Geophysical Research Abstracts, Vol. 9, 10561, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10561

Great Red Spot and Jovian vortices as statistical equilibria of the *Shallow Water model*

F. Bouchet (1), P.H. Chavanis (2) and J. Sommeria (3)

(1) INLN-CNRS, Nice, France. (Contact : Freddy.Bouchet@inln.cnrs.fr) (2) Université Paul Sabatier, Toulouse, France (3) LEGI-CORIOLIS, Grenoble, France.

We explain the emergence and stability of the most important jets and vortices, in the highly turbulent Jupiter's atmosphere, by a statistical mechanics of the potential vorticity mixing. Using the ***Shallow Water 1-1/2 layer***, with topography, when the Rossby deformation radius is small, we predict strong jets. These jets can be either zonal, or closed into ***a ring structure like the Great Red Spot one***.

For smaller vortices, or for stronger topography curvature, we reproduce the characteristics properties of the White Ovals or of the cyclonic Brown Barges. The link between their shape, topography and surrounding shear is explicitly described. We obtain very strong qualitative results for the Jupiter's vortices. For instance, any of these vortices must be on topography extrema (in the reference frame moving with the structure), the shear in the active layer is larger than the shear in the deep layer. On a same latitudinal band, the velocity of the vortex is related to their latitude. These theoretical predictions are in accordance with the observed properties of Jovian vortices.

By contrast with one of our previous study in the Quasi-Geostrophic model, we are able to ***describe ageostrophy*** of such equilibrium flows and the ***asymmetry between cyclones and anticyclones***. This provides a statistical mechanics explanation of these widely debated observations.