

# ON THE USE OF NEXRAD STAGE IV DATA IN THE MULTIMEDIA MODELING OF POLLUTANT TRANSPORT

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## 1. INTRODUCTION

The Environmental Protection Agency (EPA) is designing the Multimedia Integrated Modeling System (MIMS) to model the cycling of pollutants and nutrients between the atmosphere and the earth's surface, including water bodies and groundwater. Our ability to accurately model both atmospheric, hydrological and surface processes that transport chemicals is highly dependent on precipitation types, rates and totals. Of special interest are precipitation extremes and subsequent flooding, which can greatly enhance the movement of such chemicals. During such events, these chemicals can enter the surface water bodies via groundwater recharge as well as overland flow. For example, the extreme flooding associated with Hurricane Floyd, which made landfall in North Carolina during September of 1999, transported tremendous amounts of agricultural and industrial waste and pesticides into area estuaries and rivers. This hurricane, which made landfall shortly after an earlier hurricane, Dennis, inundated sections of eastern North Carolina with more than 20 inches of rain.

During the development of MIMS, we are investigating the use of the National Weather Service NEXRAD (NEXT generation RADar) Stage IV precipitation estimates in our modeling efforts. The NEXRAD Stage IV data consist of precipitation data fields that have assimilated both raingage data and WSR-88D (Weather Surveillance Radar 1988 Doppler Version) data into a comprehensive hourly, national dataset with a 4-km<sup>2</sup> resolution.

The purpose of this research is to evaluate the quality and identify limitations of the NEXRAD data through a comparison with "ground truth" data obtained from a network of ten closely spaced raingages. The evaluation, which will use visualization tools and statistical analyses will determine if the spatial resolution of NEXRAD data is adequate to capture the spatial variability of precipitation on the watershed that is used in the surface hydrology models associated with MIMS.

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## 2. MIMS

The MIMS project was initiated by EPA's Office of Research and Development to create a problem solving software framework to support various ecosystem modeling and environmental health assessment (Johnston et al., 2000). The integration of environmental models will introduce many challenges such as atmospheric-terrestrial interactions, spatial and temporal scale discrepancies, non-continuous grid structuring, and database handling.

A comprehensive ecosystem exposure assessment case study is being developed and tested in the Neuse River basin in eastern North Carolina. This river basin has drawn national attention because of its fish kills and the discovery of the toxic dinoflagellate - *pfisteria*. The case study, which will measure aquatic ecosystem health with fish health and water quality as the initial endpoints, will provide a prototype focal point for the MIMS software framework development.

## 3. NEXRAD STAGE IV DATA

The National Centers for Environmental Prediction (NCEP), in cooperation with the Office of Hydrology (OH), have developed the multi-sensor National Precipitation Analysis (NPA). This analysis uses approximately 3000 automated raingage observations in conjunction with hourly digital precipitation radar estimates obtained from the WSR-88D Radar Product Generator. The data, which are available hourly and in near real time, are gridded on a 131 x 131 4-km polar stereographic grid centered over each of the nearly 100 radar sites in the contiguous United States. The individual radar estimates are merged together on the national Hydrologic Rainfall Analysis Project (HRAP). The NPA uses the raingage data and an adjustment algorithm developed by Smith and Krajewski (1991) to adjust the radar data for biases. Once adjusted, the data are adapted by NCEP to a national 4-km grid from algorithms developed by OH. Data from grids which contain more than one radar estimate are averaged together using an inverse-distance weighted average. Currently, there is no quality control of the estimates (e.g., removal of anomalous propagation). The purpose of this study is to assess the quality of these estimates and to determine if they are suitable for use as input into the surface hydrology models within the MIMS system.

#### 4. LIZZIE SITE CASE STUDY

The purpose of the Lizzie Research Station, established by the North Carolina Department of Natural Resources (NCDENR) in 1993, is to study groundwater recharge and near-surface flow. The site covers 300+ acres of the drainage area of the Contentnea Creek, which is within the Neuse River basin located in the eastern part of the State. Approximately 50 groundwater wells and 3 stream gages are maintained at the site. In addition to the base network, water quality sampling has now been added to the site as part of the MIMS project. The water quality samples are collected from 18 of the 50 wells and one of the stream gages. These data will be used to test watershed and groundwater models for MIMS.

A total of 10 closely spaced raingages will be located in a small stream system within the Neuse River Basin. The locations of the raingage sites were selected to provide coverage around two small tributaries, the Middle Swamp and Sandy Run and to be juxtaposed to the Lizzie Research Station. These 10 raingages will test the validity of the NEXRAD Stage IV data for use in this MIMS prototype case study and provide "ground truth" precipitation values.

#### 5. SUMMARY

Precipitation events, especially extreme events, can greatly enhance overland flow and groundwater recharge, thereby influencing the transport of pollutants and nutrients. Accurate representation of precipitation input into hydrology models is therefore critical. The purpose of this research is to determine if NEXRAD data can be used as input into hydrological models as part of a MIMS prototype study taking place in the Neuse River Basin of eastern North Carolina.

#### 6. REFERENCES

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