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IMPACT OF DATA ASSIMILATION ON WRF MODEL PREDICTION: SATELLITE DATA, SURFACE AND UPPER AIR OBSERVATIONS

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Abstract

More than 4 billion people (54% of world's population, according to World Bank) now live in urban areas. Sofia region is one of the most densely populated areas in Bulgaria which contains more than a sixth of the whole country's population. Global numerical weather forecasting models (e.g. GFS, ECMWF, etc.) and regional numerical weather forecasting models (ALADIN, COSMO, HIRLAM, etc.) used operationally in Bulgaria are configured to be representative for the weather processes in scales of around 2-30 km resolution. The low resolution makes these models incapable of predicting and describing local (several hundred meters scale) meteorological processes well, especially in complex orography. Sofia city is located in a very complex terrain and therefore has a specific local micro climate.

A number of studies has shown improvement of weather predictions assimilating data from different available sources. The impact of high-resolution data assimilation on short-term mesoscale numerical weather prediction using the Weather Research and Forecasting model (WRF) and its data assimilation module (WRFDA) was investigated. Remote sensing data acquired from satellite instruments and complimentary surface and upper air observations were exploited. Four case scenarios of data assimilation were compared: 1) only satellite data; 2) only surface and upper air observations; 3) combination of both scenarios 1 and 2; and 4) without assimilation of any data. The objective of the study is to assess the most precise configuration for short-term high-resolution data assimilation to ensure the local forecast with improved analysis of atmospheric conditions - with sufficient details and accuracy. The outcome of this work will be useful for supporting weather services, airport safe operations and local air quality assessment studies.

Keywords: meteorological modelling, data assimilation, WRF, satellite observations, surface observations, upper air observations