tracking process begins with region selection, where users choose from predefined ocean regions that correspond to major shipping areas worldwide. These regions are strategically defined to encompass high-traffic maritime corridors and areas of particular interest to commercial shipping operations.
- After selecting a region, users can specify the maximum number of vessels to display, allowing for focused analysis when dealing with high-density shipping areas. This filtering capability prevents information overload while ensuring users can access detailed data for the most relevant vessels in their area of interest.
- The system provides a "Load Vessels" function that retrieves current vessel data for the selected region. This process typically takes several seconds as the system queries real-time AIS data sources and processes the information for display.

3. Vessel Information and Interaction

- Once vessels are loaded, they appear as color-coded markers on the map, with different colors representing different vessel types. Cargo ships and tankers are distinguished through distinct visual markers, enabling users to quickly identify vessel categories across the display area.
- Clicking on any vessel marker opens a detailed information popup that provides comprehensive data about the selected vessel. This information includes vessel identification details such as Maritime Mobile Service Identity (MMSI) numbers, International Maritime Organization (IMO) numbers, vessel names, and flag states.
- Operational data displayed for each vessel includes current position coordinates, speed in kilometers per hour, bearing direction, destination port, and estimated arrival information when available. Physical specifications such as vessel length, beam width, and draught measurements provide additional context for operational planning.
- The vessel list panel on the left side of the screen provides an alternative method for vessel selection and review. This list displays all loaded vessels in a structured format, allowing users to scroll through available vessels and select specific ones for detailed examination. Selected vessels are highlighted both in the list and on the map for easy identification.

4. Advanced Features and Data Management

- The system includes a collapsible interface design that adapts to different screen sizes and user preferences. Users can collapse the main control panel to maximize map viewing area, with a toggle button remaining available for quick access to controls when needed.
- The detailed vessel information panel appears on the right side of the screen when a specific vessel is selected, providing comprehensive technical and operational data without obscuring the map view. This panel can be closed when not needed, returning the interface to its standard configuration.
- Vessel data includes real-time position information, movement characteristics, and technical specifications that support operational decision-making. The system automatically updates vessel positions based on the most recent AIS data available, ensuring users have access to current information.

Maritime Route Risk Analysis – Comprehensive Planning Guide

1. Port Selection and Route Definition

- The Maritime Route Risk Analysis application begins with a sophisticated port selection process that enables users to define origin and destination points for their planned routes. The selection process uses a hierarchical structure that first requires users to identify the relevant water body, then the country, and finally the specific port within that region.
- This three-tier selection approach ensures users can easily navigate the extensive global port database while maintaining accuracy in their selections. Water bodies correspond to major ocean regions and seas, countries represent the political entities controlling port facilities, and ports represent the actual terminals and harbors available for vessel operations.
- Once users select their origin water body, the system automatically populates the country selection menu with all nations that have ports within that water body.

- Similarly, after country selection, the port menu displays all available ports within that country and water body combination. This process is repeated for the destination selection, ensuring users can accurately specify both ends of their planned route.
- The system validates port selections and enables the route calculation function only when both origin and destination ports have been properly specified. This validation prevents incomplete route requests and ensures the system has sufficient information to perform accurate calculations.

2. Route Calculation and Visualization

- After completing port selections, users initiate the route calculation process, which typically takes several seconds as the system processes multiple data sources. During this time, the system calculates the optimal or most used sea route between the specified ports while simultaneously gathering current disaster information from global monitoring systems.
- The calculated route appears on the map as a continuous line connecting the origin and destination ports, following recognized shipping lanes and avoiding known navigational hazards. The route calculation considers factors such as distance, typical weather patterns, and navigational constraints to provide realistic routing options.
- Route information is displayed in the left panel, including total distance measurements and estimated travel times based on standard vessel speeds. This information provides users with baseline data for operational planning and scheduling decisions.
- The map visualization includes color-coded markers for both origin and destination ports, clearly distinguishing the start and end points of the calculated route. These markers provide additional port information when clicked, including facility details and operational characteristics.

3. Disaster Risk Assessment and Analysis

- Simultaneously with route calculation, the system performs comprehensive disaster risk assessment by analyzing current natural disaster data from the Global Disaster Alert and Coordination System. This analysis identifies active disasters that may impact the planned route, including their location, severity, and potential influence on maritime operations.
- Disaster events are categorized by type, including earthquakes, tropical cyclones, floods, volcanic eruptions, droughts, and wildfires. Each disaster is assigned an alert level (Red, Orange, Green, or Unknown) that indicates the severity and potential impact on maritime operations. These alert levels are visually represented through color-coded markers on the map.
- The system identifies three categories of disaster risk: disasters near the origin port, disasters near the destination port, and disasters along the calculated route. Each category is analyzed separately to provide users with specific information about risks at different stages of their planned voyage.
- Disaster information includes detailed descriptions of the event type, current alert status, affected geographic area, and expected duration when available. This information enables users to make informed decisions about route timing, alternative routing options, or additional safety precautions.

4. Vessel Tracking Integration

- A unique feature of the risk analysis system is its integration with real-time vessel tracking data within disaster-affected areas. The system automatically identifies cargo ships and tankers currently operating within the geographic boundaries of active disasters, providing users with information about potential rescue operations, port congestion, or alternative routing needs.
- Vessels identified within disaster zones are displayed as specialized markers on the map, with detailed information available through click interactions. This vessel information includes standard AIS data as well as context about the specific disaster affecting their operational area.
- The system provides summary information about the total number of vessels detected within disaster areas, enabling users to assess the broader impact of natural events on maritime traffic. This information is valuable for understanding potential delays, port congestion, or alternative routing requirements.

5. Risk Visualization and Decision Support

- The complete risk analysis is presented through an integrated map display that combines route visualization, disaster markers, port locations, and vessel positions in a comprehensive operational picture. The system uses distinct visual elements to represent different types of information while maintaining clarity and readability.
- Alert messages in the left panel provide summary information about identified risks, including counts of disasters near ports and along routes. These alerts serve as quick reference points for users to understand the overall risk profile of their planned route without requiring detailed map analysis.
- The legend system provides clear identification of all map elements, ensuring users can correctly interpret the various markers, lines, and colored areas displayed on the map. This legend includes disaster alert levels, vessel types, port designations, and route markings.
- Users can interact with all map elements to access detailed information, enabling thorough analysis of specific risks or operational factors. This interactive capability supports detailed planning and risk mitigation strategy development.

Operational Benefits and Use Cases

1. Strategic Planning Applications

- The integrated system supports various levels of strategic planning for maritime operations. Fleet managers can use the system to monitor vessel deployments across multiple regions while simultaneously assessing route risks for upcoming voyages. This capability enables proactive decision-making and risk mitigation planning.
- Port authorities can utilize the system to understand vessel traffic patterns in their regions while monitoring potential disruptions from natural disasters. This information supports port operations planning and emergency preparedness activities.
- Insurance and risk management professionals can leverage the system's comprehensive risk assessment capabilities to evaluate policy exposures and develop more accurate risk models for maritime operations.

2. Emergency Response and Safety Management

- During emergency situations, the system provides critical information for coordinating response activities. Emergency response coordinators can identify vessels in distress areas, assess the scope of potential impacts, and coordinate rescue or assistance operations.
- The real-time tracking capabilities enable rapid identification of vessels that may require assistance or evacuation from disaster-affected areas. This information is crucial for maritime search and rescue operations and emergency response planning.

3. Commercial Operations Optimization

- Shipping companies can use the system to optimize route planning by avoiding areas affected by natural disasters, potentially reducing delays and operational costs. The combination of route calculation and risk assessment enables more informed decision-making about voyage planning.
- The vessel tracking capabilities provide valuable competitive intelligence about shipping patterns and market activity in specific regions, supporting commercial strategy development and market analysis.

4. Regulatory Compliance and Reporting

- The comprehensive data collection and analysis capabilities support regulatory reporting requirements for maritime safety and environmental protection. Organizations can use the system to document compliance with safety protocols and demonstrate due diligence in risk assessment procedures.
- The historical tracking and risk assessment data can be valuable for incident investigation and analysis, providing detailed information about conditions and decisions leading up to specific events or operational outcomes.
- This integrated maritime tracking and risk analysis system represents a significant advancement in maritime situational awareness, providing users with the comprehensive information needed for safe, efficient, and profitable maritime operations in an increasingly complex global environment.

Future Development Roadmap

- The Maritime Vessel Tracking and Route Risk Analysis System is positioned for continuous enhancement through several strategic development initiatives. Planned improvements include integration of advanced weather forecasting models to provide comprehensive meteorological risk assessment alongside disaster monitoring, enabling users to evaluate multiple environmental factors simultaneously.
- The system could expand to include additional vessel types beyond cargo ships and tankers, incorporating passenger vessels, fishing fleets, and specialized maritime equipment to provide broader industry coverage.
- Machine learning algorithms could be implemented to develop predictive analytics capabilities, allowing the system to forecast potential route disruptions and suggest proactive alternative routing based on historical patterns and current conditions.
- Enhanced mobile compatibility and offline functionality are planned to support field operations where internet connectivity may be limited. The platform could also provide real-time berth availability and port congestion data, while expanding the disaster monitoring scope to include cyber security threats, piracy alerts, and political instability indicators that may impact maritime operations.