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How can rescuers quickly find people lost at sea?

Authors:
Mattia Serra, Pratik Sathe, Irina Rypina, Anthony Kirincich, Shane Ross, Pierre Lermusiaux, Arthur Allen, Thomas Peacock, and George Haller

Associate Editors:
Lois Flounders and Lindsay Martin

Abstract

Every year the U.S. Coast Guard spends over 50,000 hours on search and rescue at sea, saving thousands and thousands of lives. Both planes and boats are used to look for lost people. But what is the best way to predict where people might be?

We came up with a new method of using information about the ocean to help rescuers find missing people. We found regions of the sea that act like attracting magnets, pulling objects towards them. These attractors can be identified in real time and turned into maps. We used manikins and buoys to test how well these maps could predict where objects will drift.

We found that our new method could quickly and accurately help to find people lost at sea!

Introduction

Have you ever wondered how rescuers find people lost at sea? The ocean is a big place – finding a person can be like trying to find a needle in a haystack! This is especially true when you think about how the ocean changes.

Search and rescue teams rely on clever mathematical calculations called algorithms which help predict where a lost person might be. Scientists enter information about the weather, ocean dynamics, and where a person was last seen into a calculation. This information creates maps for the rescuers of the best areas to search.

We think there might be a better way to find people lost at sea quickly. We used a new algorithm to predict where people might drift. We took information about ocean dynamics in new ways to make maps of things called Transient Attracting Profiles *(TRAPs)*. These TRAPs are like magnets – they're curves of the sea which pull objects (like people!) towards them. But how helpful is our new method to search and rescue teams?

Methods

We wanted to test how well our algorithm worked in real life. Can it predict where TRAPs are? How strongly do the TRAPs pull in objects drifting in the water?

We went out to sea to test our method in 3 real-life experiments. Each time we used information about ocean dynamics to create maps of the nearby TRAPs.

These maps would hopefully predict where drifting objects would end up. Every 30 minutes, we updated our maps with the newest information. Our maps changed as the ocean changed in real time, which is very important for searching and rescuing.

We used different objects – buoys and *manikins* (Figure 1) – and put them in the water to see where they would drift. We put GPS trackers on the objects, and the trackers recorded the location of the objects every 5 minutes. We let them drift for a few hours and then collected them.

buoy

manikin

boat

Figure 1:
The boat, buoys and manikins we used in the experiments.
Source: Nature Communications

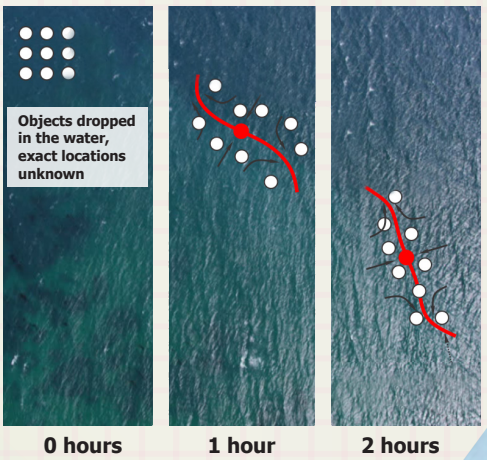
Results

Our experiments let us see where the objects drifted in real time. The TRAPs acted like powerful magnets in the sea, pulling everything towards them. The shape of the object didn't matter – within 2 to 3 hours, the buoys and manikins were always drawn towards the TRAPs (Figure 2).

Our new method worked very well in the real world. We could predict where an object would end up, even without complete information about ocean dynamics, or where and what object was lost at sea.

Why is it important to use the most up-to-date information about ocean dynamics to map the TRAPs?

Figure 2:
A TRAP (shown as a red line - the circle is the centre) as it moves over time and attracts drifting objects in the water. All within a few hours!
Source: Nature Communications - https://www.nature.com/articles/s41467-020-16281-x



Discussion

Being able to quickly and accurately predict where people are lost at sea is very important. Search and rescue teams use these predictions to plan things like flight paths for planes and ship routes to look for missing people.

There are many problems with the current methods and algorithms, though. Rescuers might not know exactly where a person was last seen, or have complete information about ocean dynamics (they're always changing). This can lead to many errors. It can also take a long time to produce the maps. Timing is a big challenge in search and rescue missions, where every minute counts!

Our new method uses an algorithm to show us in real time where to find the areas of the ocean that act like a powerful magnet. These TRAPs are a reliable way of predicting where objects will end up within a few hours. Finding people in such a short period of time means the chance of rescuing them alive is much higher.

We can also use TRAPs in other ways. For example, we could predict how an oil spill will spread in the ocean. By doing this, we can quickly put barriers up to contain the spill and prevent lots of damage to the environment. Our findings can help to save lives and limit environmental disasters!

Conclusion

The ocean is a fascinating place. A beach changes every day as the tide rises and falls, and the sea can be calm one second and stormy the next! So it's important to respect the ocean. Here are some things you can do to keep yourself safe at sea:

- Always check the conditions (the wind and tides).
- Tell someone before going out.
- Swim with a buddy.
- Wear a life jacket.
- Obey all signs and flags.
- Learn about rip current safety.
- Swim near a lifeguard.

If you ever get in trouble in the water, it's best to stay calm and float until someone comes to your rescue!

Glossary of Key Terms

Algorithm – a set of instructions that a computer follows in a calculation. In our study, the computer uses a specific set of instructions to work out exactly where the TRAPs are in an area.

GPS trackers – a device that captures information about the movements and location of an object. For example, GPS is used in a navigation system (like Google Maps) to tell you where you are.

Manikin – a 3D model of a human body. Manikins are used in scientific and medical research, while mannequins show off clothes in stores.

Ocean dynamics – the motion of water in the oceans (due to currents, wind, and other factors). Scientists use equations to describe ocean dynamics, which are constantly changing.

TRAPs – this stands for Transient Attracting Profiles. Basically, TRAPs are short-term (they change frequently) curves that pull (attract) things towards them - anything from floating trash to people.

Check your understanding

1. What are some of the problems with current search and rescue algorithms?

2. Why is it important for search and rescue teams to be able to quickly plan their search area?

3. How quickly can TRAPs pull in objects such as buoys and manikins?

4. We could use the TRAPs algorithm to limit environmental disasters such as oil spills – why is this, and can you think of other uses for this method?

5. How can you stay safe at sea?

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