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Photogrammetric Analysis of Rotor Clouds

Ulrike Romatschke (1), Vanda Grubišić (1), and Joseph Zehnder (2)

(1) National Center for Atmospheric Research, Earth Observing Laboratory, Boulder, CO, United States (romatsch@ucar.edu, grubisic@ucar.edu), (2) Southwest Weather Consulting, Tempe, AZ, United States (j.zehnder@swwxconsulting.com)

Stereo photogrammetric analysis is a little utilized but highly valuable tool for studying evolution of convective clouds; also of small, highly ephemeral clouds. Using computer vision techniques we have developed algorithms for camera calibration, automatic feature matching, and ultimately reconstruction of 3D cloud scenes using stereo photographic images. In this study, we apply these algorithms to the digital photogrammetric data set that was collected during the Terrain-induced Rotor Experiment (T-REX). The data set consists of matched stereo pairs of photographic images of rotor clouds that were obtained at high temporal (on the order of seconds) and spatial resolution (limited by the pixel size of the cameras). Using these techniques we analyze the evolution of small-scale cloud fragments that form at the upstream edge of the main rotor cloud that eventually get subsumed by the main cloud. The analysis allows the quantification of the physical properties and dynamics of rotor clouds such as growth, horizontal and vertical movement and provides new insights into the highly turbulent environment on the mountain lee sides that is associated with atmospheric rotors.