INTERNSHIP PROPOSAL

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Thesis possibility after internship: YES

An idealized model to explain the turbulence over the poles of Jupiter

Jupiter is one of the gas planets of the solar system characterized by a massive fluid envelope with a quasi-horizontal atmospheric circulation. Since the 17th century, we know the existence of large-scale alternated jet-streams as well as the famous Great Red Spot (Fig. 1). The Juno spatial mission obtained new images of the atmosphere of Jupiterbetween 2017 and 2019. Remarkable structures were observed at the poles such as cyclonic and anticyclonic vortices in addition to a soup of finer scale turbulence (Fig. 2).
In general, the so-called shallow-water models are sufficient to explain the jet-streams but they intrinsically fail in describing smaller scale turbulent structures. This internship is devoted to test a new model that would better fit the dynamical processes at play in the polar regions. It is the so-called Surface Quasi-Geostrophic (SQG) model that represents surface-intensified motions (Lapeyre 2017, Fig. 3) which would better agree with the atmospheric characteristics in these regions (Adriani et al. 2020). Numerical simulations on the sphere will be performed in order to determine which kind of processes are needed to represent the turbulent properties of the polar regions. To this end, we will examine what are the dynamical forcings that could explain the development of the turbulence (e.g. small scale convection), and how does this translate in terms of energy transfer between scales.


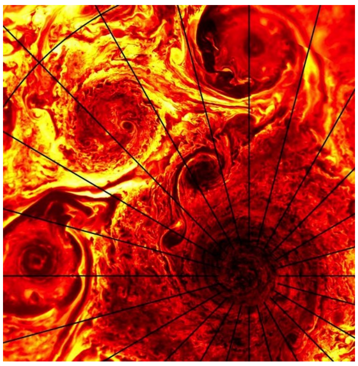
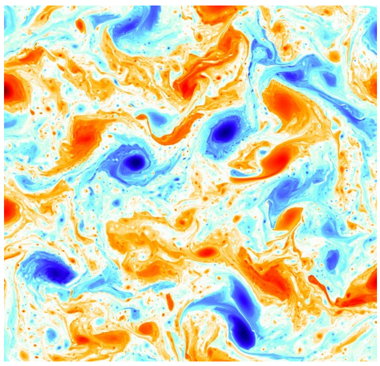

Fig 1: Jupiter atmosphere as observed by Cassini mission in 2000. Fig 2: A zoom in the polar region as observed by Juno mission in 2018. Fig 3: a very idealized SQG simulation.

- Adriani A. et al. (2020). Two-year observations of the Jupiter polar regions by JIRAM on board Juno. J. Geophys. Res.: Planets, 125, e2019JE006098.
- Lapeyre G. (2017), Surface Quasi-Geostrophy. Fluids, 2, 7.