# Cloud motion vectors from MISR using sub-pixel enhancements

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***Abstract***

The operational retrieval of height-resolved cloud motion vectors by the Multiangle Imaging Spectro Radiometer on the Terra satellite has been significantly improved by using sub-pixel approaches to co-registration and disparity assessment, and by imposing stronger quality control based on the agreement between independent forward and aft triplet retrievals. Analysis of the fore-aft differences indicates that CMVs pass the basic operational quality control 67% of the time, with rms differences -- in speed of 2.4 m/s, in direction of $17^0$, and in height assignment of 290 m. The use of enhanced quality control thresholds reduces these rms values to 1.5 m/s, $14^0$ and 165 m, respectively, at the cost of reduced coverage to 45%. Use of the enhanced thresholds also eliminates a tendency for the rms differences to increase with height. Comparison of CMVs from an earlier operational version that had slightly weaker quality control, with 6-hour forecast winds from the Global Modeling and Assimilation Office yielded very low bias values and an rms vector difference that ranged from 5 m/s for low clouds to 10m/s for high clouds.

***Popular Summary***

Unlike most satellite instruments, Multiangle Imaging SpectroRadiometer (MISR) on the Terra satellite is a new instrument that will image Earth's climate system simultaneously at 9 different angles. One camera points toward nadir, and the others provide forward and aftward view angles, at the Earth's surface, of 26.1°, 45.6°, 60.0°, and 70.5°. As the instrument flies overhead, each region of the Earth's surface is successively imaged by all nine cameras in each of four wavelengths (blue, green, red, and near-infrared).

In addition to measure the amount of sunlight that is scattered in different directions, MISR can also distinguish different types of clouds, aerosol particles, and surfaces. With the information obtained from MISR in the amount, types, and heights of clouds and the distribution of land surface cover, the height-resolved cloud motion vectors (CMVs) can be retrieved.

In this paper, we focused on improving operational retrieval algorithm of height-resolved CMVs. Sub-pixel approaches were used for co-registration and disparity assessment, and stronger quality control was imposed based on the agreement between independent forward and aft triplet retrievals. Analysis of the fore-aft differences indicated that CMVs passed the basic operational quality control 67% of the time, with rms differences -- in speed of 2.4 m/s, in direction of $17^0$, and in height assignment of 290 m. The use of

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