Vortex Asymmetries in the Midlatitude Atmosphere

The most prominent features of the North American weather pattern, as highlighted in most weather segments on the TV news, are the (west-to-east) jetstream and vortical cells, so called *cyclones* and *anticyclones*, of relative low and high pressures. The time-dependent interaction of these vortices with the jetstream is what we experience as weather. Mathematical modelling of the atmosphere is really a problem of fluid mechanics, but of a particular sort where density/temperature effects and Coriolis force (due to the Earth's rotation) play dominant roles.

There is a recognized asymmetry, from both observations and computational models, that cyclonic lows tend to be more intense and localized, while anticyclonic highs tend to be weaker and broader. However the best understood theory for atmospheric dynamics, known as *quasigeostrophy*, is completely symmetric for cyclones and anticyclones. Thus, despite the pervasiveness of this asymmetry and its importance to atmospheric dynamics, the underlying fluid mechanics behind this bias remains poorly understood. Recent work has produced an asymptotic extension to quasigeostrophy which is applied to this question of symmetry-breaking in the atmosphere, "*Why are low pressure cells more intense than highs in the meteorology of the midlatitudes?*"

This work is in collaboration with C Snyder (NCAR), R Rotunno (NCAR) and G Hakim (Univ of Washington).

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The dark contours in the figure below map out cyclonic lows (red) and anticyclonic highs (blue) for the northern hemisphere on 19 Sept (http://grads.iges.org/pix/hemi.fcst.html).