Implement of Hybrid σ-p Coordinate in Regional Spectral Model

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A hybrid σ-p vertical coordinate was implemented into Regional Spectral Model (RSM) to align with the coordinate of Central Weather Bureau Global Forecast System (CWBGFS) and to reduce the numerical errors at high altitudes over mountains. Prior to the implement, the discretization form of the governing equations and semi-implicit adjustment method for the σ-p coordinate were derived. Then, to examine the results of this implement, an ideal hydrostatic mountain wave case was used to compare the results of the hybrid coordinate and the original σ coordinate in RSM. Since the discretization for σ-p coordinate also worked for σ coordinate when the coefficients were properly set, the results of these two different discretization methods applied on σ coordinate were also compared. Furthermore, a set of pure dynamical core experiments of one-day integration with the initial condition from a real case was also utilized to examine whether the simulation of the new vertical discretization was reasonable compared with the original discretization. From both the ideal mountain wave case and the one-day pure dynamical core experiment, the simulation results of the new discretization were similar to that of the original one in RSM at lower levels and were more different at high altitudes. In this presentation, more detailed results will be shared. The ongoing works include conducting real case simulation with physics parameterization and evaluating the performance of this hybrid σ-p vertical coordinate in RSM.

Keywords:hybrid σ-p coordinate, vertical discretization, RSM