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Chaotic Behaviuor of the Navier-Stokes Solutions, Gyroscopes and Storm Surging

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Storm surges are phenomena inflicting wide damages all over the planet. Unfortunately they are badly represented in classical forecast model schemes because their multiscale nature is at odd with the scale truncation of these models. For similar reasons, classical data analysis often compelled to considered them as 'outliers' of the normal atmospheric activity, whereas as in fact they result from the same physical mechanisms that create less extreme behavior.
A better representation of storm surges requires a multicale understanding of how a cascade of seemingly harmless instabilities can generate major ones. This correspond to the conjectured, outstanding intermittency.of the chaotic behaviour of the Navier-Stokes solutions.
However, our limited, mathematical understanding of the Navier-Stokes equations prevent us to directly use them to investigate this question. We therefore use the most relevant cascade model to theoretically tackle this question of intermittency, i.e. the Scaling Gyroscopes Cascade (SGC). Indeed, this model is obtained with the help of a non trivial tree-decomposition of the Lie structure of the Navier-Stokes equations. the SGC model is deduced from these equations by preserving only a certain type of direct interactions, while the resulting indirect interactions are built dynamically along the tree-structure of the cascade. Because its fundamental element corresponds to a 'top' -i.e. an object with which almost anyone began to discover the puzzling nonlinear properties of rotation!- the SGC model remains rather simple, yet not simplistic! In particular, the SGC model enables us to investigate in details the occurrence of the critical singularity of a first order multifractal phase transition, which theoretically define storm surges.
Overall, these theoretical findings could significantly reduce numerous uncertainties of environmental risk assessments.