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# How many modes does it take to describe climate change?: The lessons from an experiment

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According to everyone's experience, predicting the weather reliably for more than 8 days seems an impossible task for our best weather agencies. At the same time, politicians and citizens are asking scientists for decades of climate predictions to help them make decisions, especially on CO2 emissions. To what extent is this request scientifically admissible?

In this lecture I will investigate this question, focusing on the topic of predictions of bifurcations of the atmospheric or oceanic circulations. In such case, the issue is whether present climate models, that have necessarily a finite resolution and a smaller number of degrees of freedom than the actual terrestrial systems, are able to reproduce spontaneous or forced bifurcations. For this, I will use recent results obtained by my group in a laboratory analog of such systems, so called von Karman flow, in which spontaneous bifurcations of the circulation take place. I will detail the analogy, and investigate the nature of bifurcations, the number of degrees of freedom that characterizes it and discuss what is the effect of reducing the number of degrees of freedom in such system.

I will also discuss the role of fluctuations and their origin, and stress the importance of describing very small scales to capture fluctuations of correct intensity and scale.