From Tornadoes to Traffic Problems to Terrorists: Challenges for the Urban Meteorologist

John T. Snow
The University of Oklahoma

Meteorology is evolving rapidly, reflecting both changes in the capabilities of the discipline and in society. Meteorology today has enormous capacity to observe, analyze, and predict the behavior of Earth's atmosphere on a broad range of scales. These abilities are the result of the parallel (and sometimes synergistic) development of enhanced understanding of the Earth system and new technology (e.g., computers, GPS, remote sensing systems, and the internet) that has continued since the close of WW II some fifty years ago. About 15 years ago, these capabilities crossed a critical threshold and meteorological products and services began to have significant economic value to a wide range of new customers. As a result, the role of meteorology today is not only to aid in protection of life and mitigation of property damage, but also to increase efficiency and enhance economic competitiveness. Parallel societal changes include increasing urbanization (often coupled with urban sprawl across environmentally sensitive or hazardous areas) and an increasingly sophisticated citizenry who value weather information for personal and professional decision making (hence the success of The Weather Channel and content-rich websites such as the TWC's weather.com).

Given this background, this talk will focus on the revolution underway in urban meteorology. Here the role of the meteorologist is increasingly complex, as the range of topics to be addressed, often in parallel, can include the traditional hazardous weather threats, air quality, water issues, trafficability issues, and wild fires, as well as man-made hazards (ranging from fires to inadvertent releases of toxic materials to terrorist assaults). There is a growing demand for weather information on the microscale in the complex "terrain" that stretches from surrounding rural areas, across suburbia, to the urban centers. Often this information is to be communicated to users who are "on the move" in the city. Economic enhancement issues may dominate the day-to-day agenda, with sudden operational shifts required address singular events. Finally, the urban meteorologist must not lose sight of the region within which the city is embedded since issues "over the horizon" may impact the urban complex.

Fortunately, new observing and modeling systems are becoming available that allow the mesoscale forecast problem to be addressed. Microscale forecasting remains more problematic, but the heightened interest in urban dispersion problems (driven in large part by the terrorist threat) may yield new tools. Detailed mapping (and constant remapping) of the urban complex, coupled with sophisticated GIS tools, also provide much promise for the future.

One of the challenges faced by the urban meteorologist is to think about observations and forecasts in non-traditional ways. A systems approach using "smart sensors" in adaptive "intelligent arrays" to obtain asynchronous streams of data will likely be essential. Observations will likely need to be assimilated and forecasts produced either continuously or in a "just in time" mode. Further, to meet the inevitable budget constraints, urban observing systems will probably have to be multi-use, providing data needed by many users, not just the meteorologist.

The talk will conclude with some comments on what we at the University of Oklahoma are doing to address the future needs of urban meteorologists.