Route Optimization Model – Instructions

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The model optimizes the rowing route using weather forecasts (up to 10 days) and past conditions (hindcast). The target destination is the **northern tip of Madagascar**, beyond this point local guidance is recommended.

The model simulates the boat's movement based on rowing performance, wind conditions, and ocean currents. It assumes that the wind and waves are aligned, with opposing or crosswinds and waves impacting the rowing performance.

The route optimization is carried out in two steps:

- **Forecast Step**: The model uses forecast data to simulate a range of possible movements. For each time step (1 hour), the boat can either row directly to the destination or take an offset course at -45°, -30°, -15°, +15°, +30°, or +45° relative to the destination. Alternatively, the boat may rest or deploy a sea anchor. After each step, the model re-evaluates and simulates the next set of potential movements, creating a branching set of outcomes. This process is repeated for up to 10 days, as the forecast data becomes increasingly unreliable beyond that time frame.
- **Hindcast Step**: Once the final location is determined from the forecast step, the model uses about 20 years of historical hindcast data to find the optimal position that minimizes travel time to the destination. For the forecast locations, the boat's movement is simulated over each year of the hindcast data, with the boat always aiming directly for the destination. The location that results in the shortest average travel time is selected as the optimal route.

File storage location:
https://www.ocean-row.uwa-ocean-physics.cloud.edu.au/

Each simulation folder (sorted by date) contains:

- **route.pdf**: Optimum route overview (large file size ~ 10 Mb)
- **user_route.csv**: Compact route summary (small file size ~20 Kb)
- **detailed_route.csv**: High-resolution route details (not suited for navigation)
- **script.log**: Server issues and error logs

Important: Use the headings suggested from **user_route.csv** or **route.pdf** as your primary navigation guide.

File Details

route.pdf

Graphical overview of the optimized route and travel statistics.

Centre Image:

- **Black line**: Geodesic (straight-line) route to destination.
- **Red line**: Optimized route based on forecast.
- **Dashed line**: Geodesic from forecast endpoint to destination.

Side Plots:

- **Time (Days):**
  - Travel time contours along the route.
  - Coloured final contour shows forecast endpoint and expected remaining travel time.
- **Wind (knots):**
  - Forecasted wind conditions along the route.
- **Boat Velocity (knots):**
  - Expected boat speed based on forecast simulations.
- **Currents (knots):**
  - Forecasted ocean current speeds.

Timeline Section (Following Pages):

- Hourly optimum route details:
  - Expected coordinates (latitude, longitude)
  - Optimum boat heading
  - Expected boat speed
  - Wind and current conditions
  - Suggested action: Row / Rest / Deploy Anchor

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user_route.csv

Compact, low-data version of the route.

Columns:

- **Time:** Local date and time
- **Zone:** Local time zone
- **Heading:** Optimum boat heading (degrees)
- **Speed_kts:** Expected boat speed (knots)
- **Wind_dir:** Wind direction (degrees)

- **Wind_kts:** Wind speed (knots)
- **Curr_dir:** Current direction (degrees)
- **Curr_kts:** Current speed (knots)
- **Lon:** Expected longitude
- **Lat:** Expected latitude
- **Status:** Row / Rest / Deploy Anchor