



Vortices near the ground

The vortices created by airplane wingtips present a significant hazard to other aircraft (see *PHYSICS TODAY*, February 2008, page 88). As a further complication, when an airplane is near the ground, the vortices it produces can interact with the surface: The boundary layer that forms along the ground can generate secondary vortices of opposite sign. Such secondary vortices significantly influence the evolution and trajectories of the original vortex pair.

Reproducing the phenomenon at the laboratory scale, Charles Williamson and coworkers at Cornell University have developed a novel laser-induced fluorescence technique for visualizing how vortex pairs interact with the ground. They pool dye on a horizontal surface prior to launching the primary vortices from rotating flaps above it, and then illuminate the system with a laser light sheet. In this image, green dye visualizes the secondary vortices, which have been generated by the ground interaction and swept up above the red primary vortices. The vortex pairs are about 8 cm apart. The lower half of the photo shows the vortex system optically reflected in the surface below.

This image was one of the winning entries in the Gallery of Fluid Motion contest at the November 2009 meeting of the American Physical Society's division of fluid dynamics. It and the other winners will appear in the September 2010 issue of *Physics of Fluids*. (Image by Daniel Harris, Victor Miller, and Charles Williamson.)

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