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## A Semi-Lagrangian Advection Algorithm for Falling Raindrops in a Two-Moment Microphysics Schemes

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A semi-Lagrangian algorithm (SLA) is implemented in NOAA's Global Forecast System (GFS) for simulating raindrop sedimentation in a double-moment microphysics schemes. This SLA includes a significant improvement to its predecessor for single-moment raindrop sedimentation. It is numerically stable and mass-conserving when used to sediment raindrops in double-moment microphysics schemes. Numerical results from an idealized single-column model show that the SLA overcomes an issue of mass accumulation at the cloud bottom in the case of the Eulerian algorithm for raindrop sedimentation, which is due to the assumption of constant terminal velocity within a time step of sedimentation. The results from the single-column model also show that the time step in the SLA can be 10 times greater than that in the Eulerian algorithm for sedimentation. Further numerical experiments using NOAA's GFS show that using the SLA mitigates the numerical instability problem associated with a newly-implemented double-moment microphysics scheme in the GFS.