Searching for objects in turbulent seas

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Imagine an object was dropped in the stormy sea. It may be a life raft, a person overboard or a black box from an aircraft. One needs to find it, or at least predict where to search for it.

Even if dominant currents and winds at the time of the search and rescue operation are known, it is impossible to predict the position of the missing object because its motion is random and unpredictable.

Such a complex unpredictable motion is known as turbulence.

Oceanographers employ thousands of satellite-tracked surface drifting buoys to study chaotic motion in the ocean.

This information is then used to predict how far the missing object moves away from the initial location.

ANU scientists Dr Hua Xia, Dr Nicolas Francois, Dr Horst Punzmann and Professor Michael Shats undertook modelling of these extremely complex types of flows using turbulence generated in the laboratory.

After several years of developing a means of producing turbulence, and developing computer algorithms for tracking large number of particles, they obtained results of great practical and fundamental importance.

"We generated flows in the laboratory by producing strong waves on the water surface and by following the motion of the test particles on the surface with high precision," Dr Xia said.

"We found that particles obey the law of diffusion similar to that predicted in 1905 by Albert Einstein, who explained motion of pollen grains in water noted by the botanist Robert Brown.

"In many cases particle diffusion found in the ocean could be reproduced in the lab. We established a law which relates the rate of particle spreading to turbulence strength."

This new law of dispersion will help to develop advanced search and rescue algorithms.

It is also important in other oceanic and atmospheric applications – the law describes the propagation of plankton on the ocean surface, and spreading of pollutants in the atmosphere, for example, the volcano eruption cloud of dust.

The research paper "Lagrangian scale of particle dispersion in turbulence" was published this week in *Nature Communications*.

More information: www.nature.com/ncomms/2013/130 … full/ncomms3013.html

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