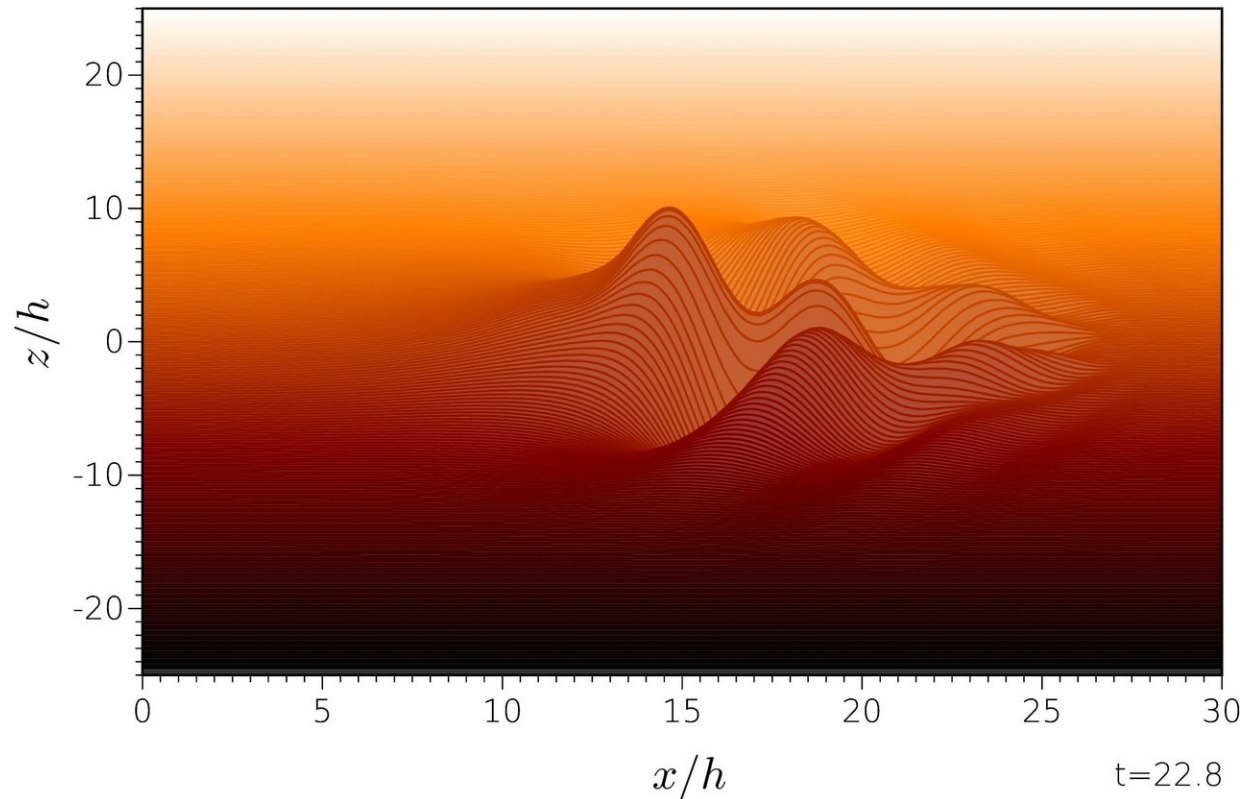


Vorticity regulates waves in fluids

June 11 2018



A study by Politecnico di Torino published in the journal *Physical Review E* demonstrates that a wave in a fluid requires amplified vorticity and not only amplified energy in order to change the nature of the flow

Waves of all types can be thought of as a large net. Meshes of different

dimensions expand to different sizes, which connect the world and allow the transport of information. The research of Prof. Daniela Tordella of the Department of Applied Science and Technology of the Politecnico di Torino, in collaboration with Federico Fraternali, post-doc at Politecnico di Torino, focuses on waves defined as "internal," that is, those propagating inside fluids, such as air, water or even the interstellar medium.

The research focuses on enstrophy, the intensity of the wave's vorticity in a fluid. Leonardo Da Vinci, observing a river from the top of a bridge, noticed that vortex waves visible to the naked eye are created inside water. Initially, in order to describe this state, the kinetic energy was taken into account. Research has proven that when the [kinetic energy](#) of a wave grows, vorticity does not always increase. However, the vorticity has to be amplified so that the flow changes its state and becomes turbulent. The enstrophy is therefore the main characteristic to understand the steps from the first ripples to the turbulence in fluids. The study was published in the journal *Physical Review E* by Daniela Tordella, Federico Fraternali, Loris Domenicale.

These phenomena are now theoretically proven and could lead to potential applications in geophysics, oceanography and atmospheric physics. The study of enstrophy takes into account the "container" hosting the [fluid](#) and where the waves propagate, which could be sea basin, or simply a kitchen sink. This could lead to the improvement of the understanding of perturbations in the atmosphere or of the propagation of deep waves in oceans that cause tsunamis, or of the turbulent transport inside oil pipelines.

More information: Federico Fraternali et al. Internal waves in sheared flows: Lower bound of the vorticity growth and propagation discontinuities in the parameter space, *Physical Review E* (2018). [DOI: 10.1103/PhysRevE.97.063102](https://doi.org/10.1103/PhysRevE.97.063102)

Provided by Politecnico di Torino

Citation: Vorticity regulates waves in fluids (2018, June 11) retrieved 18 April 2024 from <https://phys.org/news/2018-06-vorticity-fluids.html>

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