SWA Environment Laser Division: Cloud Motion Wind Vector Algorithm

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A detailed description of the Cloud Motion Vector (CMV) algorithm can be found in O'Handley et.al., (2001) and O'Handley and Emmitt (2002). The original CMV algorithm was created and used to simulate cloud track winds from a 1993 ECMWF T213 spectral model 30-day forecast or "nature run" for the NPOESS OSSE project. Simulated Cloud motion Winds (CMW) were produced for all geosynchronous satellites in an area extending 60° from the sub-point. At each grid point within these regions, a satellite cloud view (SCV) profile was first determined using the maximum/random overlap assumption. The resulting SCV cloud fraction at each altitude represented the amount of cloud that would be visible to a geosynchronous satellite. Then, each profile was searched from the top down, looking for suitable tracers. A suitable tracer was defined as a level where the SCV was between .05 and .25. The first such level identified was designated as the CMW target for that location, and the model u and v wind components were assigned to that CMW.

However, to ensure realistic representation, numerous sensitivity and comparison tests were conducted to arrive at cloud fraction thresholds, thinning ratios and vertical layer designations to depict the spatial distributions, vertical distributions and number densities (thinning) of the then current operational CMWs from each geosynchronous satellite. In addition, a sub-algorithm was developed for simulating the well-known slow bias where we determine the depth or thickness of a cloud and, for deeper clouds, the wind velocity at the middle of the cloud layer is assigned to the CMW (whose height is based on the cloud top).

The original CMV algorithm was developed in 2001-2002 specifically for use with the T213 Nature Run and to reflect the numbers and distributions of operational CMWs at that time. Much of the work done since for the Sensor Web Project and the

WISSCR/OAWL OSSEs modified the algorithms, thresholds and relationships to develop CMWs that would be represented for the GMAO Nature Run and T511 Nature Run and reflect the current distributions and densities of operational CMWs as well as the expected densities and distributions of the future GOES-R (both nominal and rapid scan scenarios).