Effects of Grid Resolution on Modeled Attainment Demonstration

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Increased focus has been directed at fine-scale modeling for improving ability of air quality modeling systems to better capture local phenomena. While this is generally true for establishing desirable model performance for base years, the need for modeling at finer resolution (4-5 km) for predicting future air quality in demonstrating attainment of air quality standards is not clear. The U.S. EPA draft guidance for demonstrating attainment of the NAAQS for ozone suggests the use of a nested modeling system over an urban area to establish base case model performance, and use the same to apply for future years to test for attainment. We demonstrate an application of this guidance for four ozone episodes in the summers of 1995, 1996 and 1997 in North Carolina. After establishing acceptable base case model performance for each episode using a nested 36/12/4-km modeling domain, we have developed future year control scenarios for 2007 and 2010, and computed relative reduction factors (RRFs) for model outputs from each of the three grid resolutions. Preliminary analyses indicate that the relative reduction factors (RRFs) and hence future year design values (DVFs) are not very sensitive to the model grid resolution. Since the attainment test has been applied for 4 different episodes under diverse meteorological regimes for different future year emissions scenarios, and since all 4 episodes show not very different results, one can generalize the results from this study. These will also have relevance for regional modeling applications that are currently ongoing for studying $PM_{2.5}$ non-attainment issues, where it is argued that finer grids as small as 4-5 km resolution are needed for addressing primary components of $PM_{2.5}$.