

CLAIRWAVE

OCEAN ACOUSTIC MODELLING

USER MANUAL

Predictive Underwater Acoustics

www.clairwave.com

Getting Started Edition · October 2026



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NEXT STEPS

The full User Manual

Part I — Getting started



CHAPTER 1

About this manual

Who the manual is for, how it is organised, and the conventions used for buttons, keys, callouts and premium features.

Who this manual is for

This manual is for anyone who uses Clairwave in a web browser: ocean scientists and acoustic analysts, offshore-energy, port and shipping teams, environmental and regulatory consultants, fisheries and survey teams, researchers and students. It explains every screen, button and setting a user can reach, and shows each one with a screenshot taken from the live application.

You do not need to know how Clairwave's servers or solvers are built. Where the physics matters for reading a result, the manual explains it in a few sentences and points to the references in *"Data sources, models and citations"* (full manual).

How the manual is organised

- **Part I — Getting started** shows you how to sign in, find your way around the screen, and run a first simulation.
- **Part II — Finding your area** covers the globe, the flat map and the 3-D terrain.
- **Part III — Acoustic simulation** explains simulation settings, run markers, the transmission-loss volume, the vertical slice, the propagation solvers, sound-speed profiles, reverberation and exports.
- **Part IV — Vessels and noise** covers live ships, their 3-D models and source levels, and noise at a point or at a habitat.
- **Part V — Weather, ambient noise and prediction** covers the forecast, ambient noise, moving markers and the signal-excess map.
- **Part VI — Clairwave from your AI assistant** shows how to use Clairwave's tools from Claude, ChatGPT or Grok.
- **Part VII — Worked examples** walks through four complete tasks from start to finish.
- **The appendices** hold quick-reference material: keys, an index of every control, plans, units, a glossary, troubleshooting, mobile use and data sources.

If you are new to Clairwave, read [Chapter 5, "Your first simulation in ten minutes"](#) first. It takes about ten minutes and needs no account.

Conventions

You see	It means
► Run Simulation	A button, field or label, written exactly as it appears on screen.
R, Esc	A key on the keyboard.
Vertical Slice › Cursor Readout	A control inside a panel: open the Vertical Slice panel, then find Cursor Readout .
2D	A picture of the actual button, cropped from the application.
Figure 5.3	A numbered screenshot. The first number is the chapter.
dB re 1 µPa	Sound level in decibels relative to 1 micropascal. Source levels are given at 1 m.

Depths are in metres below the sea surface and are positive downward. Bearings are true bearings in degrees, clockwise from north. Ranges are in kilometres unless a control lets you choose nautical miles.

Callout boxes

TIP

A shortcut or a better way to do something.

NOTE

Background that helps you read a result correctly.

CAUTION

Something that can lose work or give a misleading answer.

PREMIUM FEATURE

A feature that needs a Premium plan. The box quotes the message a Free or Guest user sees instead.

MCP

How to do the same thing from an AI assistant with the Clairwave tools.

Guest, Free, Premium and Enterprise

Plan	How you get it	In short
Guest	Continue as guest on the sign-in page	Free-plan features without an account. Nothing is saved.
Free	Create an account	Runs up to a 10 km radius at 200 Hz, the RAM, Bellhop and OAST solvers, seasonal sound-speed profiles, live AIS around Gibraltar, and a 48-hour weather forecast.
Premium	Upgrade in the application	Any range and frequency, GPU solvers, the GIOPS ocean forecast and custom sound-speed profiles, worldwide live AIS and the AIS time machine, reverberation, a 15-day weather forecast and more.
Enterprise	Contact Clairwave	Premium for an organisation, including on-premises and air-gapped installations.

[Appendix B, “Free, Guest and Premium compared”](#) lists every limit and every lock message.

Getting help

- Hover over any control for a tooltip. Most tooltips say what the control does and its units.
- [Appendix C, “Troubleshooting and FAQ”](#) answers the most common questions.
- For anything else, write to contact@clairwave.com.



CHAPTER 2

Welcome to Clairwave

What Clairwave predicts, the acoustic prediction loop, and the three ways to use it: the web app, the landing-page tools and your AI assistant.

What Clairwave does

Clairwave predicts how sound travels underwater, anywhere on Earth, in your browser. You choose a place, a sound source and a frequency, and Clairwave returns a 3-D picture of how loud that sound is at every range, depth and bearing around it.

It combines four things that usually live in separate tools:

- **The environment.** Seafloor depth, seabed type, and the speed of sound through the water, which changes with temperature, salinity and depth.
- **Propagation.** Established acoustic models such as RAM, Bellhop and OAST, plus Clairwave's own GPU solvers, compute the transmission loss.
- **Noise.** Live ship positions from AIS, a source-level model for every vessel, and ambient noise from wind, rain and sea state.
- **Detection.** The sonar equation turns all of this into a map of where a sound of interest, such as a vessel, a marine-mammal call or an acoustic instrument, can or cannot be detected, hour by hour.

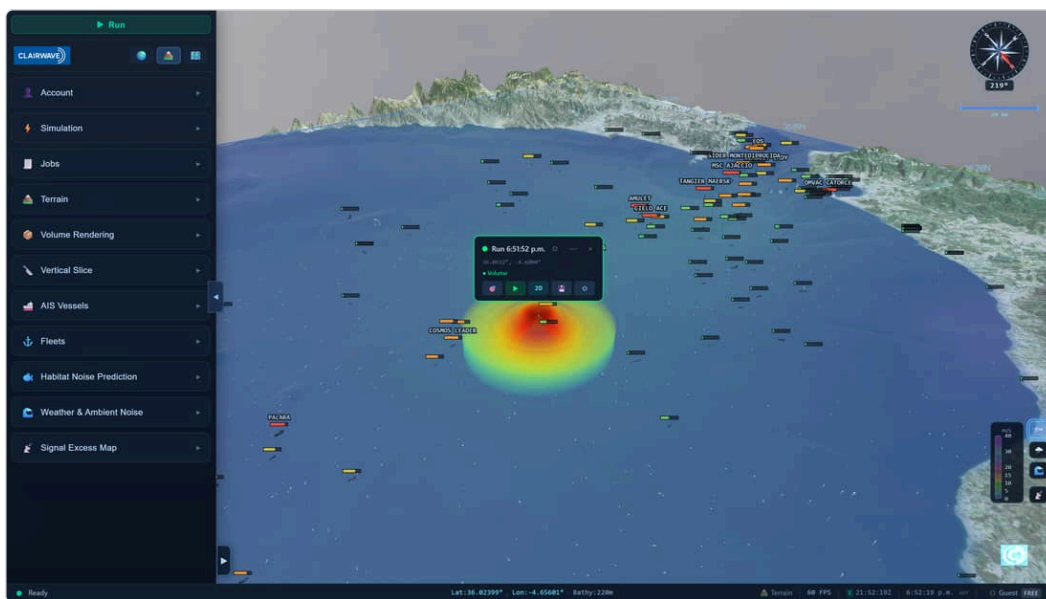


Figure 2.1 Clairwave's terrain view over the Alboran Sea: a transmission-loss volume around a run marker, live AIS vessels with noise badges, and the wind forecast drawn as streamlines.

The acoustic prediction loop

Most work in Clairwave follows the same four steps.

1. **Environment.** Load an area in terrain mode. Clairwave fetches the bathymetry, the seabed and a sound-speed profile for the month you choose. Premium users can use the 10-day GIOPS ocean forecast instead.
2. **Propagation.** Run a simulation at a point. The result is a transmission-loss (TL) volume and, along any bearing, a vertical slice.
3. **Noise.** Look at the ships nearby and the weather forecast. Clairwave estimates the noise they add at any point.
4. **Signal excess.** Combine them in the sonar equation to see where a sound of interest is detectable, now or at any forecast hour.

You can stop after any step. Many users only need step 2, a TL volume and a slice.

The sonar equation in one page

Clairwave expresses detectability as **signal excess (SE)**, in decibels:

$$SE = SL - TL - NL - DT + AG$$

Term	Name	Meaning
SL	Source level	How loud the source you want to hear is (in sonar terms, the <i>target</i>), in dB re 1 μ Pa at 1 m.
TL	Transmission loss	How much the sound weakens between that source and the receiver. Clairwave computes this.
NL	Noise level	Background noise at the receiver from ships, wind, rain and other sources.
DT	Detection threshold	The signal-to-noise ratio your processing needs to declare a detection.
AG	Array gain	The gain of a receiving array over a single hydrophone. It is 0 dB for one hydrophone.

Where SE is zero or more, the source is detectable. Where it is negative, it is not. For an active sonar or echosounder, the sound travels out and back, so TL counts twice and the target strength (TS) of the object that returns the echo is added. *"The signal excess map"* (full manual) and *"MCP tool reference"* (full manual) show how Clairwave applies

both forms.

Where the data comes from

Data	Source
Bathymetry	GEBCO global grid, about 450 m resolution
Sound speed	Seasonal temperature and salinity climatology. Premium adds the GIOPS 10-day ocean forecast and custom profiles.
Seabed	Seabed lithology map, converted to sound speed, density and attenuation
Weather	Open-Meteo, serving Google's WeatherNext ensemble forecast, plus a marine wave model
Ships	Live AIS, a class-based ship source-level model, and 3-D hull models generated from photographs
Imagery	Esri ArcGIS basemaps

"Data sources, models and citations" (full manual) gives full references.

TWO DIFFERENT FORECASTS

The **ocean** forecast (GIOPS) changes the sound-speed profile and runs 10 days ahead. The **weather** forecast drives wind, rain, waves and ambient noise and runs up to 15 days ahead. They are separate and appear in different parts of the application.

Three ways to use Clairwave

1. **The web application** at www.clairwave.com, which is what most of this manual describes.
2. **The website tools.** The landing page has a live validation dashboard comparing Clairwave with hydrophone recordings, and the 3-D ship-model library at www.clairwave.com/fleet shows the ship models.
3. **Your AI assistant.** Clairwave publishes an MCP server, so Claude, ChatGPT or Grok can run Clairwave's tools for you and link back to the results. Part VI explains how.

The **Guide & FAQ** link in the landing-page menu leads to the free Getting Started guide, a PDF, and short answers to the questions new users ask most. Inside the application, the same guide and, on the Premium plan, this full manual are in the **Account** panel (*Chapter 3, "Signing in and managing your account"*).

To learn ocean acoustics while you learn the application, open the 🎓 **Academy** panel. Its course, *Underwater Acoustics in Practice*, pairs short lessons with scenarios you run in the scene. Modules 0 to 2 are free; see *Chapter 6, "Learning with the Academy"*.

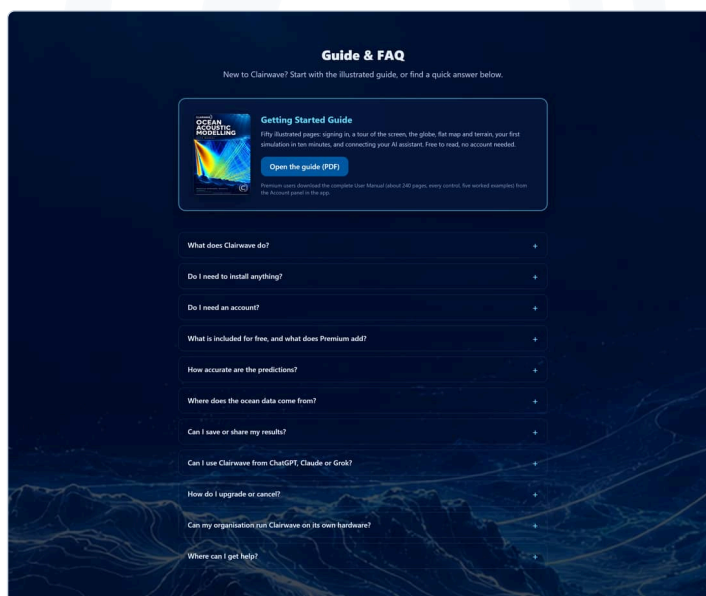


Figure 2.2 The Guide & FAQ section of the landing page. Click a question to open its answer.

System requirements

- A current desktop browser with **WebGL 2**: Microsoft Edge, Google Chrome, Mozilla Firefox or Apple Safari.
- A computer with a graphics processor. Clairwave runs on integrated graphics, but a dedicated GPU keeps the 3-D view smooth.
- For the elastic sea-ice solver only: **WebGPU**, which Edge and Chrome support from version 113.
- A screen at least 1280 pixels wide for the full layout. Phones and tablets work with a simplified layout; see *"Using Clairwave on a phone or tablet"* (full manual).

CHAPTER 3

Signing in and managing your account

Launching the app, continuing as a guest, creating an account, social sign-in, passkeys, and the Account & subscription window.

Launching Clairwave

Go to www.clairwave.com and click **Launch Clairwave**, or **Launch** in the menu bar. The same button appears at the top and bottom of the landing page and under each pricing plan.

The landing page has no separate sign-in link. Clairwave asks you to sign in when you launch the application.

The sign-in page

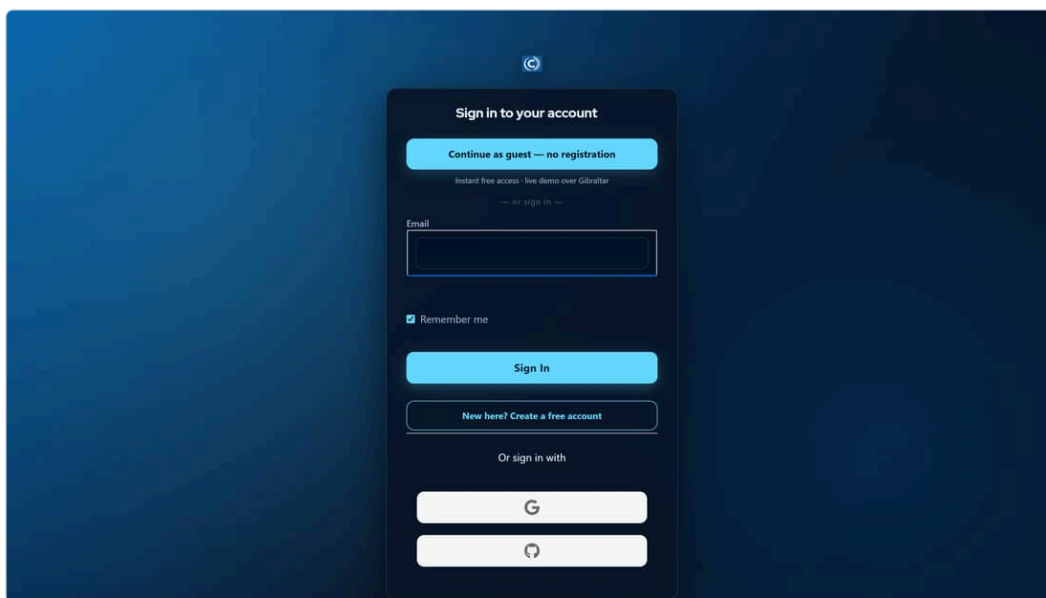


Figure 3.1 The sign-in page.

Control	What it does
Continue as guest — no registration	Opens the application immediately on the Free plan, with a live demonstration over Gibraltar. Nothing is saved to an account.
Email	The email address of your Clairwave account.
Remember me	Keeps you signed in on this browser.
Sign In	Continues to the password step.
New here? Create a free account	Opens the registration form.
Or sign in with (Google, GitHub)	Signs in with that account instead of a password.

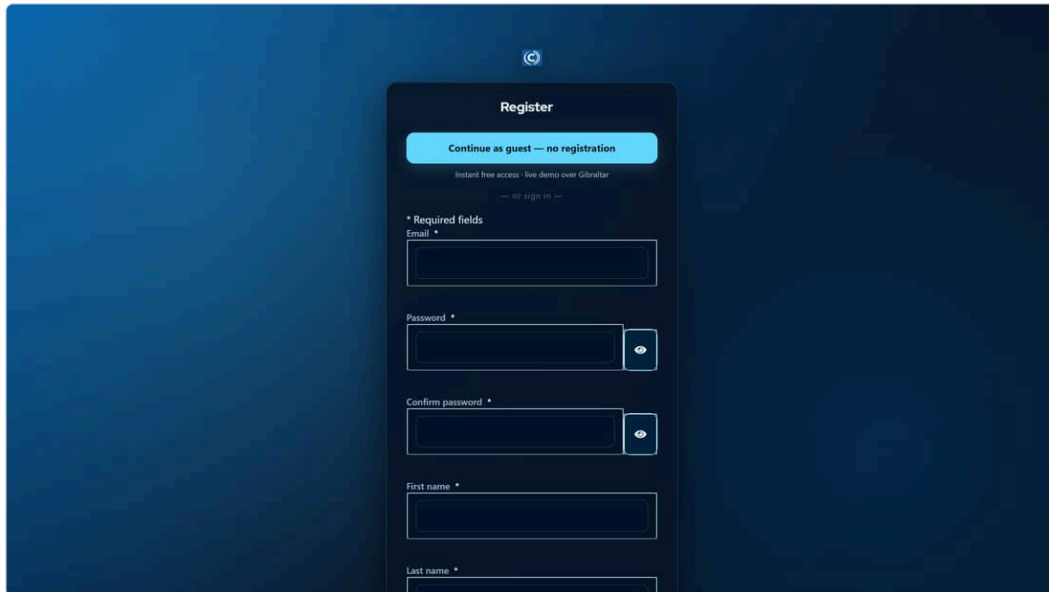
Continuing as a guest

Click **Continue as guest — no registration**. Clairwave opens in terrain mode over the Alboran Sea and starts a first simulation for you. [Chapter 5, “Your first simulation in ten minutes”](#) walks through that session.

A guest has every Free-plan feature. The session ends when you close the tab, and your work in it is not kept. The stored results of a guest’s runs, and their `?run=` links, are deleted 7 days after the run.

Creating a free account

1. On the sign-in page, click **New here? Create a free account**.
2. Enter your **Email**, a **Password** twice, and your **First name** and **Last name**. Click the eye button beside a password field to show what you typed.
3. Click **Register**.
4. Open the verification email Clairwave sends you and click its link.



The registration form is titled "Register" and features a blue header bar with the text "Continue as guest — no registration". Below this, it says "Instant free access - live demo over Gibraltar" and "— or sign in —". The form includes several input fields, each marked with an asterisk (*) to indicate they are required:

- * Required fields**
- Email ***: A text input field.
- Password ***: A text input field with a toggle icon for password visibility.
- Confirm password ***: A text input field with a toggle icon for password visibility.
- First name ***: A text input field.
- Last name ***: A text input field.

Figure 3.2 The registration form. Fields marked * are required.

To register with Google or GitHub instead, click its button under **Or sign in with**. With Google you do not need to verify your email. With GitHub, Clairwave still sends a verification email.

Every new account starts on the Free plan.

Signing in

1. Enter your **Email** and click **Sign In**.
2. Enter your password and click **Sign In** again.

If you forget your password, click **Forgot password?** on the password step and follow the emailed link. If your account has more than one way to sign in, such as a password and a passkey, **Try Another Way** lets you choose.

If you last signed in with Google or GitHub, Clairwave remembers that and sends you straight to that provider next time.

The loading screen

After you sign in, a loading screen appears while Clairwave prepares the 3-D engine. The first visit takes a few seconds longer while your graphics processor is set up. Later visits reuse that work.

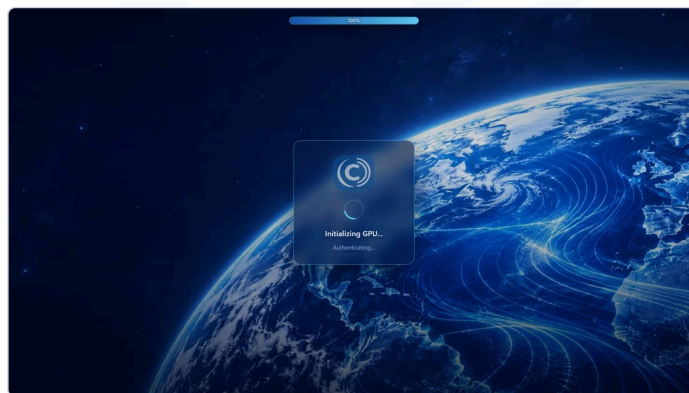


Figure 3.3 The loading screen. The lines under the logo show what Clairwave is doing: "Initializing GPU..." then "Authenticating...".

If you see *Authentication error — retrying...*, Clairwave could not confirm your sign-in and tries again automatically.

Your account in the status bar

The right end of the status bar shows who is signed in and on which plan.

Picture	Meaning
 Guest FREE	A guest, or a Free account. The circle O marks the Free plan.
 60 FPS 13:13:57 18:13:57 a.m. Premium Demonstration PREMIUM	A Premium account. The star ★ and the gold PREMIUM tag mark the Premium plan.

Click it to open the **Account & subscription** window.

The Account panel

The  **Account** panel is the first panel in the sidebar. It gathers your account, your plan and the user manuals in one place.

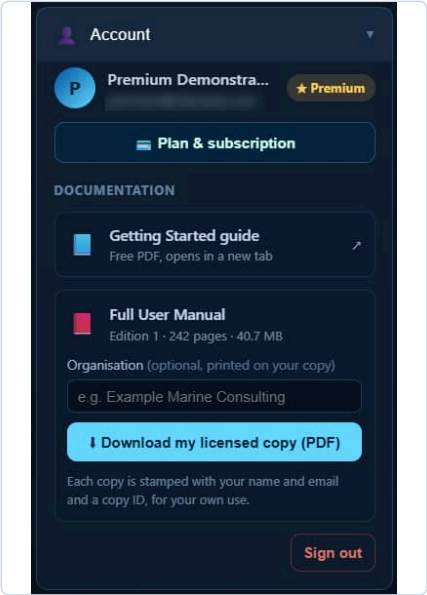


Figure 3.4 The Account panel for a Premium account.

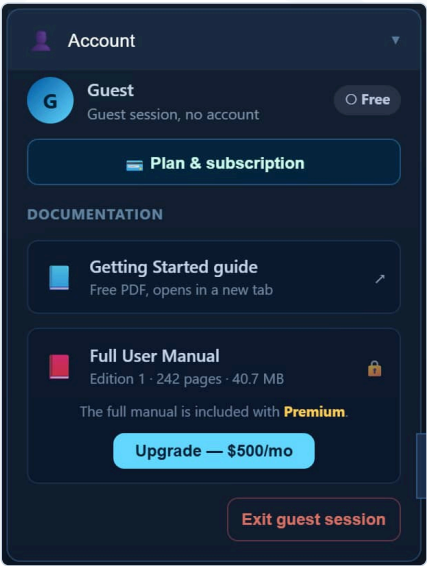
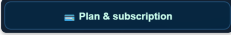
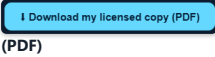
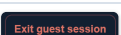


Figure 3.5 The same panel for a guest. The full manual is locked.

The top of the panel shows your name, your email and your plan: ★ **Premium** or ○ **Free**. A guest sees *Guest session, no account*.

Control	What it does
 Plan & subscription	Opens the Account & subscription window, described below.
 Getting Started guide	Opens the free Getting Started guide, a PDF, in a new tab.
 Organisation	Premium. Optional. Printed on your copy of the manual after your name. Clairwave remembers it on this computer.
 Download my licensed copy (PDF)	Premium. Downloads this full manual, stamped for you.
 Full User Manual (locked)	Free plan and guests. The full manual comes with Premium. Upgrade — \$500/mo opens the Account & subscription window.
 Sign out	Signs you out and returns you to the landing page.
 Exit guest session	Ends the guest session and returns you to the landing page.

Downloading the full manual

DOWNLOAD YOUR LICENSED COPY

1. Open the  **Account** panel.
2. If you like, type your organisation in **Organisation**.
3. Click  **Download my licensed copy (PDF)**. The button reads  *Preparing...* for a few seconds while Clairwave prepares your copy.
4. Your browser saves the PDF. The panel shows *Downloaded* and the file name.

Every page after the cover carries a line at the bottom edge with your name, your email, the date and a copy ID. The copy is for your own use. You can read, search and print it, but not edit it. The line under **Full User Manual** shows the edition, the number of pages and the file size.

MANY DOWNLOADS IN A SHORT TIME

If you ask for many new copies within an hour, the panel shows *too many new copies this hour — try again later*. Wait, then download again.

The Account & subscription window

The window shows:

- **Your name and email**, with ✕ to close the window.
- **Current plan**: Free or Premium, and the price of Premium.
- **A feature table** comparing Free and Premium. The column for your plan is highlighted.
- **Buttons**:
 - **Upgrade to Premium — \$500/mo** on the Free plan.
 - **Manage subscription** on the Premium plan.
 - **Sign out** on every plan.

Upgrading to Premium

1. Click the account chip in the status bar.
2. Click **Upgrade to Premium — \$500/mo**. The button reads *Redirecting...* while Clairwave opens secure checkout.
3. Complete payment on the Stripe checkout page.
4. Stripe returns you to Clairwave. The status bar shows *Welcome to Premium! All features unlocked*. and the Account window opens with your new plan.

If the payment is still being confirmed, the message reads *Payment received — your upgrade will activate shortly*. instead.

GUESTS CANNOT UPGRADE

Upgrading needs an account. As a guest, create a free account first, then upgrade.

Managing or cancelling a subscription

On the Premium plan, click **Manage subscription**. Clairwave opens the Stripe customer portal, where you can change your payment method, download invoices or cancel.

When a subscription ends or a payment fails, your account returns to the Free plan.

Your stored runs

Each 3-D run you make is stored on the server, so that you can open it again from the  **Jobs** panel or with its `?run=` link. The top of the  **Jobs** panel shows how many runs you have stored and how much space they take.

Stored runs are deleted automatically 30 days after the run. On the Premium plan, click  **Keep** on a run in the  **Jobs** panel to hold it in long-term storage instead. Each user has 2 GB of long-term storage. Delete the runs you no longer need with . See “*Simulation settings*” (full manual).

A guest’s stored runs are deleted 7 days after the run.

Signing out

Click **Sign out** at the bottom of the **Account** panel, or click the account chip in the status bar, then **Sign out**. Clairwave returns you to the landing page.

Plans compared

	Free and Guest	Premium
Simulation range	Up to 10 km	Unlimited
Frequency	200 Hz	Any, broadband and batch
RAM, Bellhop and OAST solvers	✓	✓
GPU solvers CWNi, CWTd, CWTDE	—	✓

	Free and Guest	Premium
GLOPS ocean forecast and custom sound-speed profiles	—	✓
Live AIS vessels	Around Gibraltar	Worldwide, plus the AIS time machine
Weather forecast	48 hours	15 days
🎓 Academy course (11 modules, EN/BM)	Modules 0–2 (guests: Module 0)	All 11 modules
Getting Started guide (PDF)	✓	✓
Full User Manual, licensed PDF	—	✓
Stored 3-D runs	Deleted after 30 days (guests: 7 days)	Deleted after 30 days, or kept with 🌟 Keep (2 GB)
Cross-device profile sync	—	✓
Custom basemaps	—	✓

Enterprise plans add on-premises and air-gapped installation, training and support. Book one from 📅 **Book a demo** under Enterprise on the landing page. [Appendix B](#), “Free, Guest and Premium compared” lists every limit.



CHAPTER 4

A tour of the screen

Every permanent element of the application window: the sidebar and its rail, the Run strip, mode buttons, status bar, HUD message log, compass, scale bar, minimap, depth axis.

The window at a glance



Figure 4.1 The Clairwave window in terrain mode. The numbers match the list below.

1. ► **Run** runs a simulation at the centre of the view.
2. **Mode buttons** switch between the globe, terrain and the navigation minimap.
3. **The sidebar panels** hold every setting, grouped by task.
4. **A marker box** belongs to each simulation run.
5. **The compass** shows which way the camera faces.
6. **The weather and signal-excess toggles** draw forecast layers on the terrain.
7. **The navigation minimap** shows and moves the loaded area.
8. **The status bar** shows messages, the scene centre, the clocks and your account.
9. **The account chip** opens your account and plan.
10. **The message log** reports what Clairwave is doing.

The rest of this chapter describes each element. The 3-D scene itself is covered in [Chapter 7, “Globe mode and the search bar”](#) and [Chapter 9, “Terrain mode”](#).

The sidebar

The sidebar on the left holds eleven panels. Click a panel's title to open it and click again to close it. Several panels can be open at once, and the sidebar scrolls when they do not fit.

Panel	What it is for	Chapter
Account	Your plan, the user manuals, signing out	Chapter 3, “Signing in and managing your account”
Academy	The course <i>Underwater Acoustics in Practice</i> : lessons, scenarios and quizzes	Chapter 6, “Learning with the Academy”
Simulation	Frequency, source depth, colour range and run options	“Simulation settings” (full manual)
Jobs	Your running and finished runs; open their results again	“Simulation settings” (full manual)
Terrain	Basemap, vertical scale, area size, ship models	Chapter 9, “Terrain mode”
Volume Rendering	How the 3-D transmission-loss volume looks	“The 3-D transmission-loss volume” (full manual)
Vertical Slice	The range–depth cross-section and its solvers	“The vertical slice window” (full manual), “Propagation solvers” (full manual)
AIS Vessels	Live ships and their noise	“Live AIS vessels” (full manual)
Habitat Noise Prediction	Vessel noise at fish farms and other sites	“Habitat noise prediction” (full manual)
Weather & Ambient Noise	Forecast and ambient noise (terrain mode)	“Weather and ambient noise” (full manual)
Signal Excess Map	Detection map on the forecast timeline (terrain mode)	“The signal excess map” (full manual)

Collapsing the sidebar

Click the ◀ tab on the sidebar’s right edge to shrink the sidebar to a narrow rail of icons. Click an icon to reopen the sidebar with that panel open. Click ▶ to expand it again.

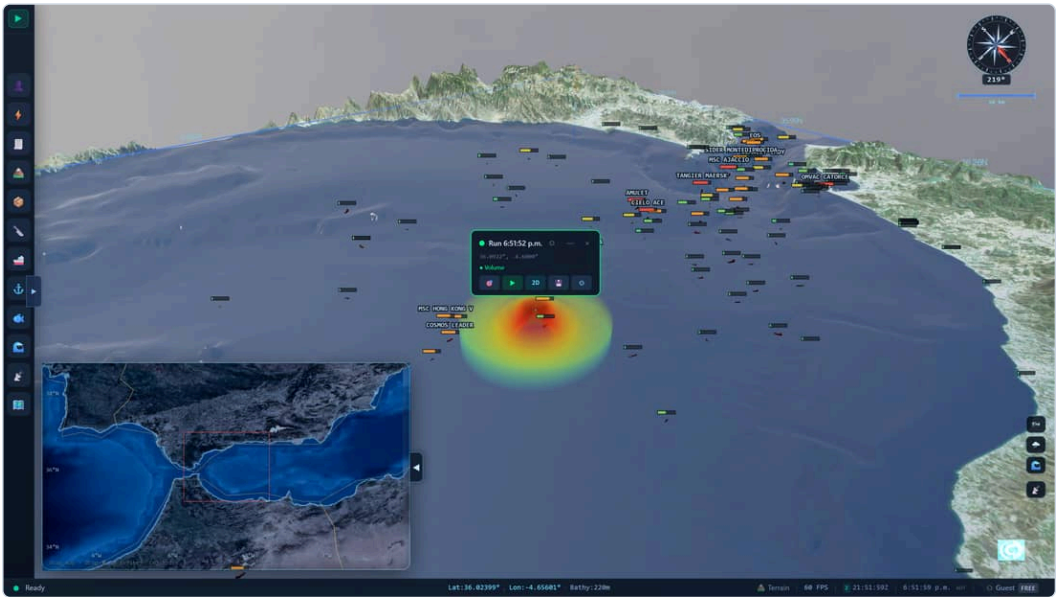


Figure 4.2 The collapsed sidebar: a rail of panel icons with ▶ Run at the top. Hover over an icon to see the panel’s name.

On a phone the sidebar starts collapsed.

The ▶ Run strip

The ▶ Run strip stays at the top of the sidebar, even when it is collapsed. Click it, or press **R** to run a simulation at the centre of the view with the settings in the **Simulation** panel.

While you hover over ▶ Run, a red crosshair marks the exact point the run will use. The icon changes to 🏁 while a run is in progress. The strip pulses after you choose a new area, to remind you that nothing has been run there yet.

Mode buttons



Figure 4.3 The Clairwave logo and the three mode buttons.

Button	Key	What it does
	G	Globe view: the whole Earth, for finding an area. See Chapter 7, “Globe mode and the search bar” .
	M	Terrain view: the 3-D bathymetry scene where simulations run. See Chapter 9, “Terrain mode” .
	N	Navigation minimap: shows or hides the minimap. Terrain mode only.

The button for the current mode is highlighted.

The status bar



Figure 4.4 The status bar.

From left to right:

- **Status message.** A green dot and a short message, such as *Ready*, *Simulation complete* or a plan limit. The dot pulses orange while Clairwave is working.
- **Scene centre.** In terrain mode, the latitude, longitude and water depth under the centre of the view, for example *Lat:36.02399° Lon:-4.65601° Bathy:220m*. This is the point ▶ Run uses. It is not the mouse position. In globe mode it shows — — —.



Figure 4.5 The right end of the status bar: view mode, frames per second, UTC and local time, and the account chip.

- **View mode:** Globe or Terrain.
- **FPS:** frames per second. Around 60 is smooth. Below 20, see [Appendix C, “Troubleshooting and FAQ”](#).
- **Z clock:** the time in UTC (Zulu), which Clairwave uses for forecasts and AIS.

- **Local time** with your time-zone abbreviation.
- **Account chip:** see *Your account in the status bar*.

On a phone, only the FPS reading stays on the right.

The message log

Clairwave reports what it is doing in a small log in the lower right: loading imagery, running a simulation, receiving data or errors. Each line starts with the time.



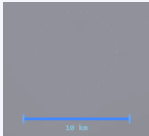
Figure 4.6 The message log after the guest demo starts.

The log keeps the last six messages and fades away ten seconds after the newest one. On a phone it shows two short lines.

The compass and scale bar

In terrain mode, a compass in the top-right corner shows the direction the camera faces, with the heading in degrees underneath. A scale bar below it shows a round distance, such as 10 km, at the centre of the view.

- **Click the compass** to turn the view back to north-up.
- **Right-click the compass**, or press and hold it on a touch screen, to change its style. Clairwave remembers your choice.

				
Compass rose (default)	Compass	North cross	Off	Heading indicator

The navigation minimap

The minimap in the lower left shows the loaded terrain as a red rectangle on the blue-toned world map, with live ships and place names.



Figure 4.7 The navigation minimap.

- **Drag the map** to look around, and use the mouse wheel to zoom.
- **Drag the red rectangle** to move it, and drag its white corner to resize it.
- Click  **Load** to load the terrain inside the rectangle.
- Press , click , or click the side tab to hide or show the minimap.

On a phone the minimap starts hidden. *Chapter 9, “Terrain mode”* explains how to use it to refine an area.

The weather and signal-excess toggles

Four round buttons on the right edge of the terrain view draw forecast layers on the map.

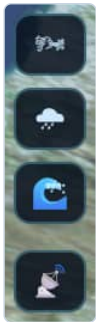


Figure 4.8 The weather and signal-excess toggles, top to bottom: wind, rain, sea state, signal excess.

Button	Layer
	Wind at 10 m, with streamlines
	Rain rate
	Sea state: significant wave height and swell
	Signal-excess map

Only one weather layer shows at a time. Click the active button again to turn it off. A colour bar with the unit appears beside the buttons while a layer is on. “*Weather overlays on the terrain*” (full manual) and “*The signal excess map*” (full manual) explain the layers.

The depth axis

At the south-west corner of the terrain a vertical **DEPTH** axis shows depth in metres. Its amber handle, with small up and down arrows, sets the vertical exaggeration: drag it up or down to stretch or flatten the terrain between 0.1× and 50×. [Chapter 9, “Terrain mode”](#) describes this and the **Vertical Scale** slider that does the same.

Keyboard shortcuts

Key	What it does
G	Globe view
M	Terrain view. In terrain mode, shows or hides the minimap.
N	Shows or hides the minimap
T	Reloads the terrain for the current area
R	Runs a simulation at the scene centre
Esc	Cancels a pick or a track drawing, and clears a vessel selection

Shortcuts do nothing while you are typing in a field. [Appendix A, “Keyboard and mouse reference”](#) lists every mouse and touch gesture as well.

CHAPTER 5

Your first simulation in ten minutes

A guided, fully screenshotted walk-through: open the guest demo over Gibraltar, read the transmission-loss volume, open the vertical slice, read TL at the cursor, change the frequency and export a picture.

This chapter walks you through one complete session, from opening the guest demo to exporting a figure. You do not need an account. Every step shows exactly what you will see on screen.

WHAT YOU WILL DO

You will look at sound spreading from a source 100 m deep in the Alboran Sea, east of the Strait of Gibraltar. You will open a range–depth cross-section, read the transmission loss at a point, set the source depth to 50 m, and save a high-resolution picture.

Step 1 — Open the guest demo

1. Go to www.clairwave.com and click **Launch Clairwave**.
2. On the sign-in page, click **Continue as guest — no registration**.

Clairwave opens straight into terrain mode over the Alboran Sea and starts a first simulation for you. The HUD message log in the lower right says *Welcome! Running your first simulation over Gibraltar....* After a few seconds a coloured dome appears around a run marker.

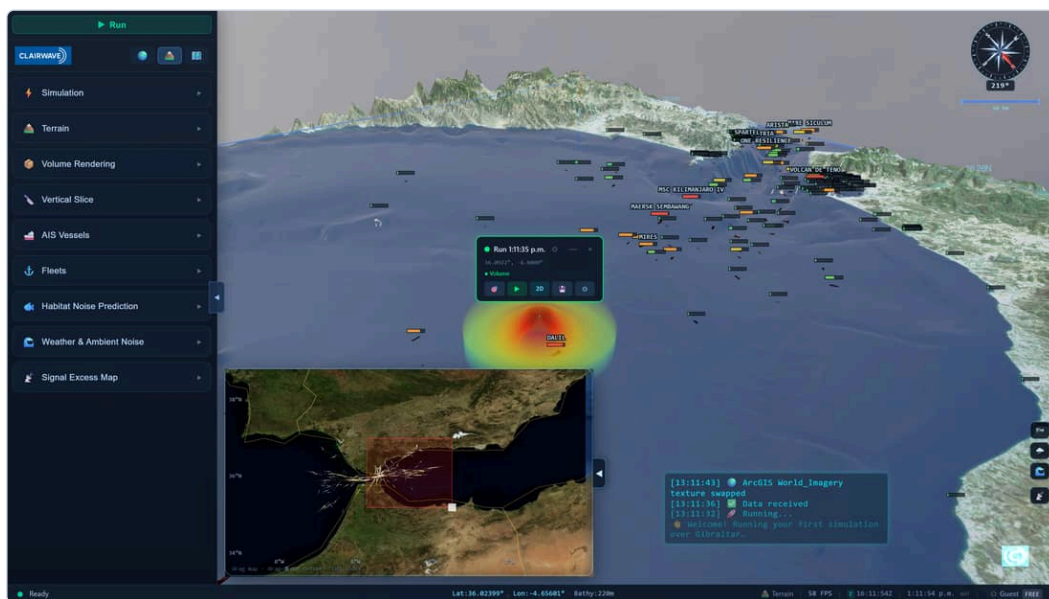


Figure 5.1 The guest demo a few seconds after launch. The coloured dome is the 3-D transmission-loss volume around the first run; the floating card above it is the run's marker box. Coloured bars over the water are AIS vessels.

GUEST LIMITS

A guest session uses the free tier: runs are limited to a 10 km radius at 200 Hz. The account chip at the right end of the status bar reads **Guest FREE**. [Appendix C](#) lists every limit.

Step 2 — Read the 3-D transmission-loss volume

The dome is a **transmission-loss (TL) volume**: a 3-D picture of how much the sound has weakened, in decibels, at every range, depth and bearing around the source.

- **Red** means low loss. The sound is still loud there.
- **Yellow to green** means more loss.
- Parts of the volume with more loss than the colour range are transparent.

The colour range is set by **dB Min** and **dB Max** in the Simulation panel. The demo uses 60 dB to 90 dB. *"The 3-D transmission-loss volume"* (full manual) explains how to change the colours and transparency.

MOVING THE CAMERA

Drag with the left mouse button to pan, drag with the right button to rotate, and use the wheel to zoom. Click the compass in the top-right corner to turn north up again.

Step 3 — Select the run marker and open its box

Every run is attached to a **marker**: a small diamond on a pole at the source position. Above it floats the **marker box**, which shows the run's name, position and status.

Click the marker box once to select it. The box gets a bright border and a row of quick-action buttons appears.

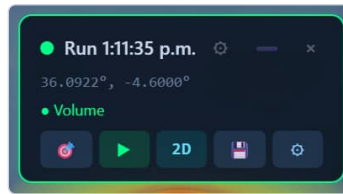


Figure 5.2 The marker box before you select it: name, position and status only.

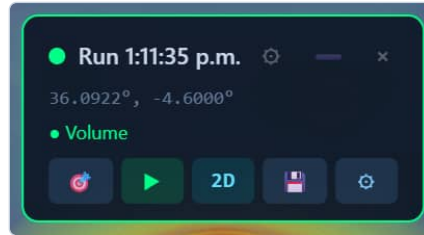


Figure 5.3 The selected marker box with its quick-action buttons.

Button	Name	What it does
	Focus	Flies the camera to the marker.
	Run	Runs the simulation again at this marker with its current settings.
	2D	Opens or closes the vertical slice for this marker.
	Settings	Opens the marker's own settings: position, source depth, motion, frequency and more.

The header row also has ⚙ (settings), — (minimise the box to a pill at the top of the screen) and × (remove the marker and its volume). “*Simulation markers and the marker box*” (full manual) describes every part of the box.

Step 4 — Open the vertical slice (2D)

Click **2D** in the marker box. A window titled **Vertical Slice - 90° E** opens on the right.

The slice is a cut through the volume along one bearing, here due east. The vertical axis is depth in metres and the horizontal axis is range in kilometres. The seafloor is drawn in brown at the bottom.

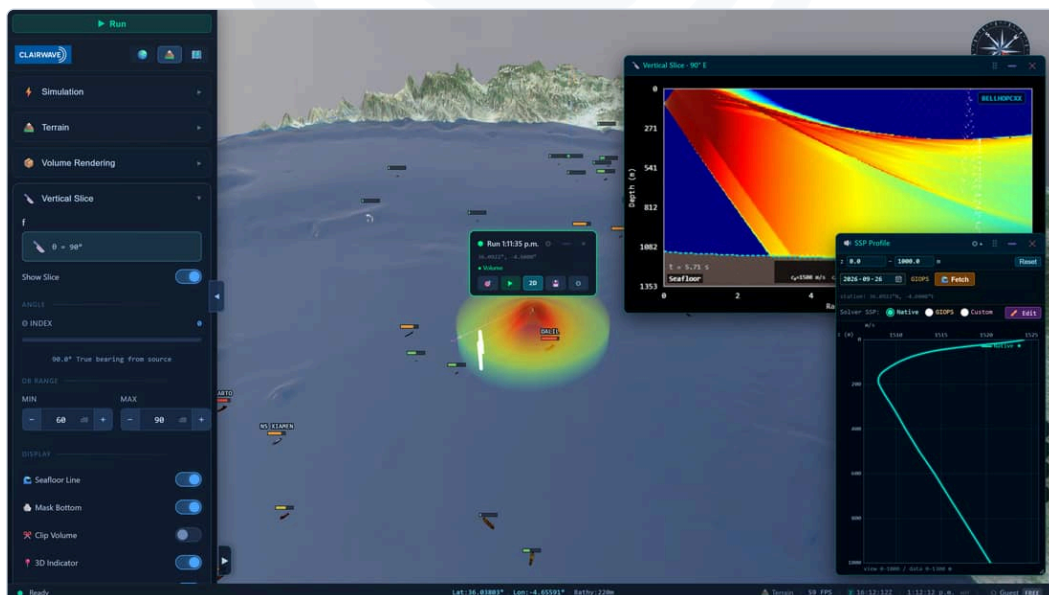


Figure 5.4 The vertical slice window, the SSP Profile dock below it, and the Vertical Slice panel, which opens in the sidebar at the same time.

The first time you open a slice, Clairwave also traces a fan of sound rays with the Bellhop ray model. The label **BELLHOPCXX** in the corner names the solver, and white pulses travel along the rays. A clock in the lower-left corner, for example **t = 5.17 s**, shows the travel time of the animation.

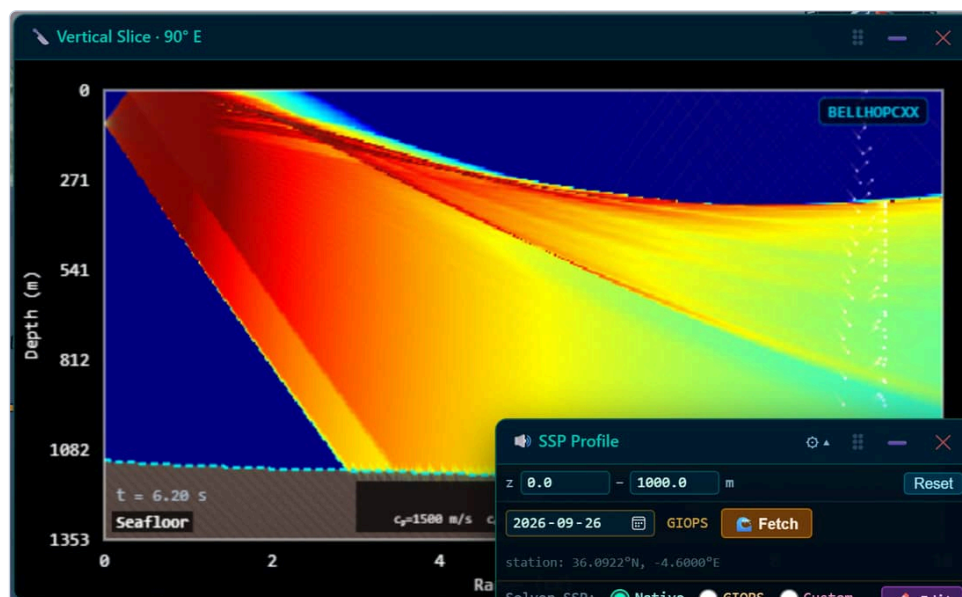


Figure 5.5 The slice window close up. The header holds the grip (≡), minimise (—) and close (X) buttons.

A second window, **SSP Profile**, docks below the slice. It shows how the speed of sound changes with depth at this location, which is what bends the rays. You can close it with its X button. “Sound-speed profiles: native, GIOPS forecast and custom” (full manual) explains it in full.

ARRANGING THE WINDOWS

Drag the slice by its title bar to move it and by its lower-right corner to resize it. Use the mouse wheel over the picture to zoom in, and click the  chip that appears to zoom back out.

Step 5 — Turn the bearing

A slice shows one bearing at a time. There are two ways to change it:

- In the scene, drag the white arrow that sticks out of the volume. A label **θ SLICE** appears while you drag, and the slice updates as you go.
- In the sidebar **Vertical Slice** panel, move the **θ INDEX** slider. The line under it shows the true bearing, for example **90.0° True bearing from source**.

When you let go, Clairwave re-runs the ray fan for the new bearing.

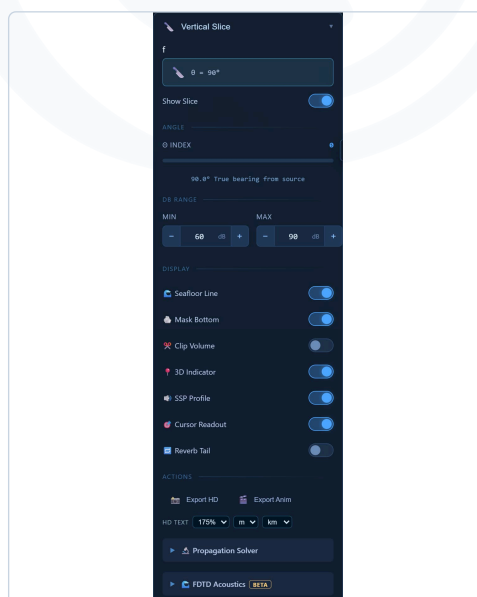


Figure 5.6 The Vertical Slice panel in the sidebar. The θ Index slider chooses the bearing; the Display switches control what is drawn on the slice.

Step 6 — Read TL under the cursor and pin a receiver

1. In the **Vertical Slice** panel, turn on **Cursor Readout**. 
2. Move the mouse over the slice. A dashed crosshair follows the pointer and a label shows the transmission loss, the range and the depth under it.

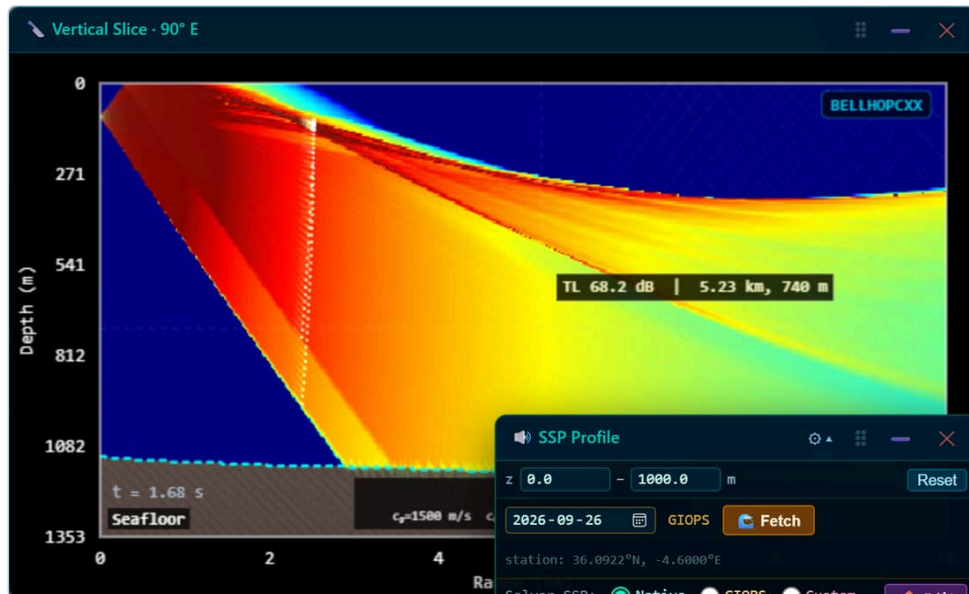


Figure 5.7 Cursor readout: at 5.23 km range and 740 m depth the transmission loss is 66.9 dB.

- Click the slice to **pin a receiver** at that point. A marker labelled **R1** stays on the slice with its level and position. Click again to add R2, R3 and so on.

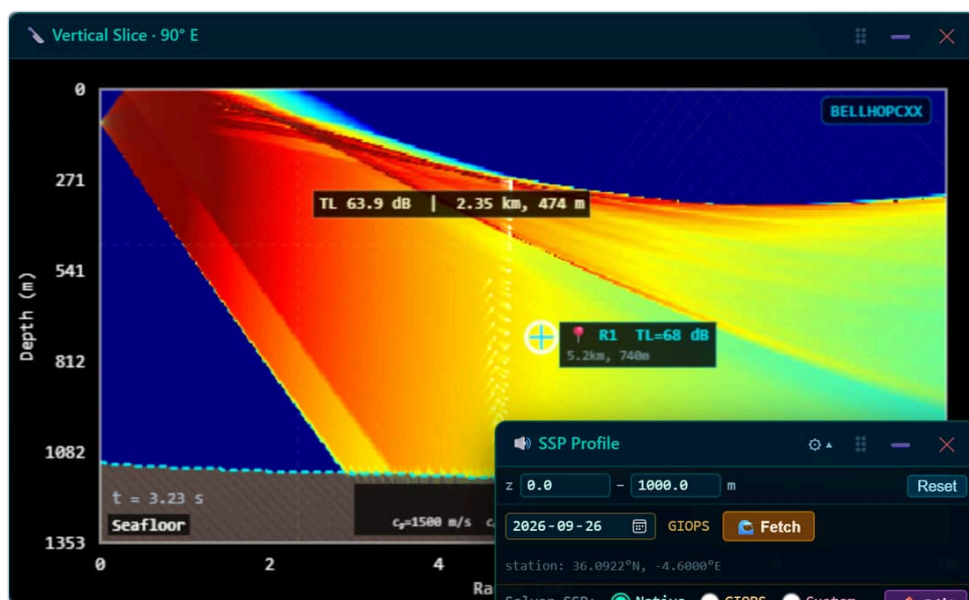


Figure 5.8 A pinned receiver R1 (right) while the cursor reads another point (upper left).

TL AND RL

When the run has a source level, the readout also shows the **received level (RL)**, which is the source level minus the transmission loss. Turning Cursor Readout off removes all pinned receivers.

Step 7 — Change the source depth and re-run

Each marker keeps its own settings, so you can change one run without touching the others.

- In the marker box, click **Settings**. The box grows into a settings panel.
- In the **Position** section, set **Src Depth** to 50 m. The hint beside the field shows the allowed range, from 0 m to the water depth at the marker.

Src Depth: m (0-1118)

Figure 5.9 The Src Depth field. The water depth here is 1118 m, so any value from 0 to 1118 m is accepted.

- Scroll to the bottom of the settings panel and click **Run**.

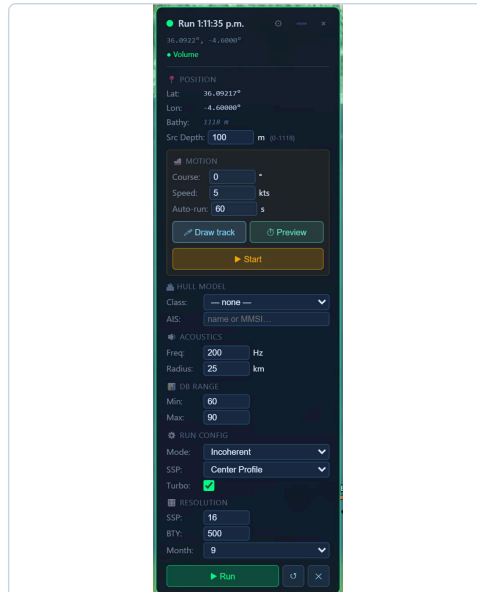


Figure 5.10 The complete marker settings panel: Position, Motion, Hull model, Acoustics, dB range, Run config and Resolution, with ▶ Run at the bottom.

The status bar shows *Simulation complete* when the new volume arrives. The slice reopens on the same bearing with the new result.

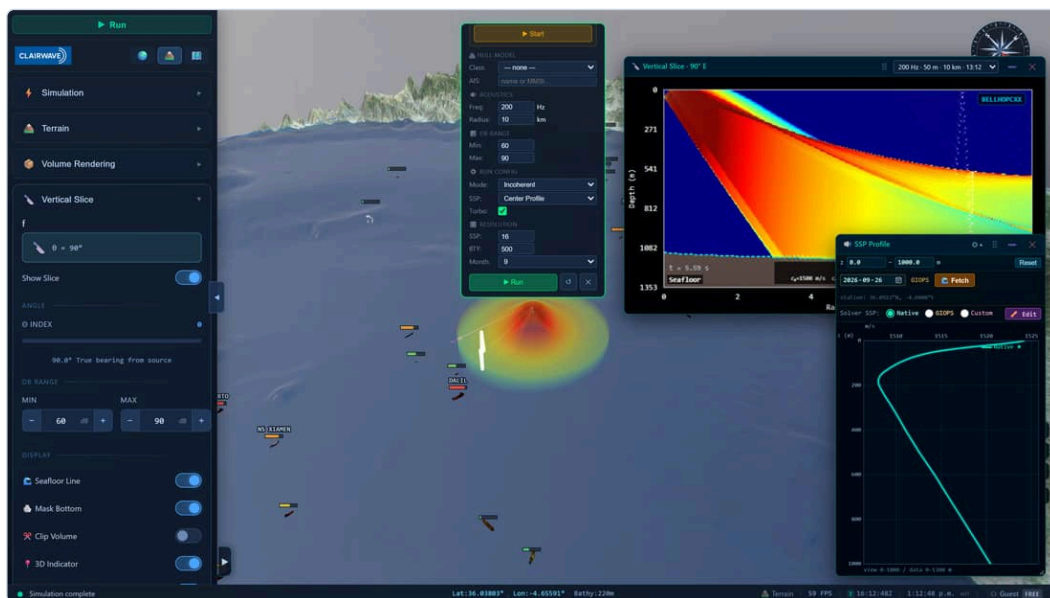


Figure 5.11 After the re-run with the source at 50 m. The selector in the slice header now lists this run as "200 Hz · 50 m · 10 km" followed by the time it ran.

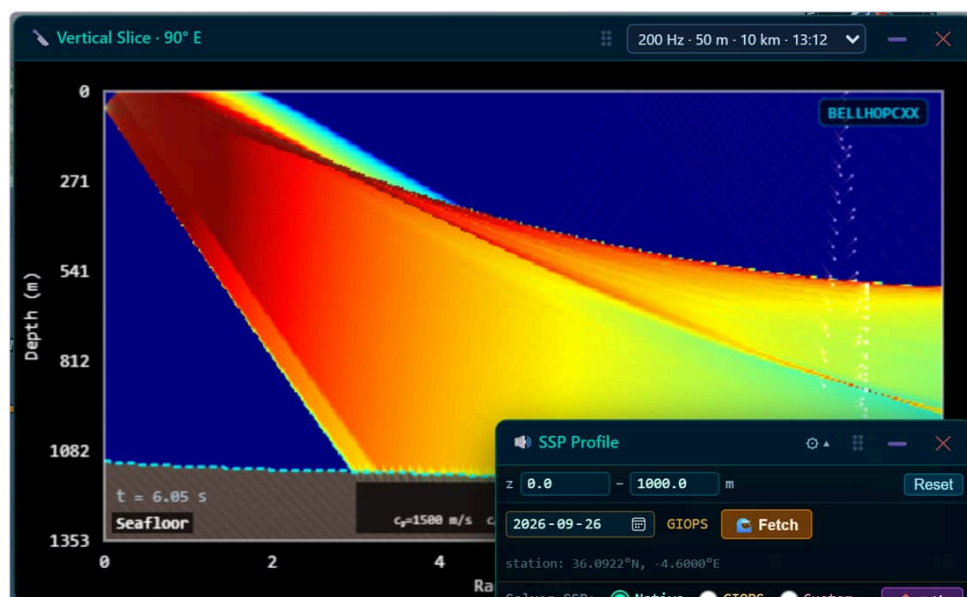


Figure 5.12 The slice for the 50 m source. Compare the shape of the loud (red) region with the first slice in Step 4.

SWITCHING BETWEEN RUNS INSTANTLY

The selector in the slice header lists the last eight runs of this marker. Choose an earlier one to switch back to it without re-computing anything. “*Simulation markers and the marker box*” (full manual) explains run history in full.

Step 8 — Export an HD image of the slice

1. In the **Vertical Slice** panel, scroll to **Actions**.
2. Optional: set **HD text** size and the depth and range units (**m** or **ft**, **km** or **NM**).
3. Click  **Export HD**.

A new browser window opens with the high-resolution picture, including the title, bearing, position, colour bar and SSP strip.

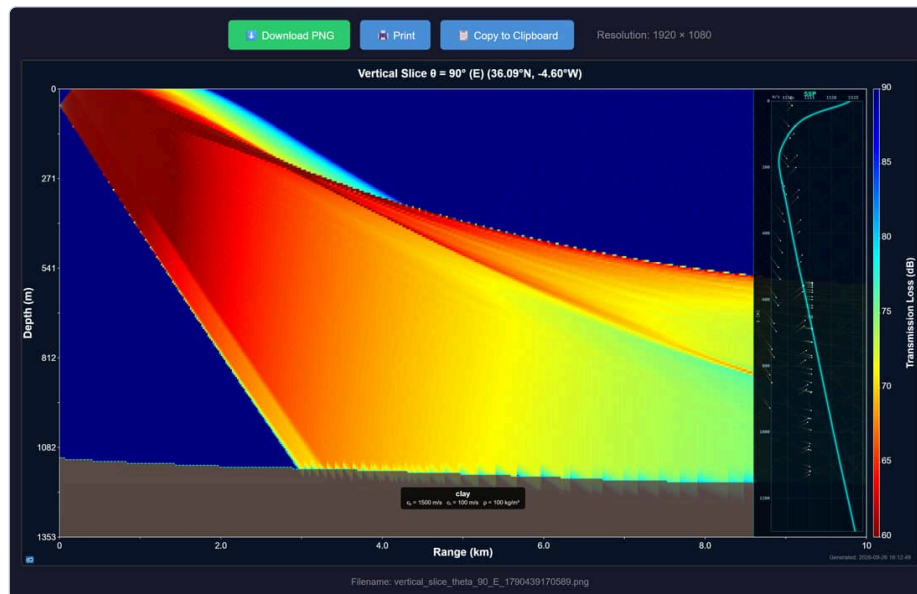


Figure 5.13 The HD export window with Download PNG, Print and Copy to Clipboard.

Click  **Download PNG** to save the file. Its name records the bearing and time, for example `vertical_slice_theta_90_E_1790419506397.png`.

POP-UP BLOCKERS

If nothing happens when you click Export HD, your browser has blocked the pop-up window. Allow pop-ups for www.clairwave.com and try again.

What to try next

- Click **▶ Run** at the top of the sidebar to run a new simulation at the centre of the view. “*Simulation settings*” (full manual) explains every setting.
- Click any coloured bar over the water to see that ship, its photo and its estimated noise. “*Live AIS vessels*” (full manual) covers vessels.
- Click on open water to drop a weather probe and see wind, waves and ambient noise at that spot. “*The drop probe and the distance ruler*” (full manual) shows how.
- Create a free account to keep your session, or upgrade for longer ranges, any frequency and GPU solvers. *Chapter 3, “Signing in and managing your account”* explains the plans.

CHAPTER 6

Learning with the Academy

The 🎓 Academy panel and its course *Underwater Acoustics in Practice*: languages, the eleven modules and who can open them, the Learn, Theory, Try it and Check tabs, and how progress is saved.

The 🎓 **Academy** panel holds a self-paced course, *Underwater Acoustics in Practice*. You read a short lesson, check the theory by hand, run a prepared scenario in the scene and answer a short quiz. The course teaches ocean acoustics through the same tools this manual describes.

Opening the Academy

The 🎓 **Academy** panel is the second panel in the sidebar, right after 👤 **Account**. Click its title to open it. With the sidebar collapsed, click 🎓, the second icon in the rail (*Chapter 4, "A tour of the screen"*).



Figure 6.1 The collapsed sidebar rail. 🎓 Academy is the second icon, under 👤 Account.

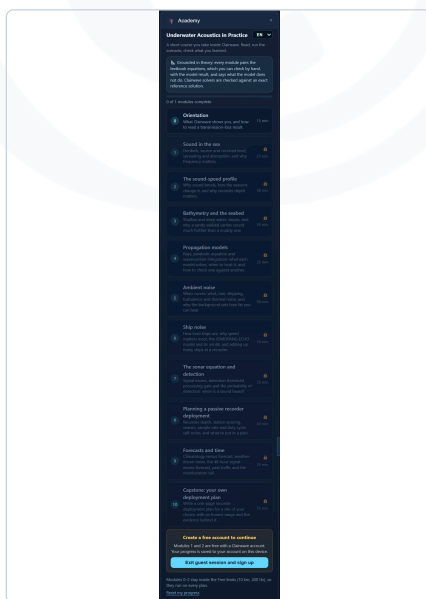


Figure 6.2 The Academy panel for a guest. Module 0 is open; the other modules carry a 🔒.

The top of the panel shows the course title, a short description and a progress bar (*0 of 1 modules complete*). Below it, each module is a row with its number, title, a one-line summary and the time it takes, from 15 to 55 minutes. A ✓ marks a module you have completed; a 🔒 marks one your plan does not open yet.

Control	What it does
EN ▼ EN / BM	Switches the course between English and Bahasa Malaysia. Clairwave remembers your choice on this device. The Academy's own tabs and buttons follow the course language; the names of other panels and buttons in the lessons stay in English, like the application. This chapter quotes the English labels.
0 of 1 modules complete 15 min Module row	Opens the module at its Learn tab. A locked row does nothing.

Control	What it does
 All modules	Returns from a module to the course overview.
Reset my progress	Clears your Academy progress on this device, after a confirmation. Shown when your progress is not saved to an account.

The modules and who can open them

The course has eleven modules, about six hours in all.

#	Module	Open to
0	Orientation	Everyone, including guests
1	Sound in the sea	Free and Premium accounts
2	The sound-speed profile	Free and Premium accounts
3	Bathymetry and the seabed	Premium
4	Propagation models	Premium
5	Ambient noise	Premium
6	Ship noise	Premium
7	The sonar equation and detection	Premium
8	Planning a passive recorder deployment	Premium
9	Forecasts and time	Premium
10	Capstone: your own deployment plan	Premium

Modules 0 to 2 stay inside the Free limits (10 km, 200 Hz), so their scenarios run on every plan. The panel says so at the bottom: *Modules 0–2 stay inside the Free limits (10 km, 200 Hz), so they run on every plan.*

MODULES 3 TO 10

Every Premium seat includes the full course for its named user. A guest sees a box under the module list: **Create a free account to continue**, with *Modules 1 and 2 are free with a Clairwave account.* and the button **Exit guest session and sign up**. A Free account sees **Modules 3–10 are included with Premium** and the button **See Premium**, which opens the Account & subscription window ([Chapter 3, “Signing in and managing your account”](#)).

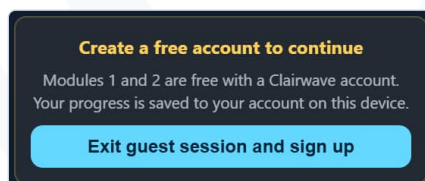


Figure 6.3 The box a guest sees under the module list.

Inside a module

Click a module to open it. Four tabs run along the top. Work through them from left to right: the button at the end of each tab takes you to the next one (**Next: Theory** ►, **Next: Try it** ►, **Next: Check** ►).



Figure 6.4 The four tabs of a module.

Tab	What it holds
Learn	A few minutes of reading with the ideas of the module. Some lessons show the buttons you will use, as small pictures.
Theory	The textbook equations behind the lesson, a Check it by hand question to work out on paper and compare with the model, What the model does not do , and References .
Try it	A scenario with fixed settings, one or more ► Load buttons, numbered Steps and What did you see? questions about the result in the scene.
Check	The quiz. A ✓ appears on the tab once you pass.

Theory: check it by hand

Each **Check it by hand** question has a **Check** button. Pick an answer and click it. Clairwave marks the answer ✓ *Correct*. or X *Not quite*. and explains how the hand estimate compares with the model, and why they differ.

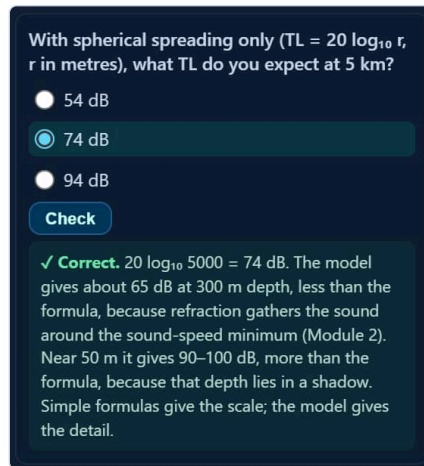


Figure 6.5 A by-hand check in Module 0 after clicking Check.

Try it: run the scenario

► **Load** · Alboran Sea · 200 Hz ► **Load** runs the lesson's scenario: Clairwave flies to the site and runs a simulation with the lesson's position, source depth, frequency, radius and month, the same way as a simulation link ("*Exporting and sharing results*" (full manual)). The button reads **Running...** until the run is placed. A run marker with its volume appears in the scene, and the panel says *Scenario loaded. Follow the steps below.* Your plan's limits apply as for any run.

Some modules have two or three ► **Load** buttons, for example the same site in February and in August. Load them one after the other and compare.

Then follow the **Steps**. They use the controls described in this manual, such as the marker box, the **2D** button and 🎯 **Cursor Readout**. Answer each **What did you see?** question with its **Check** button.

Check: the quiz

The **Check** tab holds five or six questions. Answer every question, then click **Submit answers**. If an answer is missing the panel says *Answer every question first*.

Clairwave shows your score (*Score: 5 of 5*) and an explanation under each question. You complete the module with 80 % or more, for example 4 of 5. The panel then says *Module complete. Well done.* and offers **Next module** ►. Below the pass mark it says how many answers you need. Click **Try again** to answer the quiz again; your best score counts.

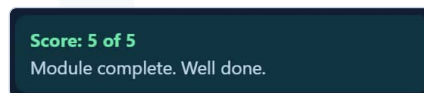


Figure 6.6 The result after passing the Module 0 quiz.

At the bottom of the **Check** tab, **Read next in the User Manual** lists the chapters of this manual that go deeper into the module.

Your progress

When you are signed in, Clairwave saves your progress to your account: completed modules, best quiz scores and the questions you answered in **Try it**. It follows you to other computers. The bottom of the overview then shows ► *Progress saved to your account*. If the connection drops, Clairwave keeps your progress on the device and saves it to your account the next time.

A guest's progress stays in the browser on that device. When you create an account, start the modules again there.

COMPLETE MODULE 0 AS A GUEST

1. Open the guest demo (*Chapter 5, "Your first simulation in ten minutes"*).
2. In the sidebar, open 🎓 **Academy** and click **0 Orientation**.
3. Read **Learn**, then click **Next: Theory** ►. Work out the by-hand question: $20 \log_{10} 5000 = 74$ dB.
4. On **Try it**, click ► **Load** · Alboran Sea · 200 Hz. Wait for the coloured dome.
5. Follow the steps: select the marker box, click **2D**, turn on 🎯 **Cursor Readout** and read the TL at 5 km. At 300 m depth it is about 65 dB; near 50 m it is 90 dB or more.
6. On **Check**, answer the five questions and click **Submit answers**.

Result: *Score: 5 of 5* and *Module complete. Well done*. Back on the overview, Module 0 carries a ✓ and the progress bar reads *1 of 1 modules complete*.

Part II — Finding your area



CHAPTER 7

Globe mode and the search bar

Spinning and zooming the globe, searching for vessels and places with the search bar, the live AIS picture at global scale, and picking an area with the red selection patch.

Globe mode shows the whole Earth. You use it to find the area you want to study: spin the globe, search for a place or a ship, and zoom in until Clairwave hands you a flat map and then the 3-D terrain. This chapter covers the globe and the search bar. [Chapter 8, “The flat map”](#) covers the flat map and [Chapter 9, “Terrain mode”](#) the terrain scene.

Opening the globe

A guest session opens straight into terrain mode over the Alboran Sea. A signed-in session opens where you last were, often on the globe.

To switch to the globe at any time:

- click  (Globe View (G)) in the sidebar header, or
- press **G**.

LEAVING TERRAIN CLEARS THE SCENE

Switching to the globe removes every run marker, volume, slice, drawn track, AIS vessel and weather layer from the terrain. [Leaving terrain mode](#) lists everything that is cleared. Your 3-D runs stay stored on the server, and you can open one again later ([Chapter 3, “Signing in and managing your account”](#)).

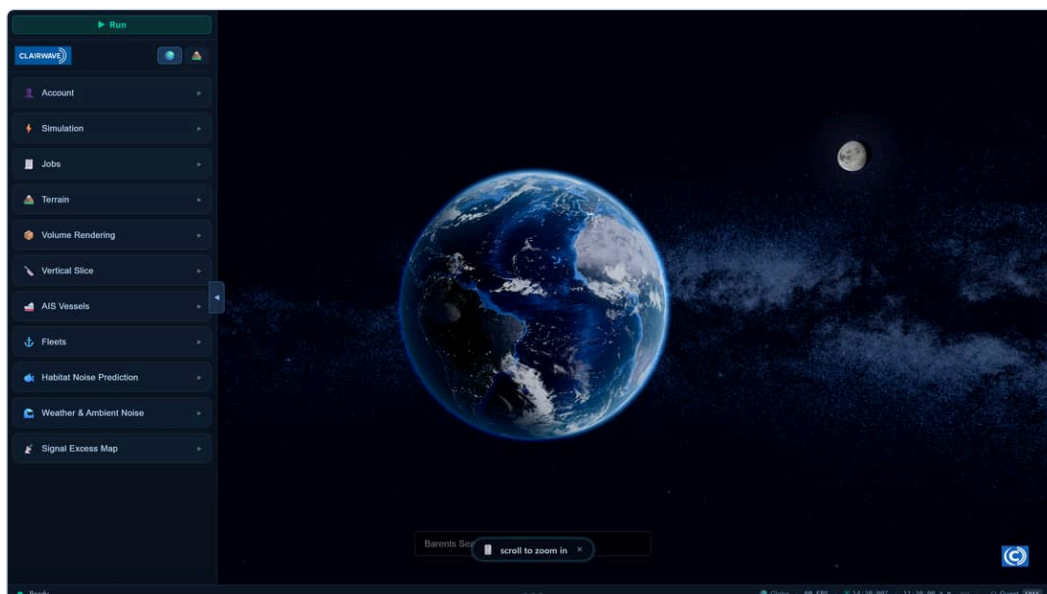


Figure 7.1 Globe mode. The search bar sits at the bottom centre and the status bar reads  Globe. The “scroll to zoom in” hint appears after a few seconds without input.

The status bar shows  **Globe** on the right and — — in place of the scene centre, because there is no terrain to measure yet.

Moving the globe

Action	Mouse	Touch
Rotate	Drag with the left button. The globe keeps spinning a little when you let go.	Drag with one finger
Zoom	Mouse wheel	Pinch
Zoom in one step	Double-click. The view moves 45 % closer to the globe.	Double-tap

When you leave it alone, the globe turns slowly on its own and the clouds drift. Zooming in stops the rotation.

The globe is lit by the Moon in the upper right of the view. The side facing it shows the oceans in blue, shaded by depth, with glowing coastlines and the moonlight reflected on the water; the far side is night, with city lights. As you zoom in, the Moon sets behind the edge of the globe.

 After about six seconds without input, a hint **scroll to zoom in** appears above the search bar. On a phone it reads **pinch out to zoom in**. Click **x** to dismiss it for the rest of the session.

What happens as you zoom in

Zooming is how you move from the globe to the terrain:

1. **Globe.** From far out you see the whole planet.
2. **Flat map.** About 50 units above the surface, the sphere flattens into a north-up 2-D map with a red selection patch in the middle. See [Chapter 8, “The flat map”](#).

3. **Terrain.** Click the red patch, click → **Load**, or keep zooming in, and Clairwave loads the 3-D terrain inside the patch. See [Chapter 9, "Terrain mode"](#).

The search bar

The search bar at the bottom centre of the globe finds places and ships. It is shown only in globe mode and on the flat map. It is hidden in terrain mode.

Search vessel or place	Queen Ma
Empty, with placeholder Search vessel or place	Typing an example name by itself

Example names

Five seconds after the globe opens, the search bar starts typing example place and ship names by itself, such as *Strait of Gibraltar*, *Halifax approaches*, *Queen Mary 2* or *Maersk*. Each name stays for a few seconds, then is erased and replaced by another. These are only suggestions: nothing is searched.

The examples stop for good as soon as you click the bar, type, paste, or press any key.

Searching for a place

1. Click the search bar.
2. Type a place name, for example *Strait of Gibraltar*, *Haro Strait* or *Bay of Fundy*.
3. Press **Enter**.

The message log shows 🔍 *Searching: Strait of Gibraltar...* The globe stops turning and flies to the place in about two seconds. When it arrives, the log shows the place and its position, for example 📍 *Strait of Gibraltar, Spain — N 35.9, W 5.6*, and the ▶ **Run** strip in the sidebar flashes for four seconds.

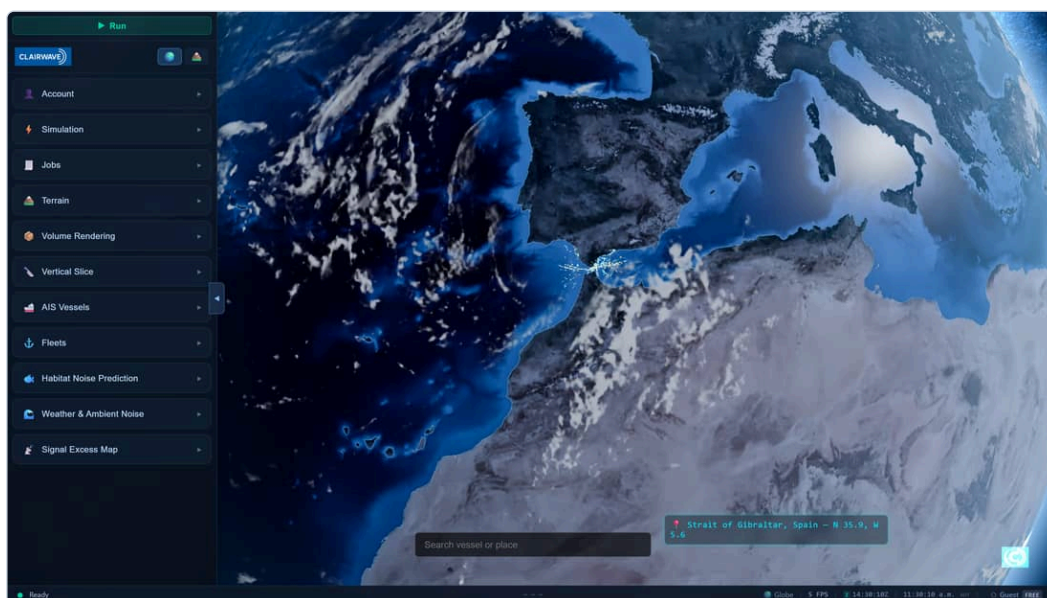
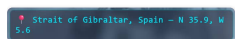


Figure 7.2 The globe arriving over the Strait of Gibraltar. The message log confirms the place found and its coordinates. The bright cluster at the strait is the live AIS traffic.



A moment later the globe flattens into the flat map, centred on the place, with a 200 km red selection patch around it. Click → **Load** under the patch to load that area in terrain mode. [Chapter 8, "The flat map"](#) shows the flat map and how to resize the patch first.

SEARCH AGAIN FROM TERRAIN

The search bar is hidden in terrain mode. Press **G** to return to the globe, then search. Remember that this clears the terrain scene.

When nothing is found

If the text matches no place, the message log says so and suggests what to try:

```
[11:30:43] 🔍 No place found for
"Blorptown Harbour" - try a place name
such as "Strait of Gibraltar", or pick a
vessel from the list
[11:30:43] 🔍 Searching: Blorptown
Harbour...
🖱️ Flat map - drag to pan · click red
patch for terrain
```

Figure 7.3 The message log after a search that matched no place.

Check the spelling, try a larger or better-known name, or pick a ship from the suggestion list ([[#vessel|Searching for a vessel]]). The search bar finds places and ships only.

Searching for a vessel

With a Premium plan, the search bar also finds ships in the live AIS feed.

1. Click the search bar.
2. Type at least two letters of the ship's name, or the start of its MMSI number.
3. A list of up to eight live matches opens above the bar. Each row shows  and the name, then the ship type, destination, speed in knots and position.
4. Click a ship, or use  and  and press **Enter**. Press **Esc** to close the list.



Figure 7.4 Vessel suggestions for "MAERSK". The first row is highlighted; Enter picks it.

When you pick a ship:

- the log shows its name and position, for example  MAERSK LIMA — N 54.3, W 130.4;
- the globe flies to the ship and a small gold ring flashes on its position;
- a window opens with the ship's 3-D hull model, turning slowly. The line at the bottom says whether it is the ship's own model or a class model, and whether a model is queued. "3-D ship models: preview, model library and model management" (full manual) explains the window and its buttons.

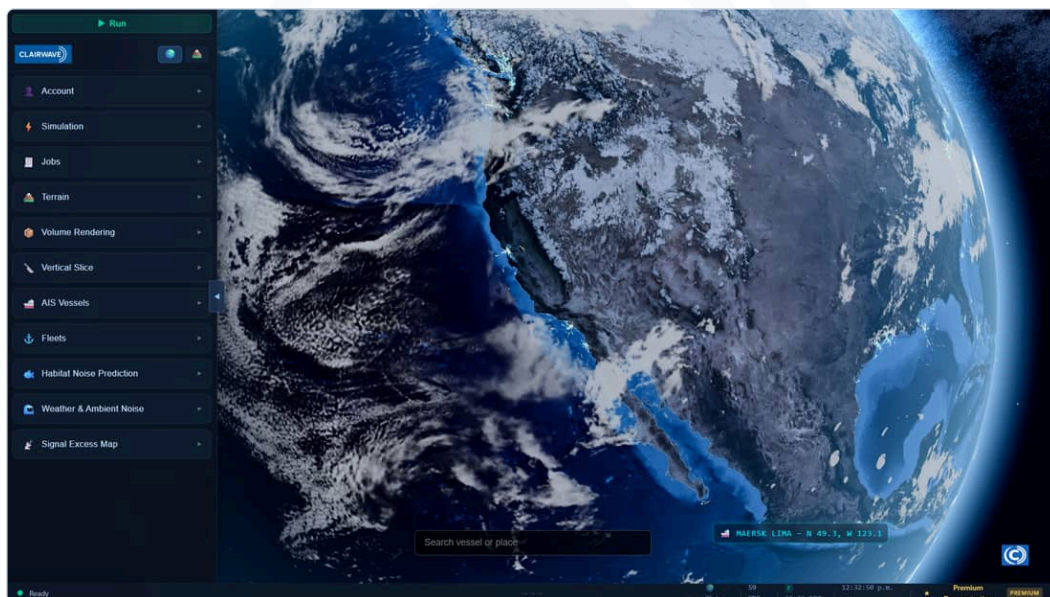


Figure 7.5 After picking a vessel: the globe flies to its position and the log names it.

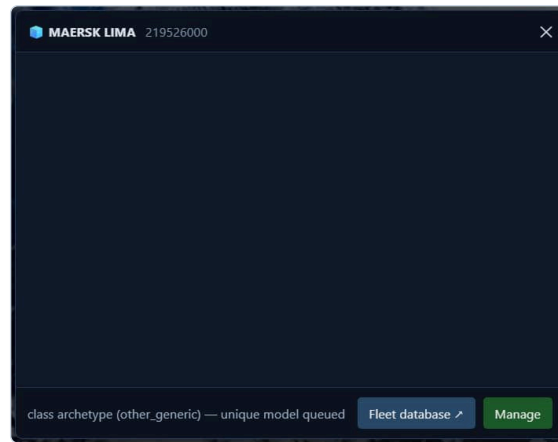


Figure 7.6 The 3-D model window that opens with a picked vessel. Close it with X.

When you then load the terrain around the ship, Clairwave pings the ship with a gold ring and selects it in the **AIS Vessels** panel. *“Live AIS vessels”* (full manual) explains the vessel card.

VESSEL SEARCH IS PREMIUM

On the Free plan and as a guest, typing a ship name shows no suggestions and no message. Press **Enter** and the text is treated as a place name. Place search works on every plan.

Live AIS on the globe

The globe and the flat map show live ship positions from AIS as small round dots. The dot colour shows speed, from cyan for slow ships to orange for fast ones. Ships moving faster than 1.5 knots draw a bright comet trail behind them, 30 km to 120 km long depending on speed, so shipping lanes stand out at a glance. The picture refreshes every minute.



Figure 7.7 Premium: worldwide live AIS on the flat map around the English Channel. The trails trace the shipping lanes.

WORLDWIDE LIVE AIS IS PREMIUM

The Free plan and guest sessions show live vessels **around Gibraltar only**. The rest of the globe has no ships. The **AIS Vessels** panel explains this with the banner *Worldwide live AIS and the historic time machine are Premium features. See [Appendix B, “Free, Guest and Premium compared”](#).*



Figure 7.8 Free plan: live AIS appears around the Strait of Gibraltar only.

On a phone or tablet, Clairwave draws trails for at most 2,500 ships to keep the globe smooth.

Keyboard shortcuts in globe mode

Key	What it does
G	Switches to globe mode (from terrain).
M	Switches to terrain mode and loads the currently selected area. In terrain mode, M shows or hides the minimap instead.
T	Loads the terrain for the currently selected area.
R	Runs a simulation. From the globe, Clairwave first enters terrain for the selected area, then runs at its centre.

Shortcuts do nothing while the cursor is in the search bar. Click the globe first. [Appendix A, "Keyboard and mouse reference"](#) lists every shortcut.

FIND A SHIP AND STUDY THE WATER AROUND IT (PREMIUM)

1. Press **G** to open the globe.
2. Click the search bar and type **MAERSK**.
3. Pick a ship from the list. The globe flies to it and its 3-D model opens.
4. Close the model window with **X**.
5. Wait a few seconds for the globe to flatten into the flat map around the ship, then click **→ Load**.

The terrain loads around the ship, the ship is pinged with a gold ring and its card opens in the **AIS Vessels** panel. Click **▶ Run** to simulate sound around the centre of the view.

CHAPTER 8

The flat map

The north-up 2-D map between the globe and the terrain: panning, zooming, resizing the patch and loading an area.

The flat map sits between the globe and the terrain. It is a north-up 2-D map on which you choose exactly which square of ocean to load. You size that square with the red selection patch, then load it with → **Load**.

How the globe becomes a map

Zoom in on the globe with the mouse wheel (pinch on a touch screen). About 50 units above the surface, the sphere dissolves in place into a flat map, centred where you were looking. A place or vessel search does the same once the globe arrives ([The search bar](#)).

The message log shows 🗎 Flat map — drag to pan · click red patch for terrain.

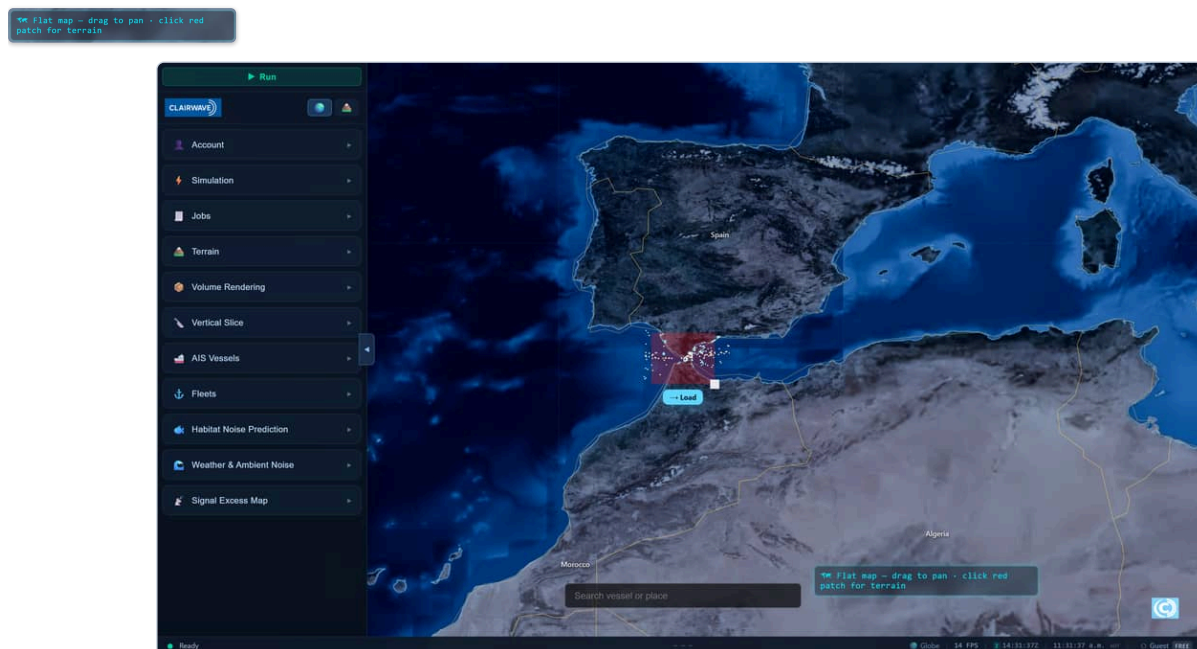


Figure 8.1 The flat map over the western Mediterranean. The red selection patch marks the area that will be loaded, with its resize handle at the lower-right corner and → Load below it.

The map shows:

- the world map in the same blue style as the globe (oceans shaded by depth, glowing coastlines), sharpened with high-resolution tiles a moment after each move;
- gold country borders and a 10° latitude and longitude grid;
- country names and ocean and sea names, with smaller names appearing as you zoom in;
- live AIS dots and comet trails, as on the globe ([Live AIS on the globe](#)). On the Free plan these appear around Gibraltar only;
- the **red selection patch** at the centre of the view, pulsing gently.

The status bar still reads 🌐 **Globe**, and the search bar stays available.

Panning and zooming

Action	Mouse	Touch
Pan	Drag the map	Drag with one finger
Zoom	Mouse wheel. The map zooms toward the pointer.	Pinch

The red patch always stays at the centre of the view, so panning moves the patch over the map. Its size in kilometres does not change when you zoom.

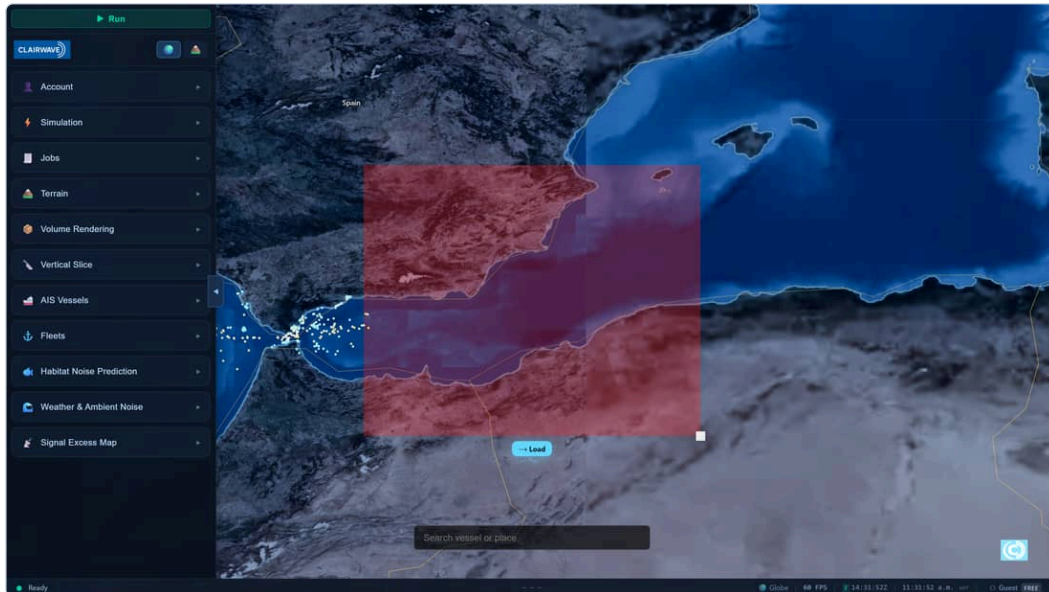
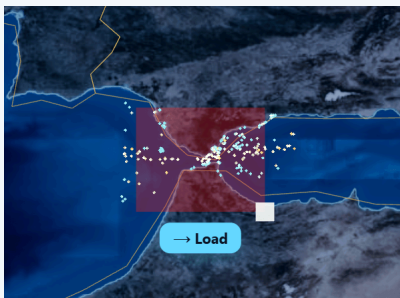


Figure 8.2 Zoomed in on the Alboran Sea. The patch keeps its size on the ground, so it looks larger as you zoom in.

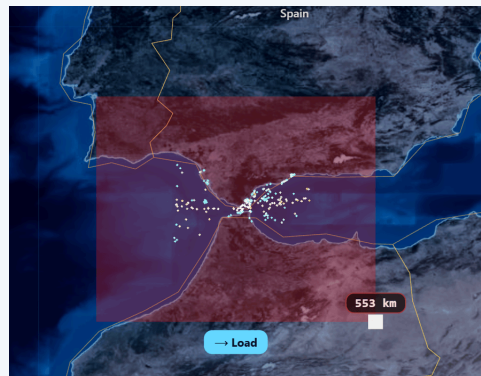
Resizing the patch

The patch starts 200 km across. You can make it anything from 50 km to 800 km.

1. Move the pointer over the small white square at the patch's lower-right corner. The pointer changes to a diagonal resize arrow.
2. Drag the square away from the centre to enlarge the patch, or toward it to shrink it.
3. While you drag, a red label above the handle shows the size, for example **615 km**.
4. Let go. The label fades after about a second.



The white resize handle at the patch corner



Dragging the handle: the readout shows 615 km

The size is the length of the patch's longer side on the ground. The terrain you load covers exactly this square.

CHOOSING A SIZE

A larger area gives you more context and more ships, but coarser terrain detail. A smaller area loads finer bathymetry and sharper imagery. For a single 10 km free-tier run, 50 km to 200 km works well. You can change the loaded area later from the **Terrain** panel or the minimap ([Terrain extent](#)).

Loading the area

There are three ways to load the terrain inside the patch:

- click  **Load** under the patch (tooltip *Load this area — enter terrain mode*);
- click the red patch itself (a click, not a drag);
- keep zooming in until the camera is very close to the map.

The map fades out, the terrain loads, and the status bar changes to  **Terrain**. [Loading a terrain tile](#) describes what you see next.

Returning to the globe

Zoom out with the mouse wheel. Just above the flat-map level, the globe re-forms underneath the map and the view rises straight out; the area you were looking at faces you with north up. The globe then starts turning slowly again.

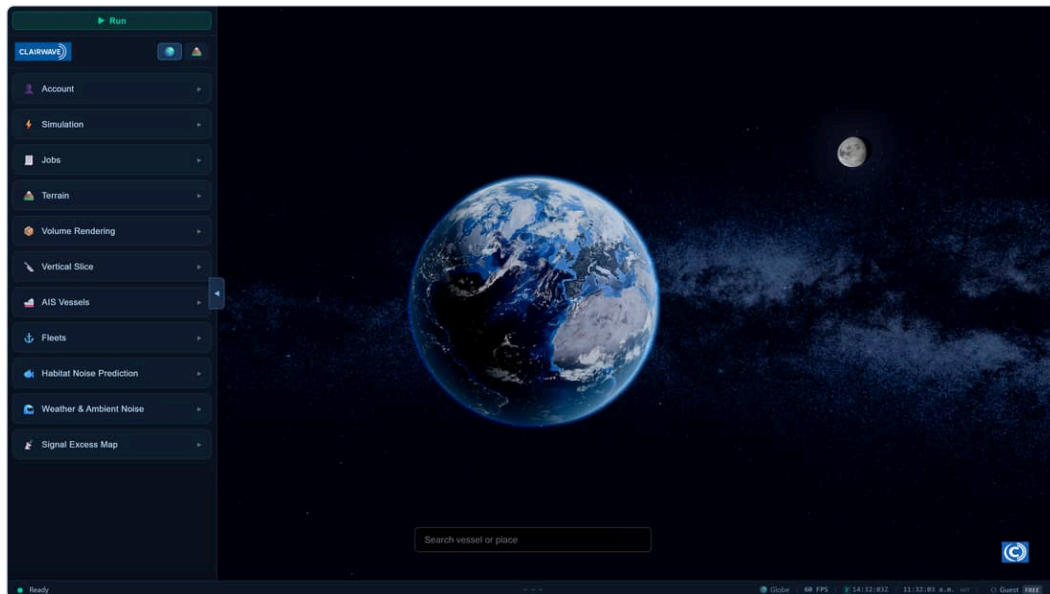


Figure 8.3 Back on the globe after zooming out of the flat map.

NOTE

The flat map counts as part of globe mode, so the  button and **G** have no effect while it is showing. Zoom out to return to the globe.

LOAD A 100 KM SQUARE AROUND GIBRALTAR

1. On the globe, type *Strait of Gibraltar* in the search bar and press **Enter**.
2. Wait for the flat map to appear with the red patch centred on the strait.
3. Drag the white corner handle toward the patch centre until the label reads about **100 km**.
4. Drag the map a little if you want the strait off-centre.
5. Click **→ Load**.

The terrain loads a 100 km × 100 km square. The **Area** readout at the bottom of the **Terrain** panel confirms the size.

CHAPTER 9

Terrain mode

The 3-D bathymetry scene where all simulation happens: camera controls, the Terrain panel, basemaps, vertical exaggeration, area extent and automatic re-centring.

Terrain mode is the 3-D scene where every simulation runs. It shows the seafloor and the land around it as a lit relief model, draped with a satellite image or another basemap, with live ships on the water. This chapter explains how to load an area, move the camera, and use every control in the **Terrain** panel.

Loading a terrain tile

You enter terrain mode in one of these ways:

- click → **Load** or the red patch on the flat map (*Loading the area*);
- zoom in on the flat map until the terrain takes over;
- press **M** or **T**, or click  (**Terrain View (M)**), to load the area selected last;
- press **R** or click ► **Run** on the globe, which loads the area and runs a simulation at its centre;
- open a guest session, which starts in terrain mode over the Alboran Sea.

Clairwave downloads the bathymetry and a first image for the area, builds the relief, and then swaps in a sharper basemap. The message log reports  **ArcGIS World Imagery texture swapped** when the sharp image is in place. The terrain tile is square, the size of the patch you chose (50 km to 800 km on the flat map, 5 km to 300 km from the **Terrain** panel).



Figure 9.1 Terrain mode after the guest demo run. (1) Compass and scale bar. (2) Weather and signal-excess toggles. (3) Navigation minimap. (4) Amber depth-axis handle. (5) Scene centre and water depth in the status bar.

When the terrain appears, Clairwave also:

- shows the compass and scale bar in the top-right corner (*The compass and scale bar*);
- opens the navigation minimap in the lower left after a moment (on a desktop screen; on a phone it stays closed);
- shows the weather and signal-excess toggles on the right edge;
- draws latitude labels along the west edge and longitude labels along the south edge, with a depth axis at the south-west corner;
- starts showing live AIS ships in the area. On the Free plan, live ships appear around Gibraltar only.

The status bar changes to  **Terrain** and shows the latitude, longitude and water depth under the centre of the view. This is the point ► **Run** uses.

Moving the camera

Action	Mouse	Touch
Pan	Drag with the left button	Drag with one finger
Rotate and tilt	Drag with the right button	Twist or drag with two fingers
Zoom	Mouse wheel. The view zooms toward the pointer.	Pinch
North up	Click the compass	Tap the compass

The camera cannot go below the horizon, so you always look down on the sea. The movement glides to a stop when you let go.

CLICKS IN THE SCENE DO THINGS

A click on a ship selects it, and a click on open water can drop a weather probe when that option is on (*"The drop probe and the distance ruler"* (full manual)). To move the camera, drag instead of clicking. Press **Esc** to clear a vessel selection.

If you zoom a very long way out, Clairwave returns to the globe automatically. This clears the terrain scene as described in [Leaving terrain mode](#).

The view stays near the loaded area. You cannot pan the centre of the view more than about one tile width from the middle of the tile. To work further away, load a new area ([Automatic re-centring](#)) or [the minimap](#).

Terrain mode also works across the 180° meridian (the date line) in the Pacific, for example around Fiji. Terrain, imagery, runs and live ships continue across it, and longitudes are always shown between -180° and 180°.

The Terrain panel

Click  **Terrain** in the sidebar to open the panel. It has three groups: **Display**, **Terrain Extent** and **Material**, with the loaded area at the bottom.

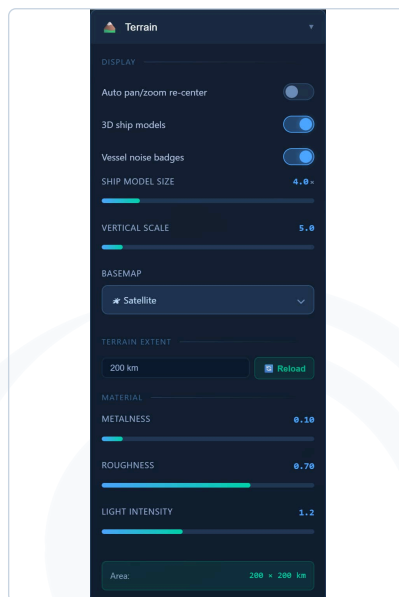


Figure 9.2 The Terrain panel with its default settings (guest session, Vertical Scale 5.0).

Display

Control	What it does
Auto pan/zoom re-center pan/zoom re-center Auto	Off by default. When on, Clairwave offers to load new terrain when you pan past the edge of the tile or zoom far in or out, with a ghost preview and a 10-second countdown. See Automatic re-centring
3D ship models 3D ship models 3D ship	On by default. Draws a 3-D hull for each AIS ship, scaled to its reported length and turned to its course. Ships without their own model use a model for their class. When off, ships are drawn as small flat chevrons coloured by type.
Vessel noise badges Vessel noise badges Vessel noise	On by default. Draws a small bar over each ship, coloured from green to red by its estimated source level, with the ship's name where there is room. The badges keep ships visible from high up.
SHIP MODEL SIZE Ship model size 4.0	Size multiplier for the 3-D ship models, from 0.5× to 20×. The default is 4×. At 1× the hulls are true to scale, which is too small to see from most viewpoints.
VERTICAL SCALE Vertical Scale 5.0	Vertical exaggeration of the terrain, from 0.1 to 50. See Exaggeration
BASEMAP Basemap Satellite	The image draped over the terrain.  Satellite is the default. Changing it is Premium. See Basemaps

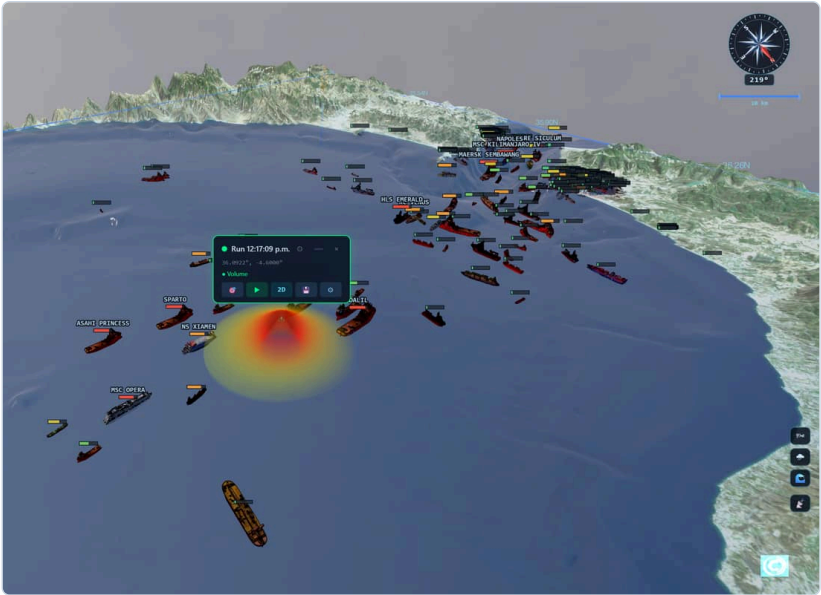
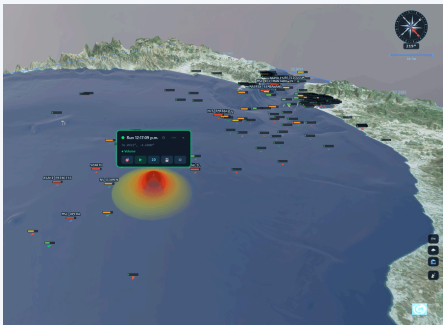


Figure 9.3 Ship model size at 20x: the hulls are easy to identify.



3D ship models off: ships become flat chevrons, coloured by type.



Vessel noise badges off as well: only the chevrons remain.

“Live AIS vessels” (full manual) explains the ship colours, the badges and how to select a ship. “3-D ship models: preview, model library and model management” (full manual) explains where the hull models come from.

Terrain Extent

Control	What it does
200 km Reload Terrain Extent list and Reload	Choose a tile size, then click Reload (tooltip <i>Reload terrain at selected extent</i>) to reload the terrain as a square of that size, centred on the centre of the view. The sizes are 5, 10, 20, 50, 100, 200 and 300 km.
Area: 200 × 200 km Area	The size of the terrain that is loaded now, in km.

The list always starts at **200 km** and does not follow the area you loaded from the flat map. Read the **Area** line for the real size.

Run markers keep their latitude and longitude when the terrain reloads. Those inside the new tile move to the right place on it; those outside it disappear until you load an area that contains them again. To move a marker to an exact position, click its coordinates and type a position (“Simulation markers and the marker box” (full manual)); the marker moves with its volume and runs again there.

LOAD A DETAILED 50 KM TILE

- 1. Pan the view so that the area of interest is in the centre.
- 2. In **Terrain Extent**, choose **50 km**.
- 3. Click  **Reload**.

The terrain reloads with finer relief and a sharper image, and the **Area** line reads **50 × 50 km**.

50 km Reload	Area:50 × 50 km
50 km chosen	The new area

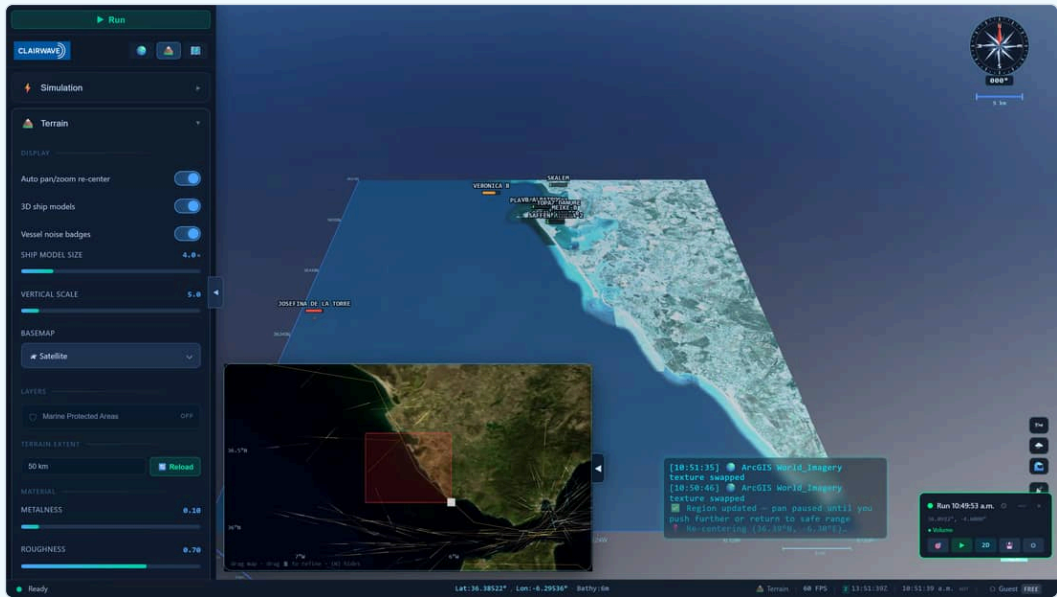


Figure 9.4 A 50 km tile. At this size the coastline and the shelf are much sharper.

Material

These three sliders change how the terrain surface reflects light. They change the look only, not any result.

Control	What it does
METALNESS0.10Metalness	How metal-like the surface is, from 0 (diffuse) to 1 (mirror).
ROUGHNESS0.70Roughness	How rough the surface is, from 0 (glossy) to 1 (matte).
LIGHT INTENSITY1.2Light Intensity	The brightness of the scene lighting, from 0.1 to 3.

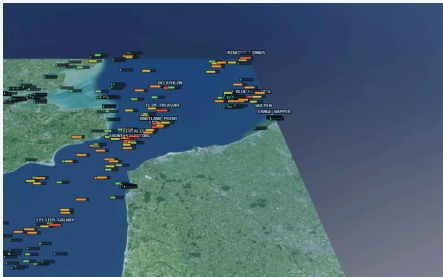
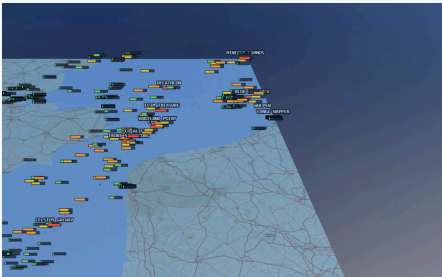
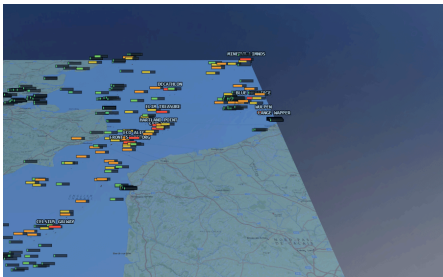
Each basemap comes with its own values. Choosing a basemap resets the three sliders, for example to 0.10, 0.70 and 1.2 for  **Satellite**.

Basemaps

The **Basemap** list offers sixteen ArcGIS layers:

 Satellite	 Streets	 Topo	 Terrain
 Physical	 Shaded Relief	 NatGeo	 Light Gray
 Dark Gray	 Ocean Base	 Ocean Labels	 Labels
 Labels Alt	 Transport	 Gray Labels	 Dark Labels

The last five layers ( **Labels** to  **Dark Labels**) carry place names, borders or roads rather than a full picture of the ground.

	
✳ Satellite	🏠 Streets
	
🏞 Topo	🌊 Ocean Base
	
🗺 NatGeo	■ Dark Gray

🔒 CHANGING THE BASEMAP IS PREMIUM

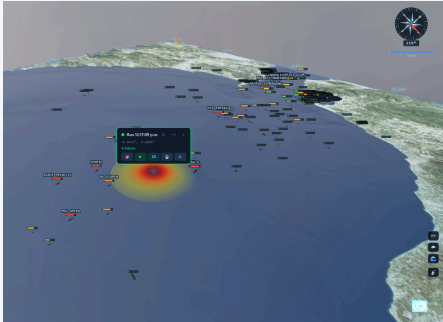
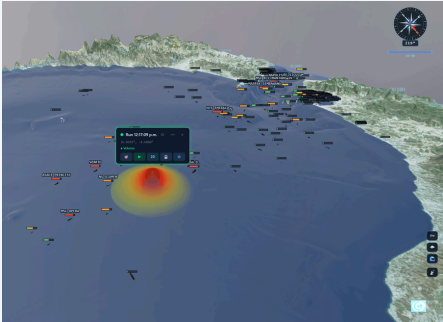
On the Free plan and as a guest, the terrain stays on ✳ **Satellite**. Choosing another basemap shows *Changing the basemap is a premium feature* in the status bar, and the terrain does not change.

● Changing the basemap is a premium feature

Lat: 36.02399° Lon: -4.65601° Bath: 220m

Vertical exaggeration

Ocean basins are wide and shallow: a 200 km tile may be only 2 km deep. At true scale the seafloor looks almost flat. Vertical exaggeration stretches the heights so that slopes, canyons and seamounts stand out. The guest demo uses 5×; a normal session starts at 1×.

	
Vertical Scale 1.0: true scale	Vertical Scale 5.0: the Moroccan coast and the shelf edge stand out

Exaggeration applies to the terrain, the transmission-loss volumes and the depth axis together, so they always line up. It does not change any result, and the status bar always shows true water depth.

There are two ways to set it:

- **The Vertical Scale slider** in the **Terrain** panel, from 0.1 to 50.
- **The depth axis** at the south-west corner of the terrain.

Dragging the depth axis

The depth axis is a vertical scale marked in metres. It fades in as the exaggeration rises above 1x. Its amber grab handle, with small up and down arrows, is always visible.

1. Move the pointer over the depth axis or its handle. It turns cyan and the pointer becomes an up-down arrow.
2. Drag up to stretch the terrain, or down to flatten it. Every 50 pixels changes the exaggeration by 1×.
3. Let go. The **Vertical Scale** slider shows the new value.

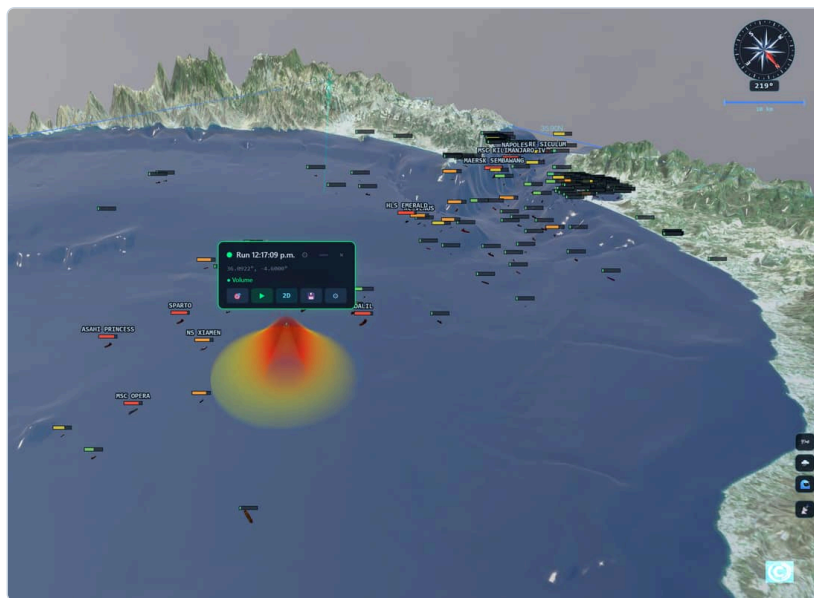
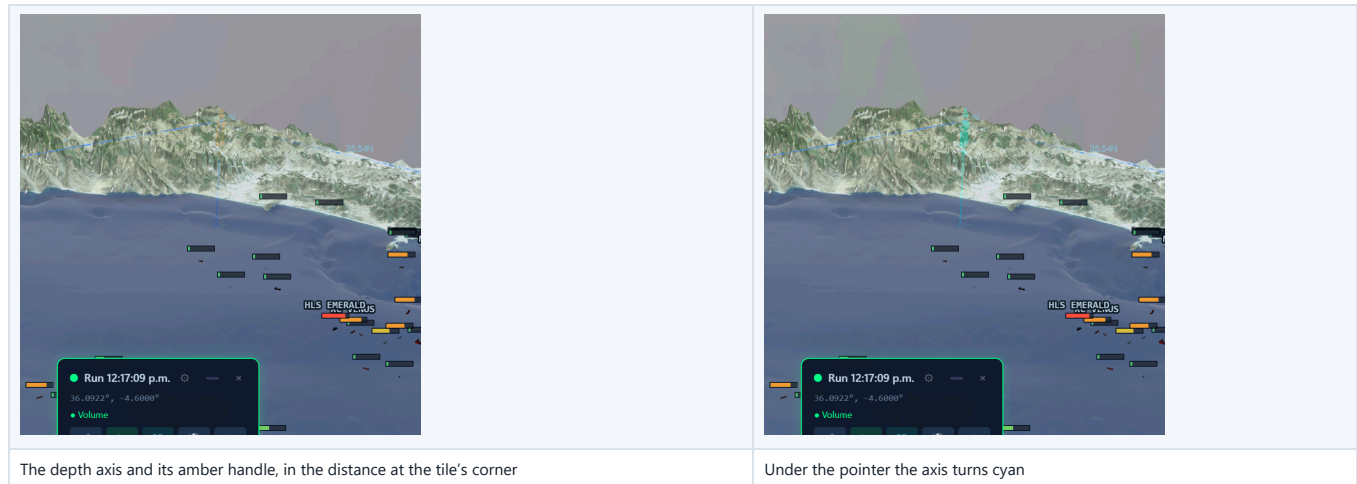


Figure 9.5 After dragging the handle up: the relief is stretched to about 8x.

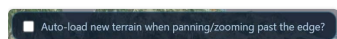


Automatic re-centring

A terrain tile has edges. When you pan past them, or zoom so far that the tile looks too coarse or too small, Clairwave can load a better tile for you. This is off by default.

Turning it on

- Turn on **Auto pan/zoom re-center** in the **Terrain** panel, or
- tick the box in the prompt that appears at the top of the view the first few times you pan or zoom past the limits:

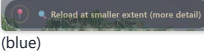
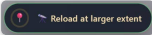


The prompt shows for at most about 15 seconds in a session, then stops asking.

The chips

With the option on, a chip appears at the top centre of the view when the camera is near a limit:

Chip	When it appears	What it loads
 Re-center map here (amber)	The centre of the view is in the outer 30 % of the tile	A tile of the same size, centred on the view

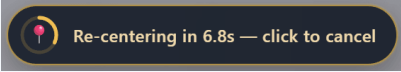
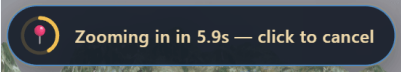
Chip	When it appears	What it loads
 Reload at smaller extent (more detail) (blue)	You are zoomed in so far that the view covers less than 30 % of the tile	A tile half as wide, with more detail
 Reload at larger extent (green)	The view covers more than 140 % of the tile	A tile twice as wide

The countdown and the ghost preview

Click a chip to start a 10-second countdown. If you pan past the edge, or keep zooming past the limit, the countdown starts by itself after about a second.

During the countdown:

- the chip reads, for example, **Re-centering in 6.6s — click to cancel**, and a ring around the  fills up;

	
Pan countdown	Zoom-in countdown

- a **ghost preview** shows the new tile: a dashed amber outline over a faint image of the new area, with its corner coordinates, a scale bar and a  **NEW CENTER** label;
- the message log shows the new centre and the time left, for example  **Auto:**  *Re-centering (36.39°N, -6.22°E) in 10.0s — click chip to cancel.*

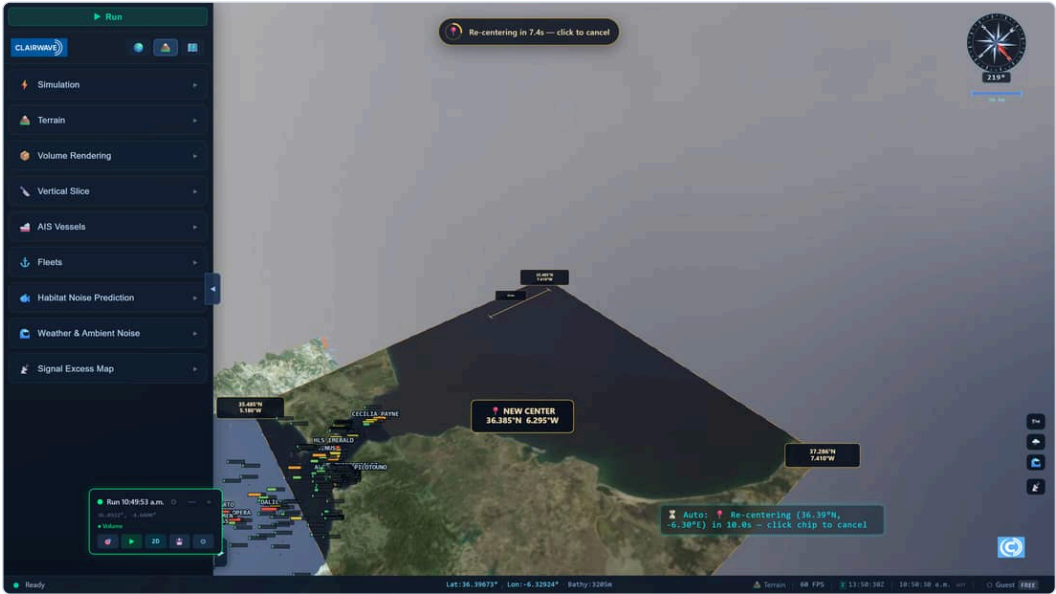
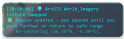


Figure 9.6 A pan countdown. The ghost preview shows the tile that will load, with its corners and new centre.

When the countdown ends, Clairwave loads the new tile, keeps your camera angle and zoom, and moves run markers to their positions on it. The log reports  *Region updated.*



To cancel, click the chip during the countdown, or move back within the limits. After a click-cancel, that trigger pauses until you pan or zoom clearly further, so the chip does not come straight back.

Refining the area with the minimap

The navigation minimap in the lower left shows the loaded tile as a red rectangle on the blue-toned world map. Use it to move or resize the tile precisely. *The navigation minimap* describes its parts.

- Press **N** if the minimap is hidden.
- Drag the red rectangle to a new position, or drag its white corner square to resize it. Drag the empty map to look around, and use the wheel to zoom it.
-  **Load** Click **Load** (tooltip *Reload terrain for this rectangle*), which appears as soon as you move the rectangle.

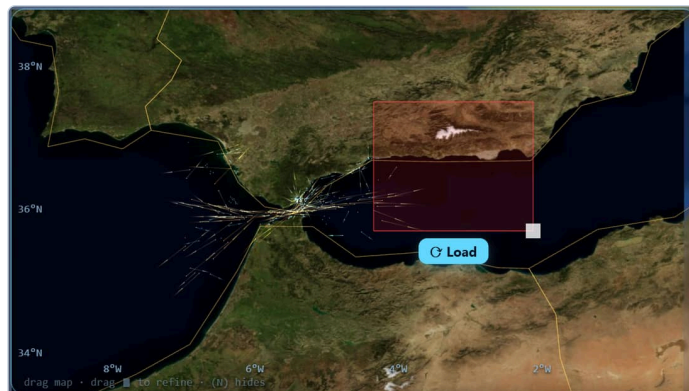


Figure 9.7 The minimap after dragging the rectangle east. Load appears under it.

The log shows Loading refined area... and then Area loaded. The camera keeps its angle and zoom over the new area, and existing run markers stay at their positions.

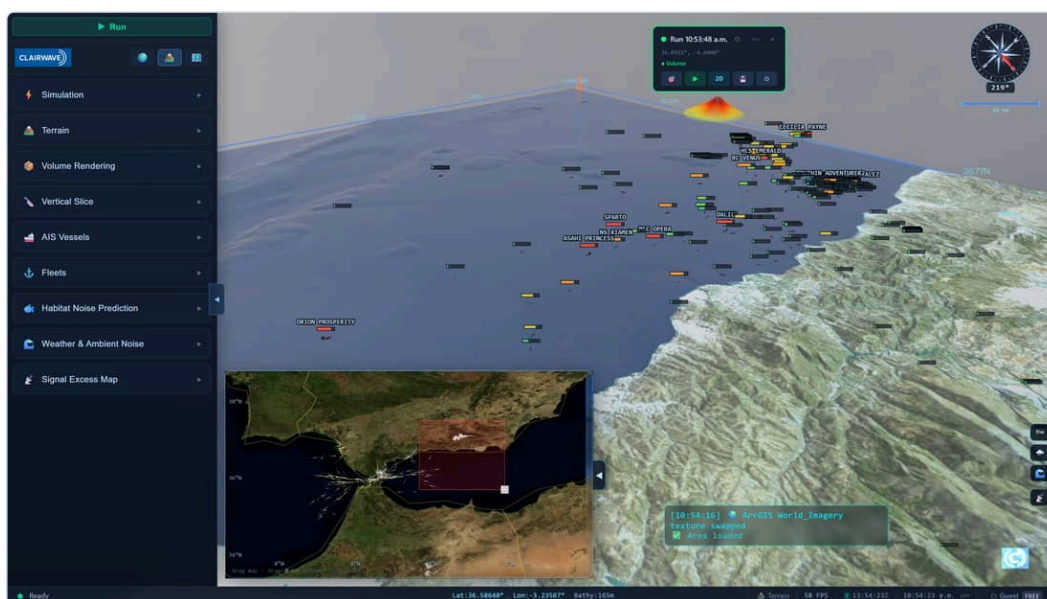


Figure 9.8 After Load: the new area east of the old one. The demo run marker keeps its position in the north-west corner.

Minimised windows: the dock

Several floating windows can be minimised: the vertical slice, the **SSP Profile** dock, the **Custom SSP** editor, the reverberation tail pane and the noise card. On a computer, a minimised window goes to the dock: a row of bars at the bottom left of the 3-D view, next to the sidebar and just above the status bar.

- Click in a window's title bar. The window shrinks to a bar with its title and joins the end of the row.
- When the row is full, a second row starts above it. The bars skip past the minimap instead of covering it.
- Click a bar, or its , to restore the window. It comes back exactly where it was, at the same size.
- Click X on a bar to close that window. The other bars move along to close the gap.
- A bar in the dock shows only the title, and X. You cannot drag it: restore the window first, then move it.

On a phone the dock is not used. A minimised window shrinks to its title bar where it is; tap the title bar to restore it (*"Using Clairwave on a phone or tablet"* (full manual)).

Leaving terrain mode: what is cleared

Clicking , pressing **G**, or zooming very far out returns you to the globe. Clairwave then removes everything that belongs to the terrain scene:

- every run marker, with its volume, slice, run history and ray and PE results;
- vessel motion, projected tracks, drawn tracks and transit previews;
- the AIS ships, the vessel selection, the noise card and the AIS time machine;
- the weather layers, the probe and the forecast grid;
- the terrain itself, the minimap, the compass and the depth axis.

Your sidebar settings, such as frequency, colour range and basemap, stay as they are.

KEEP A RUN BEFORE LEAVING

Your 3-D runs stay stored on the server for a while: open one again later from the **Jobs** panel or with its ?run= link ([Chapter 3, "Signing in and managing your account"](#)). Export what you need first (*"Exporting and sharing results"* (full manual)).

Part VI — Clairwave from your AI assistant



CHAPTER 10

Connecting an AI assistant (MCP)

What the Clairwave MCP server is, adding it to Claude, ChatGPT, Grok, Claude Code or your own API code, the links it returns, limits and privacy.

What MCP gives you

Clairwave runs an open **MCP server** at <https://www.clairwave.com/mcp>. MCP, the Model Context Protocol, is a standard way for an AI assistant to call outside tools. Once you connect Clairwave, you can ask Claude, ChatGPT or Grok an acoustic question in plain language. The assistant calls Clairwave's tools, gets computed answers, and replies with the numbers and a link.

The assistant can:

- turn a place name such as *Halifax approaches* or *Strait of Hormuz* into a water position;
- read seafloor depth at a point or along a transect;
- fetch the seasonal sound-speed profile and seabed parameters for any month;
- run a transmission-loss calculation along a bearing (RAM) or a full 3-D volume (Bellhop);
- estimate passive or active detection range with the sonar equation;
- list live AIS ships near a point, look one up, estimate its source level and find a photo;
- estimate shipping noise at a fixed site such as a fish farm or hydrophone.

"*MCP tool reference*" (full manual) describes all thirteen tools. "*MCP worked examples*" (full manual) shows six real conversations.

The server is open by design. You need no Clairwave account and no API key. It works the same for everyone who connects.

WHY USE THE TOOLS INSTEAD OF ASKING THE ASSISTANT DIRECTLY?

Without the tools, an assistant can only estimate ocean acoustics from memory. With them, every number comes from Clairwave's bathymetry, sound-speed climatology, seabed data and solvers, and each answer names the model and run it used.

The AI Assistants section of the landing page

The **AI Assistants** link in the landing-page menu takes you to the section that holds everything you need to connect.

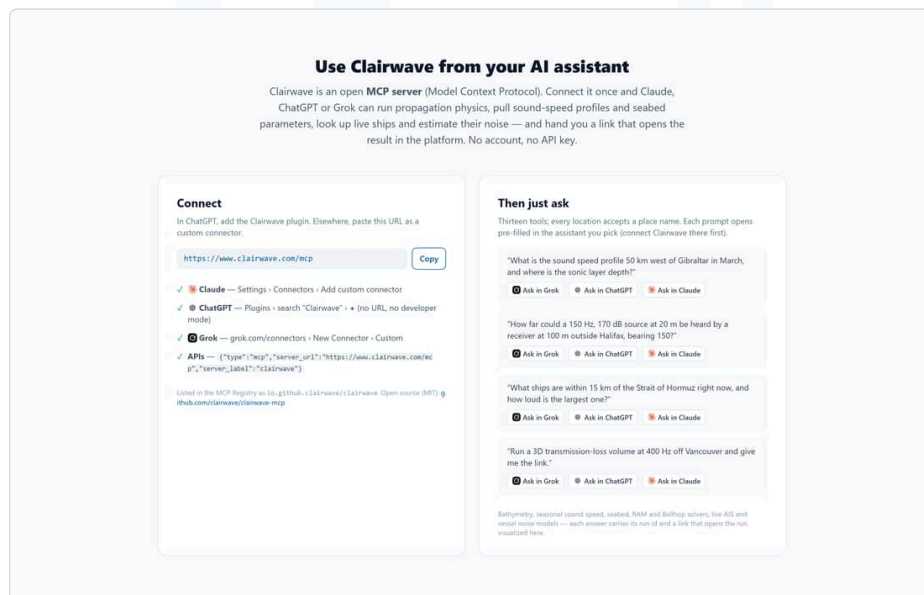


Figure 10.1 The "Use Clairwave from your AI assistant" section of www.clairwave.com. Left: the server address and setup paths. Right: example prompts.

Control	What it does
https://www.clairwave.com/mcp Copy	Copies the server address <code>https://www.clairwave.com/mcp</code> to the clipboard. The button reads <i>Copied</i> for a moment.
Ask in Grok Ask in ChatGPT Ask in Claude Ask in Grok, Ask in ChatGPT, Ask in Claude	Opens that assistant in a new tab with the example prompt already typed, prefixed with <i>Using the Clairwave connector</i> (<code>https://www.clairwave.com/mcp</code>):. Nothing is sent until you send it. Connect Clairwave in that assistant first.

Adding Clairwave to Claude (web and desktop)

Claude on the web (claude.ai) and the Claude desktop app share the same connector settings.

ADD THE CLAIRWAVE CONNECTOR

1. In Claude, open **Settings** > **Connectors**.
2. Click **Add custom connector**.
3. Enter a name, for example *Clairwave*.
4. Paste `https://www.clairwave.com/mcp` as the server URL.
5. Leave authentication empty. Clairwave needs none.
6. Save the connector.

To use it, start a new chat and make sure the Clairwave connector is switched on in the chat's tools menu. Then ask your question. Claude shows each tool call it makes, and asks your permission first if your settings require it.

SCREENS DIFFER BY VERSION

The exact wording of the connector screens is Claude's, not Clairwave's, and it changes from time to time. If a label here does not match, look for "Connectors" or "Integrations" in Claude's settings.

Adding Clairwave to ChatGPT

In ChatGPT, Clairwave is a ready-made plugin. You do not need developer mode or the server address.

ADD THE CLAIRWAVE PLUGIN

1. Sign in to ChatGPT at chatgpt.com.
2. Click **Plugins** in the left sidebar.
3. Type *clairwave* in the search box.
4. Click + next to **Clairwave**, *Ocean acoustics & live ships*.

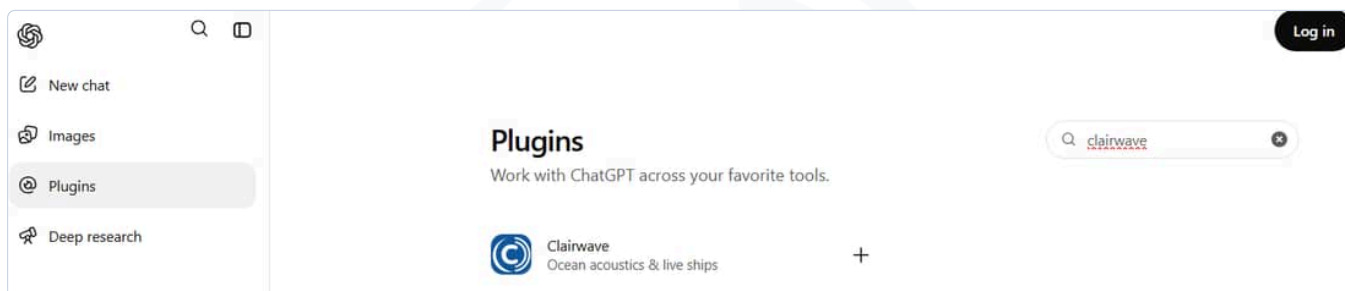


Figure 10.2 The Clairwave plugin in ChatGPT's plugin directory. The + button adds it.

Then start a new chat and ask your question. If ChatGPT answers from memory instead of calling Clairwave, name it in the prompt, for example *Using Clairwave, what is the sound speed profile off Halifax in August?*

SCREENS DIFFER BY VERSION

The plugin directory is ChatGPT's own screen, and its layout can change. Search for *Clairwave* wherever ChatGPT lists plugins or apps.

Claude Code, Grok and API clients

Claude Code. Add the server from a terminal:

```
claude mcp add --transport http clairwave https://www.clairwave.com/mcp
```

Run `claude mcp list` to check that it is connected. In a session, ask your question as usual.

Grok. Go to grok.com/connectors, choose **New Connector** > **Custom**, and paste the server URL.

Your own code. API clients that accept remote MCP servers as a tool take a definition like this one, shown on the landing page:

```
{"type": "mcp", "server_url": "https://www.clairwave.com/mcp", "server_label": "clairwave"}
```

Each provider's API names these fields in its own way. Check its documentation for the exact shape.

Technical details for client developers:

Item	Value
Transport	Streamable HTTP, stateless, JSON replies. <code>https://www.clairwave.com/mcp</code> and <code>/mcp/</code> both work.
Required header	<code>Accept: application/json, text/event-stream</code> . Without it the server answers HTTP 406.
Protocol version tested	2025-06-18
Authentication	None

Item	Value
Tools	13. No resources or prompts.
Registry name	io.github.clairwave/clairwave in the MCP Registry

Opening results in the app: open_url links

Most results include an **open_url**. It is a link such as `https://www.clairwave.com/demo?guest=1&run=08590060-...` that opens that exact result in the Clairwave web app. The link opens as a guest, so nobody needs to sign in. You can pass it to a colleague.

The server tells the assistant to always show this link. If an assistant leaves it out, ask *"Give me the open_url link."*

The link ends in	What opens
<code>&run=<run id></code>	The stored run: terrain mode around the run position, a marker named <i>Run</i> plus the first eight characters of the id, and its transmission-loss volume. The message log reports 🗨️ <i>Opening run ...</i> then ✅ <i>Run ... loaded.</i>
<code>&mmsi=<MMSI></code>	The vessel: Clairwave looks it up in the live feed, flies to it and opens its 3-D model preview. If the ship is not transmitting, the message log says so.

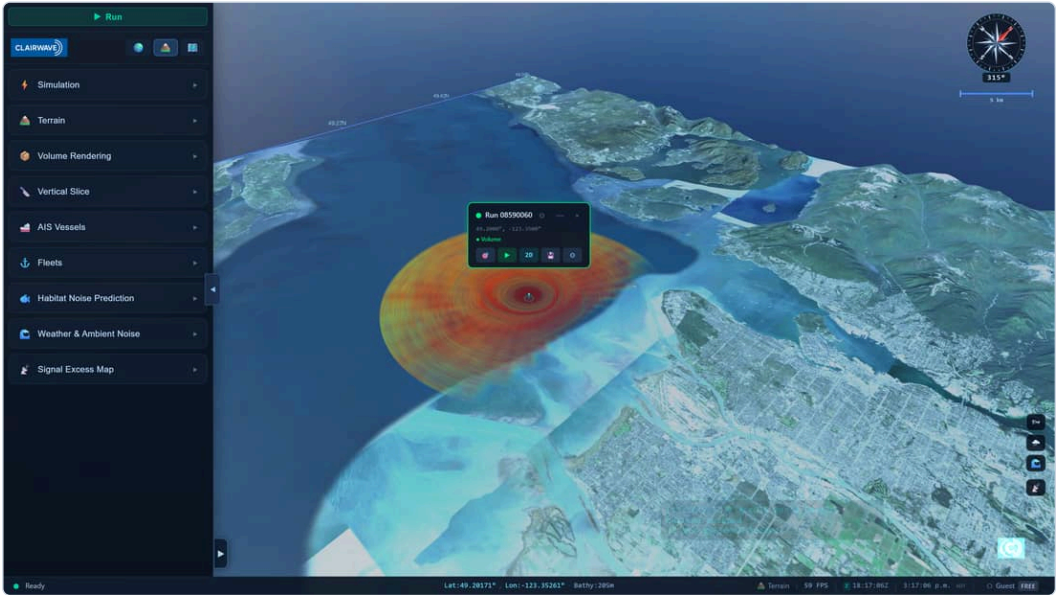


Figure 10.3 A 3-D transmission-loss volume made by `run_bellhop_volume` off Vancouver, opened from its `open_url` as a guest. The marker is named after the run id.

SHIPS IN GUEST LINKS

Links open Clairwave as a guest, and a guest sees live AIS ships only around the Strait of Gibraltar. A run or vessel link elsewhere opens the environment and the run normally, but shows no live ships and cannot look up a vessel outside that area. Sign in with a Premium account to see ships worldwide. [Appendix C](#) compares the plans.

Once the run is open, everything in Part III works on it: open the vertical slice with **2D**, read values with the cursor readout, or export a picture. See *"Simulation markers and the marker box"* (full manual) and *"The vertical slice window"* (full manual).

ENVIRONMENT RUNS

The sound-speed, transmission-loss and detection tools all share one *environment run* per location and month. Their `open_url` opens that run: a 10 km, 200 Hz Bellhop volume with the same sound speed, seabed and bathymetry the tool used. The single-bearing RAM calculation itself is computed on the fly and is not stored, so the volume you see is the environment, not a copy of the line the assistant quoted.

🔒 RE-RUNNING AN OPENED RUN

The link opens the stored result at any size. If you change settings and click ▶ **Run** as a guest, the Free limits apply: *Free tier — range → 10km, frequency → 200Hz*. See [Appendix B](#), *"Free, Guest and Premium compared"*.

Limits, reproducibility and privacy

Limits. All MCP users share the server's compute. The `about` tool states a shared budget of about 20 compute calls per minute across all callers. Calls that run a solver take a few seconds each. A 3-D volume takes longer as the radius grows; keep `radius_km` at about 50 km or less.

Reproducibility. Every result carries a `provenance` block naming the data and model used. Simulation results add a `replication` bundle: the sound-speed profile, seabed parameters, bathymetry transect and computational grid, plus the environment run id. Its JSON and NumPy files can be downloaded from the links in `files`. You can re-run the same case in MATLAB, Python or any propagation code.

Assumptions are stated. When you leave out a value, the tools use a typical default and list it with its source, for example *default: hull-mounted sonar at 7 m*. Ask the assistant which values were assumed, and give your own where they matter.

Privacy. Each tool call is logged on the server: the tool name, its arguments, the time and duration, the name and version of the assistant client, the caller's IP address and user agent. Do not put personal or confidential information in your questions. Locations and ship names you ask about are part of the logged arguments.

Self-hosting the open-source server

The server's source code is open under the MIT licence at github.com/clairwave/clairwave-mcp. You can read exactly what each tool computes, or run your own copy.

To run it locally for a desktop assistant that launches MCP servers itself, install its Python requirements and start it with:

```
python server.py --stdio
```

A self-hosted copy still fetches bathymetry, sound speed, AIS and solver runs from the Clairwave platform at www.clairwave.com. It changes where the protocol runs, not where the physics runs. Without platform credentials it calls the platform anonymously, so the Free limits can apply to its runs.

ENTERPRISE

For an on-premises or air-gapped installation of both the platform and the MCP server, contact Clairwave about an Enterprise plan. See [Appendix B, "Free, Guest and Premium compared"](#).



Appendices



APPENDIX A

Keyboard and mouse reference

Every key, click, drag and touch gesture in one table.

This appendix collects every key, click, drag and touch gesture in one place. The chapter in the last column explains each one in context.

Keyboard

Shortcuts do nothing while you are typing in a field.

Key	Where	What it does	See
G	Anywhere	Switches to the globe.	Chapter 7, "Globe mode and the search bar"
M	Globe	Switches to terrain mode.	Chapter 9, "Terrain mode"
M	Terrain	Shows or hides the navigation minimap.	Chapter 4, "A tour of the screen"
N	Terrain	Shows or hides the navigation minimap.	Chapter 4, "A tour of the screen"
T	Terrain	Reloads the terrain for the current area.	Chapter 9, "Terrain mode"
R	Anywhere	Runs a simulation at the scene centre. From the globe, it enters terrain mode first. Ctrl + R is left to the browser.	Chapter 5, "Your first simulation in ten minutes"
Esc	Anywhere	Closes the active panel. Cancels a pick on the map or a track drawing. Clears a vessel multi-selection and closes the noise card.	"Live AIS vessels" (full manual), "Moving markers, drawn tracks and the transit preview" (full manual)
Enter	Search bar	Searches for the vessel or place you typed.	Chapter 7, "Globe mode and the search bar"
Enter	Drawing a track	Finishes the track.	"Moving markers, drawn tracks and the transit preview" (full manual)
↑ ↓	Search suggestions	Moves through the vessel suggestions. Enter picks one, Esc hides the list.	Chapter 7, "Globe mode and the search bar"

Mouse and trackpad

Globe and flat map

Gesture	What it does
Drag	Globe: rotates the Earth, with a little inertia when you let go. Flat map: pans the map.
Mouse wheel or trackpad pinch	Zooms in and out. Zooming into the globe turns it into the flat map; zooming far out returns to the globe.
Double-click	Globe: zooms in toward the point.
Click the red selection patch	Enters terrain mode for that area.
Drag the white corner of the patch	Flat map: resizes the patch (50–800 km).
Click → Load	Flat map: loads the patch in terrain mode.

Terrain scene

Gesture	What it does
Left-drag	Pans the view.
Right-drag	Rotates and tilts the camera.
Mouse wheel	Zooms toward the cursor.
Click a vessel (chevron, hull or noise badge)	Selects the vessel and opens its card in AIS Vessels . Click again to deselect.
Ctrl , Shift or Cmd + click a vessel	Adds it to, or removes it from, the multi-selection and opens the 🔊 noise card.
Ctrl , Shift or Cmd + drag	Draws a box and selects every vessel inside it.
Click water	Clears the vessel multi-selection. With Drop probe on click on, drops the 📍 probe there.
Drag from the probe pin, a vessel or a run marker	Draws a distance ruler. Hold still for 3 seconds before releasing to pin it.
Drag the amber handle on the DEPTH axis	Changes the vertical exaggeration (0.1× to 50×).
Drag the bearing arrow at a volume	Turns the vertical slice to a new bearing (slice open).

Gesture	What it does
Click the compass	Turns the view back to north-up.
Right-click the compass	Changes the compass style.
Click a marker box	Selects the run and flies the camera to it.
Right-click a marker box	Opens the marker menu: Focus Camera , Run Simulation , Settings Panel , Start Motion or Stop Motion , Toggle Volume , Toggle Slice , Duplicate , Rename , Export Config , Remove . See “Simulation markers and the marker box” (full manual).
Click while picking	During a map pick (weather point, noise point, track drawing) the next click sets the point. The cursor is a crosshair.
Double-click while drawing a track	Finishes the track.

Minimap

Gesture	What it does
Drag the map, mouse wheel	Pans and zooms the minimap.
Drag the red rectangle	Moves the area to load.
Drag the rectangle's white corner	Resizes it.
Click Load	Loads the terrain inside the rectangle.

Floating windows

Where	Gesture	What it does
Any floating window	Drag the header or grip	Moves the window.
Vertical slice	Drag the corner grip	Resizes it (kept at 16:9).
Vertical slice	Mouse wheel / drag	Zooms (1.25× per notch) / pans. Click the chip to fit again.
Vertical slice	Double-click the header or picture	Opens the Vertical Slice panel in the sidebar.
Vertical slice, Cursor Readout on	Hover / click	Shows TL and RL under the cursor / pins a receiver .
SSP Profile dock	Mouse wheel / drag	Zooms the depth axis toward the cursor / pans it.
Reverb tail pane	Click or drag the plot	Scrubs the playhead in the pane and the slice. Double-click resumes the sweep.
Reverb tail pane	Double-click the title	Docks the pane back beside the slice.

Touch

On a phone or tablet, Clairwave uses the same gestures as other map apps. “Using Clairwave on a phone or tablet” (full manual) describes the phone layout.

Gesture	Where	What it does
One-finger drag	Globe	Rotates the Earth.
One-finger drag	Flat map, terrain, minimap	Pans.
Pinch	Globe, flat map, minimap	Zooms.
Two-finger drag, pinch or twist	Terrain	Zooms and rotates the camera.
Tap	Terrain	Selects a vessel or marker box, or drops the probe (as a click).
Tap while drawing a track	Terrain	Adds a waypoint. Tap Finish track to finish.
Press and hold a marker box (half a second)	Terrain	Opens the marker menu. The phone vibrates.
Press and hold the compass	Terrain	Changes the compass style.
Pinch / drag	Vertical slice	Zooms / pans the picture.
Drag the header / corner grip	Floating windows	Moves / resizes the window. Tap a minimised header to restore it.

APPENDIX B

Free, Guest and Premium compared

Every limit and locked feature.

Feature matrix

Guest is the Free plan without an account: click **Continue as guest — no registration** on the sign-in page. **Enterprise** is Premium for an organisation, with on-premises and air-gapped options. Book it from  **Book a demo** on the landing page. See [Chapter 3, “Signing in and managing your account”](#) for signing in and upgrading.

Feature	Guest	Free	Premium	Enterprise
Price	\$0	\$0	\$500 CAD per seat per month	On request
Account needed	No	Yes	Yes	Yes
Simulation radius	Up to 10 km	Up to 10 km	Unlimited	Unlimited
Frequency	200 Hz	200 Hz	Any, broadband and batch	Any
RAM, Bellhop and OAST solvers	✓	✓	✓	✓
GPU solvers CWNl, CWTd, CWTDE	—	—	✓	✓
Seasonal (native) sound-speed profiles	✓	✓	✓	✓
GIOPS 10-day ocean forecast and custom sound-speed profiles	—	—	✓	✓
Reverberation tail RL(t)	—	—	✓	✓
Live AIS vessels	Around Gibraltar	Around Gibraltar	Worldwide	Worldwide
Vessel suggestions in the search bar	—	—	✓	✓
AIS time machine and habitat history	—	—	✓	✓
Noise card: fast estimate	✓	✓	✓	✓
Noise card: RAM-PE broadband	—	—	✓	✓
Weather forecast	48 hours	48 hours	15 days	15 days
Signal-excess map	✓	✓	✓	✓
Signal excess:  Re-run TL at this hour (GIOPS)	—	—	✓	✓
Cross-device profile sync	—	—	✓	✓
Stored 3-D runs ( Jobs > Open run)	Deleted after 7 days	Deleted after 30 days	30 days, or kept with  Keep (2 GB)	30 days, or kept with  Keep (2 GB)
Basemap choice	Satellite only	Satellite only	All 16	All 16
Exports: HD slice picture, ray animation, marker config	✓	✓	✓	✓
3-D ship model preview and model library	✓	✓	✓	✓
AI assistant (MCP) tools	✓ (no account)	✓	✓	✓
 Academy course (11 modules, EN/BM)	Module 0	Modules 0–2	All 11 modules	All 11 modules
Getting Started guide (PDF)	✓	✓	✓	✓
Full User Manual, licensed PDF from the Account panel	—	—	✓	✓
On-premises or air-gapped installation, training, support	—	—	—	✓

THE FDTD AND ELASTIC FEATURES

The FDTD solver, CWTd, CWTDE, elastic sediment, reverb capture and the elastic ice layer are beta features. See *“Advanced (beta): FDTD, elastic sediment and sea ice”* (full manual).

THE MCP TOOLS ARE NOT LIMITED BY YOUR PLAN

The AI-assistant tools in Part VI run on Clairwave’s own service account, so anyone can ask for a 50 km volume or a 3.5 kHz detection range. Opening the result as a guest works too. Only re-running it inside the app applies your plan’s limits. See [Chapter 10, “Connecting an AI assistant \(MCP\)”](#).

What the lock messages mean

When you reach a Premium feature on the Free or Guest plan, Clairwave tells you in one of four places: the status bar (bottom left), the message log (bottom right), the panel itself, or a greyed-out option marked . The table lists every message, where it appears and what Clairwave does instead.

Message	Where	What it means
Free tier — range → 10km, frequency → 200Hz	Status bar, after ► Run	Your run went ahead, but with the radius cut to 10 km and the frequency set to 200 Hz. Only the parts that were changed are listed.
solver → RAM (GPU is premium)	Status bar, same message	A GPU solver was selected for the run; RAM was used instead.
🔒 CWN1 — Wavenumber Int., CUDA (premium), and the same for CWTDE and CWTDE	Vertical Slice > Propagation Solver > Solver	The GPU solvers are greyed out and cannot be chosen.
GPU solvers are a premium feature — using RAM	Status bar	You picked a GPU solver; the selector went back to RAM.
🔒 GIOPS SSP is premium	SSP Profile dock	The GIOPS forecast profile cannot be fetched.
GIOPS forecast SSP is a premium feature / Custom SSP is a premium feature	Status bar	You chose GIOPS or Custom as the solver sound speed; it went back to Native .
GIOPS SSP unavailable (premium) — re-running with the native profile	Signal Excess Map status	⚠ Re-run TL at this hour ran with the seasonal profile instead of the forecast.
Reverb tail is a premium feature — sign in with a premium account	Reverb tail pane	The reverberation tail was not computed.
🌐 Worldwide live AIS and the historic time machine are Premium features. The free plan shows live vessels around Gibraltar — upgrade for worldwide tracking and weeks of archived tracks.	Top of AIS Vessels	The permanent banner for Free and Guest users.
🔒 AIS history is a premium feature	Habitat Noise Prediction	The 🌐 History mode cannot load archived traffic. Live mode works.
🔒 RAM-PE broadband noise is a premium feature — showing the fast estimate	Message log	The noise card stays on ⚡ Fast estimate . The RAM-PE broadband button carries a 🔒.
Long-term storage (🔥 Keep) is a premium feature.	Tooltip on the storage line of Jobs	The 🔥 Keep button is not shown. Your stored runs are deleted 30 days after the run. See “Simulation settings” (full manual).
Changing the basemap is a premium feature	Status bar	The basemap went back to 🌐 Satellite .
Free tier shows 48 h · premium unlocks the full 15-day run.	Weather & Ambient Noise	The forecast slider stops at 48 hours.
GIOPS forecast SSP is premium	Tooltip on ⚠ Re-run TL at this hour	The button is disabled.

The search bar gives no message for vessel names on the Free plan: it shows no suggestions. Place names still work.

🔒 UPGRADING

Click the account chip in the status bar, then **Upgrade to Premium — \$500/mo**. A guest must create a free account first. See [Chapter 3, “Signing in and managing your account”](#).

APPENDIX C

Troubleshooting and FAQ

Blank scene, slow runs, missing vessels, locked features, browser and GPU issues.

The scene is blank or slow

The page stays on the loading screen. The first visit prepares your graphics processor and takes longer; the screen shows *Initializing GPU...* and *First load (this takes a moment)*. If it shows *Authentication error — retrying...*, Clairwave could not confirm your sign-in and retries by itself. If nothing changes after a minute, reload the page.

The window is black or the globe never appears. Clairwave needs **WebGL 2**.

1. Use a current Microsoft Edge, Google Chrome, Mozilla Firefox or Apple Safari.
2. Turn on hardware (graphics) acceleration in the browser settings, then restart the browser.
3. Update your graphics driver.
4. On a laptop with two graphics processors, set the browser to use the high-performance one.
5. Close other tabs that use 3-D graphics.

See [Chapter 2, “Welcome to Clairwave”](#) for the full requirements.

The globe looks wrong or runs slowly on an older graphics card. Sign in, then open www.clairwave.com/demo?globe=classic for the previous, simpler globe (for that visit only).

The globe appears, but terrain mode is dark or missing imagery. Imagery arrives in tiles after the terrain. Wait a few seconds; the message log reports each step. On a slow connection, choose a smaller area in **Terrain > Terrain Extent** and click  **Reload**.

The view is jerky. Check **FPS** in the status bar. Around 60 is smooth; below 20, try these in order:

Try	Where
Hide the 3-D ship models, or the noise badges	Terrain > 3D ship models, Vessel noise badges
Load a smaller area	Terrain > Terrain Extent
Raise Sampling (coarser, faster volume rendering)	Volume Rendering
Close the vertical slice, SSP dock and reverb pane you are not using	Their × buttons
Remove old runs	× on each marker box
Turn off the weather overlay and its particles	Weather & Ambient Noise > Wind / rain / sea-state overlay

A new area does not load. If loading fails, the message log says  *Could not load that area — the previous area is still shown*, and the previous area stays on screen. A failed fly-in from the globe says  *Could not load this area — please try again* and stays on the globe. Wait a moment and try again.

I zoomed out and everything disappeared. Zooming far out of terrain mode returns to the globe, and leaving terrain clears the markers, volumes, probe and rulers. Save runs you need first (Premium), or re-run them.

A run fails or never finishes

What you see	What to do
Alert <i>Request to backend failed</i> .	The simulation server did not answer. Check your connection and click  Run again.
Status <i>Simulation failed: ...</i>	The solver reported an error; the text after the colon says why. Common causes: the scene centre is on land or in very shallow water, or the source is deeper than the seabed. Move the view over deeper water and run again.
 <i>Still computing — runs in shallow water ... can take up to 4 minutes, and the status bar counts Computing... N s (up to 4 min)</i>	Not an error. Runs in shallow water, especially with Turbo Mode off, can take up to 4 minutes. Wait for the result.
Status <i>Simulation failed: the server took too long to answer (HTTP ...) — try again with Turbo on or a smaller radius</i>	The server did not answer in time. Turn Turbo Mode on or choose a smaller radius, then run again.
Status <i>Simulation failed: the simulation did not finish within 270 s</i>	The run took longer than the app waits. Turn Turbo Mode on or choose a smaller radius, then run again.
Status <i>Volume load failed</i>	The run finished but its volume did not download. Click  on the marker box to re-run.
Status <i>Free tier — range → 10km, frequency → 200Hz</i>	Not an error. The run went ahead at the Free limits. See Appendix B, “Free, Guest and Premium compared” .
The marker shows  No data	The run has no volume yet. Click  on its marker box.
A GPU solver shows  Queued, or <i>Waiting for a GPU (n jobs ahead, ...)</i> , for a long time	Other GPU runs are ahead of yours in the queue. Wait: your run starts when its turn comes, and it keeps going if you close the slice. Follow it in  Jobs (“ <i>Simulation settings</i> ” (full manual)). Or click × Cancel and use RAM or Bellhop. See “ <i>Propagation solvers</i> ” (full manual).
A long CWTDE or CWN slice run stops with <i>PE API error: 524</i> after about 2 minutes, or with <i>PE API error: 500</i>	Older versions cut long slice runs off, and CWN could fail over deep water. Both are fixed: a slice run now continues in the background for as long as GPU Timeout allows, up to 1 hour, and a deep-water CWN slice takes a few seconds. Reload the page and run again.
<i>Storage is full: new 3-D runs are paused until space is freed. Please try again later. (or new jobs are paused)</i>	The server’s run storage is full. Nothing is wrong with your run. Try again later.

What you see	What to do
 Jobs says <i>The stored files of this run have expired — run it again.</i>	Stored runs are deleted 30 days after the run (7 days for a guest's run), unless kept with  Keep (Premium). Run it again. See “ <i>Simulation settings</i> ” (full manual).
A job in  Jobs shows Lost and <i>Stopped responding (server restart?) — run it again.</i>	The server stopped while the job ran. Run it again.
<i>No ray data for this bearing — run a Bellhop solve (or open the 2D slice) first.</i>	The ray animation export needs a Bellhop run at that bearing.

WHERE EXACTLY DOES ► RUN SIMULATE?

At the scene centre, not where you last clicked. Hover over ► **Run** to see the red crosshair, and read its depth in the status bar before you run.

HD export or video export does nothing

 **Export HD** opens the picture in a new browser window. If you see *Popup blocked. Please allow popups for this site to export images.*, allow pop-ups for www.clairwave.com in the browser's address bar, then click the button again.

Video export is not supported in this browser. means the browser cannot record WebM video. Use a current Edge or Chrome. See “*Exporting and sharing results*” (full manual).

No vessels or no weather

No ships appear.

- On the Free and Guest plans, live AIS covers the area **around Gibraltar only**. The **AIS Vessels** panel says so at the top. Worldwide AIS is Premium.
- AIS comes from shore receivers. Busy coasts are well covered; open ocean far from land may have few or no ships even on Premium.
- Check that **Terrain > 3D ship models** and **Vessel noise badges** are on, and that the **Min** speed slider in **AIS Vessels** (0–5 kn) is not hiding slow ships.
- The **AIS Vessels** list shows at most 250 ships, sorted by range from the scene centre by default.

A ship I searched for is not found. Vessel suggestions in the search bar are Premium. A ship that has not transmitted recently is not in the live feed.

No weather.

- The weather toggles, the **Weather & Ambient Noise** panel and the probe work in **terrain mode** only.
- The probe card shows  *forecast...* while it loads and *no forecast* if the forecast service did not answer. Wait a moment or drop the probe again.
- On the Free plan, the forecast slider stops at 48 hours. The full 15-day run is Premium.
- Only one weather layer shows at a time. Clicking the active button turns it off.

The signal-excess map is empty. It needs a run with a TL volume. The panel says *No run with a TL volume yet — run a marker (►) and the map appears.* See “*The signal excess map*” (full manual).

A feature is locked

A  , a greyed-out option or a message ending in *is a premium feature* means the feature needs a Premium plan. [Appendix B, “Free, Guest and Premium compared”](#) lists every message and what Clairwave did instead. To upgrade, click the account chip in the status bar. A guest must create a free account first.

The **Approve** and **Regenerate** buttons in 3-D model management are operator tools. They need a QC token, whatever your plan. See “*3-D ship models: preview, model library and model management*” (full manual).

Sign-in problems

Problem	Solution
The verification email did not arrive	Check the spam folder. Accounts made with Google skip this step.
Forgotten password	On the password step, click Forgot password? and follow the emailed link.
Clairwave sends me straight to Google or GitHub	Clairwave remembers the provider you used last time. Sign out there, or use a private window, to choose another way.
My Premium features did not appear after paying	Wait for <i>Welcome to Premium! All features unlocked</i> . If you see <i>Payment received — your upgrade will activate shortly</i> , sign out and in again after a minute.
I was a guest and my runs are gone	Guest sessions keep nothing after you close the tab. A run's stored results and its  run= link last 7 days after the run.

See [Chapter 3, “Signing in and managing your account”](#).

Mobile and tablet tips

- The sidebar starts collapsed. Tap an icon on the rail to open that panel.
- The minimap starts hidden. Tap  to show it.
- Floating windows are small on a phone. Drag their corner grip to enlarge them, or turn the phone to landscape.
- Finish a drawn track by tapping  **Finish track** again; there is no Enter key.
- Performance limits are lower on touch devices: fewer ships in the list and on the globe, and smaller textures.

"Using Clairwave on a phone or tablet" (full manual) covers the phone layout in detail.

AI assistant (MCP) questions

Question	Answer
My assistant does not show the tools	In ChatGPT, check that the Clairwave plugin is added (Plugins , search <i>Clairwave</i>). In Claude or Grok, check that the connector is added and switched on for the chat. The address is <code>https://www.clairwave.com/mcp</code> , with no authentication.
My own client gets HTTP 406	Send the header <code>Accept: application/json, text/event-stream</code> .
The answer has no link	Ask <i>"Show me the open_url."</i> Every run and vessel result carries one.
The detection range says "at least"	Detection held to the end of the searched range. Ask again with a larger <code>max_range_km</code> .
The ship photo is missing	Photos are found by IMO number or name, and many ships have none. See <i>"MCP tool reference"</i> (full manual).
An anchored ship shows a very low source level	The model is for ships under way. Ask for its level at a given speed.

See [Chapter 10, "Connecting an AI assistant \(MCP\)"](#) and *"MCP tool reference"* (full manual).



 NEXT STEPS

The full User Manual

This Getting Started edition covers signing in, the screen, finding your area and your first simulation.

The complete Clairwave User Manual (about 220 pages, with a picture of every control and four end-to-end worked examples) is included with Premium. It also covers:

- Simulation settings
- Simulation markers and the marker box
- The 3-D transmission-loss volume
- The vertical slice window
- Propagation solvers
- Sound-speed profiles: native, GIOPS forecast and custom
- Reverberation tail RL(t)
- Advanced (beta): FDTD, elastic sediment and sea ice
- Exporting and sharing results
- Live AIS vessels
- The AIS time machine
- 3-D ship models: preview, model library and model management
- Ship noise at a point: the noise card
- Habitat noise prediction
- Weather and ambient noise
- Weather overlays on the terrain
- The drop probe and the distance ruler
- Moving markers, drawn tracks and the transit preview
- The signal excess map
- MCP tool reference
- MCP worked examples
- Example: predicting hull-sonar performance
- Example: shipping noise at a fish farm
- Example: a 48-hour signal-excess forecast
- Example: a vessel transit along a drawn track
- Units, conventions and colour scales
- Glossary
- Using Clairwave on a phone or tablet
- Data sources, models and citations

Premium users download their own licensed copy in the app: open the **Account** panel at the top of the sidebar and click **Download my licensed copy (PDF)**. Enterprise customers can also write to contact@clairwave.com.