



FIG. 1. Density (red high, blue low).

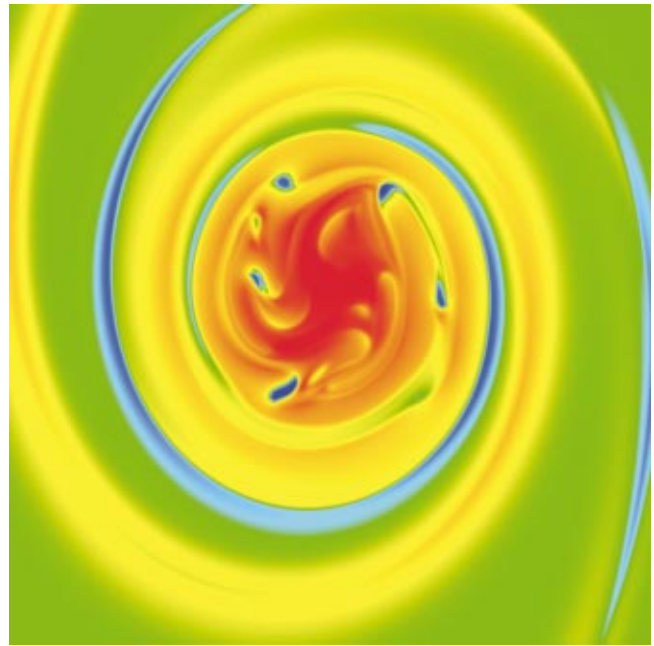


FIG. 2. Vorticity (red positive, blue negative).

Visualizations of the Dynamics of a Vortical Flow

Submitted by
Paul Miller, Peter Lindstrom, and Andrew Cook,
 Lawrence Livermore National Laboratory

These closeups are from a video documenting a direct numerical simulation of an experiment by Niederhaus and Jacobs [Phys. Fluids **10**, S6 (1998)]. The images illustrate the behavior of two high-Schmidt-number, incompressible fluids of different densities that are initially separated by a sinusoidal interface and then impulsively accelerated. The acceleration results in the deposition, on the density interface, of baroclinic vorticity that coalesces into a single large vortex. At intermediate time, when the density interface (Fig. 1) is rolled up by this large vortex (Fig. 2), the low-pressure region caused by the vortex interacts with the steep density gradients, producing new baroclinic vorticity. We term this secondary instability a *centrifugal baroclinic instability*. Figure 3 is a height-map depiction of the vorticity field, with a superimposed color map of the baroclinic torque (vorticity production), at the same time as the other two images. Note the opposite-signed values of baroclinic torque, including negative production (blue) high on ridges (locations of large positive vorticity). This increase in complexity of the vortic-

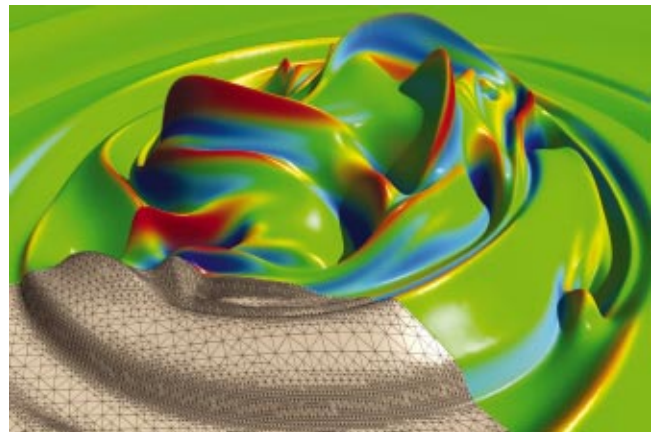


FIG. 3. Vorticity (height) and baroclinic torque (color: red positive, blue negative).

ity structure eventually leads to a breakdown of the initial jelly-roll structure of the density field, producing increased amounts of mixed fluid at later times, as observed experimentally.

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