Topological **F**luid **W**aves
From condensed matter to geophysics

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Master 2 internship - PhD 2019

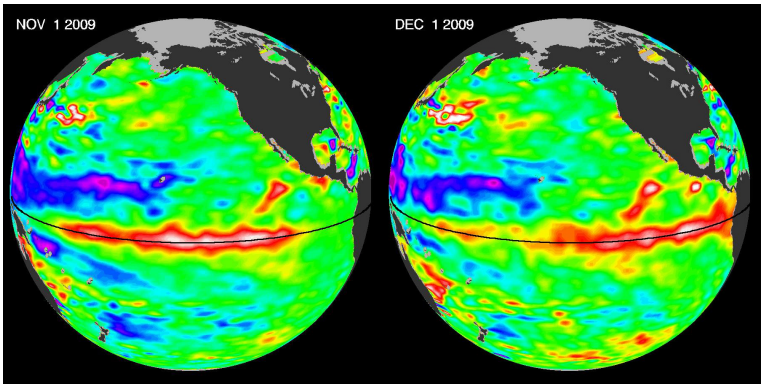

Figure 1: Propagation of an equatorially trapped temperature anomaly before an El Nino event. This is now understood as a topological wave [*P. Delplace, B. Marston, A. Venaille* 2017, Science.]

Keywords: Wave Dynamics, Condensed Matter, Fluids, Geophysics.

Borrowing concepts from topological insulators, the physics of waves is currently witnessing a revolution. Topology has brought new light to the old subject of linear dynamics, with the discovery of new classes of waves, and an explanation for peculiar propagating modes whose emergence were up to now mysterious. Over the last few years, this led to the design of new meta-materials in photonics, acoustics, mechanics.

This new physics has just begun to impact hydrodynamics, and in particular geophysical fluid dynamics. Last year, we showed that equatorial waves involved in El Nino phenomenon have a topological origin (Fig. 1). This is only one exemple among a variety of potential manifestations of topology in fluids that remain to be found.

Several lines of research are possible for this internship/PhD, from analogies with condensed matter systems, to the theory of geophysical flows, and laboratory experiments. We are looking for a student with a strong physics background, interested to work at the interface between different domains. Possible collaboration with Brown University, experimentalists of the physics lab at ENS de Lyon, and mathematicians. Funding available for outstanding students.

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