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PRESS RELEASE I PARIS I 16 DECEMBER 2013

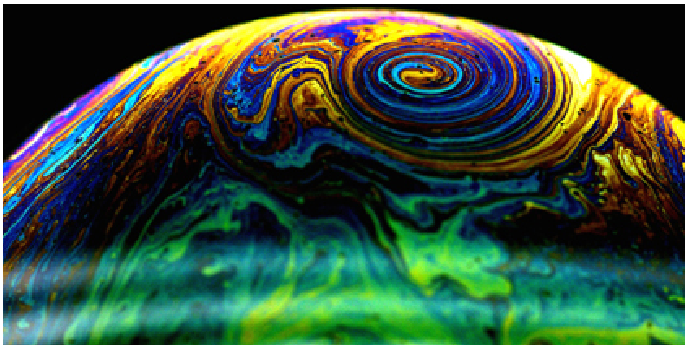
Soap bubbles for predicting cyclone intensity?

Could soap bubbles be used to predict the strength of hurricanes and typhoons? However unexpected it may sound, this question prompted physicists at the Laboratoire Ondes et Matière d'Aquitaine (CNRS/université de Bordeaux) to perform a highly novel experiment: they used soap bubbles to model atmospheric flow. A detailed study of the rotation rates of the bubble vortices enabled the scientists to obtain a relationship that accurately describes the evolution of their intensity, and propose a simple model to predict that of tropical cyclones. The work, carried out in collaboration with researchers from the Institut de Mathématiques de Bordeaux (CNRS/université de Bordeaux/Institut Polytechnique de Bordeaux) and a team from Université de la Réunion, has just been published in the journal *Nature Scientific Reports.*

Predicting wind intensity or strength in tropical cyclones, typhoons and hurricanes is a key objective in meteorology: the lives of hundreds of thousands of people may depend on it. However, despite recent progress, such forecasts remain difficult since they involve many factors related to the complexity of these giant vortices and their interaction with the environment. A new research avenue has now been opened up by physicists at the Laboratoire Ondes et Matière d'Aquitaine (CNRS/Université Bordeaux 1), who have performed a highly novel experiment using, of all things, soap bubbles. The researchers carried out simulations of flow on soap bubbles, reproducing the curvature of the atmosphere and approximating as closely as possible a simple model of atmospheric flow. The experiment allowed them to obtain vortices that resemble tropical cyclones and whose rotation rate and intensity exhibit astonishing dynamics—weak initially or just after the birth of the vortex, and increasing significantly over time. Following this intensification phase, the vortex attains its maximum intensity before entering a phase of decline.

A detailed study of the rotation rate of the vortices enabled the researchers to obtain a simple relationship that accurately describes the evolution of their intensity. For instance, the relationship can be used to determine the maximum intensity of the vortex and the time it takes to reach it, on the basis of its initial evolution. This prediction can begin around fifty hours after the formation of the vortex, a period corresponding to approximately one quarter of its lifetime and during which wind speeds intensify. The team then set out to verify that these results could be applied to real tropical cyclones. By applying the same analysis to approximately 150 tropical cyclones in the Pacific and Atlantic oceans, they showed that the relationship held true for such low-pressure systems. This study therefore provides a simple model that could help meteorologists to better predict the strength of tropical cyclones in the future.

To find out more: http://www.loma.cnrs.fr/spip.php?rubrique52 www.cnrs.fr



Vortices in a soap bubble.
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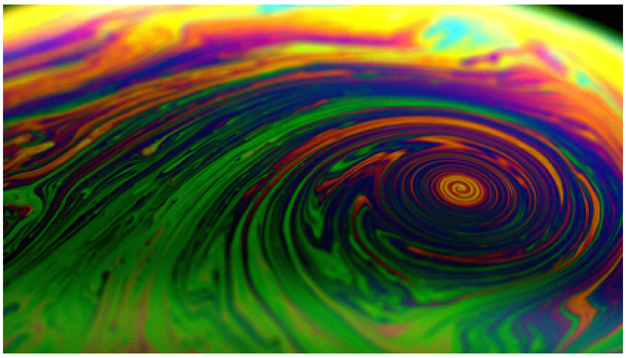

Close-up of a vortex in a soap bubble.
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Reference

Intensity of vortices: from soap bubbles to Hurricanes, T. Meuel, Y. L. Xiong, P. Fischer, C. H. Bruneau, M. Bessafi & H. Kellay, Nature Scientific Reports, Article number: 3455 DOI: 10.1038/srep03455, 13 December 2013. http://www.nature.com/srep/2013/131213/srep03455/full/srep03455.html

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