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The mysteries of the Great Whirl

And our CTD at the bottom of the Ocean

A Scientific Article written as part of Dynamical Oceanography

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On board of the Pelagia, near the Coast of Somalia

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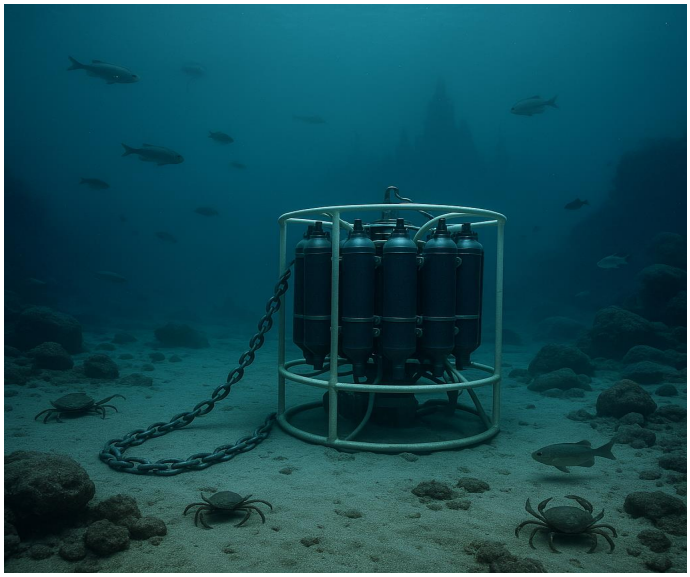
Imagine the loudest firework bang you've ever heard, times 10. That was the sound when the wire of the CTD snapped, the agonizing 'bang' echoing across the ship. The CTD instrument, used for measuring temperature and salinity over depth by letting it down on the side of the ship, was stuck behind something on the bottom of the ocean (the crew still argues about possibilities ranging from crab-cages to the lost city of Atlantis).

The hull of the ship, which had been held sideways by the tension in the wire, immediately reacted in a complete reversal: making a full 180-degree turn from side to side. At the same time, lunch plates flew off the tables, crashing to the floor (much to the delight of Chubby, the captain's dog). Emma, a marine biologist, ran after a new species of fish flopping around on deck, which desperately wanted to use the momentum to jump back into the ocean. Meanwhile, Captain Ahab was blissfully unaware, his snoring drowning out all other sounds.

An artist's impression of the research vessel upon the Great Whirl Gyre (credit: Chat GPT DALLE, prompt 2)



Our CTD instrument on the bottom of the ocean near 11°14'02.3"N 52°03'10.3"E (credit: ChatGPT, DALLE3, prompt 1)

Modern-day oceanography makes a historic turn

Two days earlier, we had ventured out into the Indian Ocean, off the coast of Somalia, with a clear mission: to answer a critical question: How is the Great Whirl initiated and strengthened? This clockwise rotating ocean flow (1) was first described and named by Lieutenant Taylor between 1785 and 1876 as part of expeditions providing maps and safe sailing routes (2). The Great Whirl forms every year off the Somali coast and strengthens during the summer monsoon, a seasonal reversing wind. Ocean flow in general greatly influences the climate and weather on land (3) and fisheries. This current swirls to speeds of 2.5 meters per second at its peak—this might not sound like much, but in the ocean, that's incredibly fast. This powerful force is as strong as some of the fastest currents in the world's oceans; its existence has long been known, and yet, it remains a mystery due to the lack of direct observations in the region (1).

The ocean, like the atmosphere, has its own set of mysterious forces that control its behaviour. Vorticity—the measure of how water rotates—can be imagined as a giant spoon stirring in the ocean, creating a spin in the water. This swirling motion is what drives the large-scale oceanic whirls, like the Great Whirl. But where does it come from?

The answer lies in something called Rossby waves. Picture them as giant, slow-moving ripples in the ocean, created by changes in temperature and pressure. These waves, originating from the deeper ocean, travel to the Somali coast, where they trigger the Great Whirl. They bring a burst of vorticity, which stirs up the currents and sets the stage for the formation of this powerful oceanic feature.
Earlier studies have suggested that the arrival of Rossby waves influences the region's ocean currents well before the strong monsoon winds make their appearance. As early as April, two months before the southwest monsoon winds even begin, the precursor to the Great Whirl starts to form. The arrival of Rossby waves at the Somali coast introduces a wave of vorticity that causes the waters to begin rotating early. By June, when the monsoon winds arrive, the Great Whirl intensifies quickly, reaching its peak by August and September. Then, as the monsoon winds die down, the Great Whirl begins to weaken, lasting as late as November (1).

To investigate this, we've come to the Somali coast to gather data on temperature, salinity, and currents, using a variety of instruments—from drifters and buoys to satellite data. But, as you might expect, things don't always go according to plan.

After the explosive snap of the CTD wire and the loss of our precious instrument to the depths of the ocean, I find myself staring at our improvised, old-school measurement system. Without our CTD, we've had to improvise, turning to a "bottles on a wire" system to collect deep ocean waters and measure temperature and salinity on deck. The idea came from Barrel, our giant mechanic, whose real name nobody knows, nor why he's called Barrel. He remembered stories about the pioneering oceanographic expeditions of the late 19th century—like those of the Fram in 1893 or the Challenger Expedition of 1872, where they used similar measuring instruments (4).

The wind howls in my ears, and the sun mercilessly beats down on the reflective surface of the ocean. The work is laborious, and the limited number of showers, combined with the sweat we generate each day, transforms the crew into salty-skinned, rusty-haired sailors.

Still, despite the hardships, there's an undeniable positivity on board. You can often hear the booming laughter of Barrel when Chubby is wreaking havoc again. No setback can stop our jokes, the stargazing nights on deck, or the will to contribute to science.

Sometimes, things don't go as planned, and we adapt to the circumstances. Because we know that, even though it may not be us who confirm the reasons behind the onset of the Great Whirl, or uncover why Barrel is named Barrel, or determine whether it truly was Atlantis holding our CTD at the bottom of the ocean, we are part of something much larger. Together, with the knowledge built up over countless years of humans endlessly exploring the ocean—from the first observations more than a hundred years ago to today's measurements and satellites — we will contribute to understanding its mysteries.

Happily, Emma managed to hold her new fish species onboard; that is some discovery!

References

1

Beal, L. M., & Donohue, K. A. (2012) *The Great Whirl: Observations of its seasonal development and interannual variability.* Journal Of Geophysical Research Oceans, *118*(1), 1–13. https://doi.org/10.1029/2012jc008198

3

How does the ocean affect climate and weather on land? : Ocean Exploration Facts: NOAA Ocean Exploration. (n.d.). https://oceanexplorer.noaa.gov/facts/climate.html

References

2

Findlay, A. G. (1876) *A directory for the navigation of the Indian Ocean, with descriptions of its coasts, islands, etc., from Cape of Good Hope to the Strait of Sunda and Western Australia, including also the Red Sea and the Persian Gulf; the winds, monsoons, and currents, and the passages from Europe to its various ports.* London, R.H. Laurie, 3rd edition.'

4

Curtin, T., & Belcher, E. (2008) Innovation in oceanographic instrumentation. *Oceanography*, *21*(3), 44–53. https://doi.org/10.5670/oceanog.2008.34

Prompts

ChatGPT

OpenAI. (2025). ChatGPT and DALL·E 3 (March, 29th version) [Large language model]. https://chat.openai.com

A word of warning:

While the references and facts presented in this article are accurate and based on real information, the story, characters, and events are entirely fictional. The goal of this article is to both entertain and educate. The author cannot be held accountable for any perceived inaccuracies, as the content is intended for amusement.

- Prompt 1: *DALLE create a picture of a CTD (conductivity, temperature, depth) instrument laying on the bottom of the ocean. (The CTD measures temperature and salinity over depth.) On a CTD there are black bottles on the outside, with a metal framework in a cylinder like shape. A metal wire, that is attached to its top, is laying around like a chain of an anker. Some fishes and other marine animals are swimming around, craps on the sandy and rocky bottom. make the ocean very deep, you cannot see the ocean's surface. In the background you might make a vague and small silhouette of Atlantis city but not make it obvious.*
- Prompt 2: *DALLE create an image of a Great Whirl gyre off the coast of Somalia with a research boat in the outer sides of this gyre. make sure the sun is blazing bright and the water is reflecting. on the boat you see salty-haired and stinky researchers sweating in the heat with their instruments and bottles of deep ocean water. in a window in this boat through the boat you can see a captain (looking like captain ahab from moby dick) sleeping and snoring in its bunkbed. in another window of this boat you can see a little dog jumping around. make sure it looks realistic, but also funny*