4.5 Implementing WRF-based RTFDDA VLES/LES NWP system for supporting test and evaluation at US Army test ranges

Liu, Yubao, Gregory Roux, Yuewei Liu, Linlin Pan, Will Y. Y. Cheng, Wanli Wu, Jason Knievel, *National Center for Atmospheric Research;* and John Pace, *U.S. Army Dugway Proving Ground*

During the last eight years, NCAR and ATEC (Army Test and Evaluation Command) jointly developed a 4DWX (4D weather) system based on WRF and four-dimensional data assimilation (FDDA). The system, known as RTFDDA, has been operated for eight test ranges spread in widely different climate zones over the United States and supports a large variety of weather-critical weapon tests and military operations. By taking the advantage of recent advances in computing and the WRF modeling system, NCAR has started to research and develop a next-generation VLES (Very-Large-Eddy Simulation) and LES scale NWP capability, intending to produce more accurate current weather analysis and (up to) 24h forecasts at ultra-high-resolution (10s – 100s m in space and 5 – 10 minutes intervals in time). Such precision weather information is deemed critical for many types of tests at the ranges.

A WRF RTFDDA VLES/LES system configured with six nested-grid domains with grid sizes at 8.1, 2.7, 0.9, 0.3, 0.1 and 0.033km respectively has been set up for the Army Dugway Proving Ground (DPG), Utah and Aberdeen Test Center (ATC), Maryland. The first 4 domains span from mesoscale to VLES scale, are configured for real-time experimental forecast, while the two finer resolution domains simulate at LES scale are for after events research purposes. NWP with refined-resolution model grids exhibits increasing ability to resolve fine-scale terrain and other inhomogeneous land-surface forcing, and up/down scale energy propagation, but the signals and value are affected greatly by the error of large-scale weather. The data assimilation of RTFDDA takes a great role in tracking the lager scale weather to drive the VLES and LES scale models. In this paper, formulation, data sources, and verification of real-time operation at DPG of the WRF-RTFDDA-VLES system will be presented. Case studies for a strong cold surge weather over the ATC area (Chesapeake Bay) with mesoscale, VLES and LES scale modeling are conducted and the modeling results will be shown to demonstrate the advantages of the VLES model over mesoscale model. Issues, challenges and some initial work for developing scale-dependent end-user forecast information, representative verification, and LES-scale data assimilation will be discussed.