J2.1 **THE NEW JERSEY WEATHER AND CLIMATE NETWORK: PROVIDING ENVIRONMENTAL INFORMATION FOR A MYRIAD OF APPLICATIONS**

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1. INTRODUCTION

In recent years, the Office of the New Jersey State Climatologist at Rutgers University (ONJSC) has developed the New Jersey Weather and Climate Network (NJWxNet). Currently, environmental data are gathered from approximately 100 automated stations across the Garden State. Network observations are available in near real time to all New Jersey residents via the World Wide Web. The NJWxNet is one of a growing number of regional networks that have appeared in recent years to serve the ever-growing needs of the local citizenry for high spatial and temporal resolution environmental information. Some of these networks are under the purview of state climate offices, and data from all networks are frequently used by state climatologists to address weather and climate issues and inquiries.

2. THE NJ WEATHER AND CLIMATE NETWORK

The NJWxNet is a unique network of networks. When "built out" by the end of 2005, it will include data gathered from approximately 45 stations operated by the ONJSC, along with close to 75 stations maintained by the National Weather Service, the U.S. Geological Survey, the US Forest Service, the NJ Department of Transportation, the NJ Turnpike Authority, Stevens Institute of Technology and others (figure 1). Within minutes of the observations being gathered, the raw data are processed into a common SQL database. Quality-controlled data and derived products are made available for display in colorful one-of-a-kind maps, tables and graphs via the NJWxNet web site <http://climate.rutgers.edu/njwxnet> (figure 2).

To date, support for the purchase and installation of ONJSC-operated stations has come from the NJ Department of Environmental Protection (NJDEP) (NJ Mesonet stations) and the NJ Office of Emergency Management (NJOEM) (NJ SafetyNet stations and one Mesonet station). Mesonet stations total 13, and include a full suite of research-quality instrumentation situated at premier venues across New Jersey that meet World Meteorological Organization siting standards (figure 3). Such standards are somewhat more relaxed at the 32 SafetyNet stations, with instruments often situated within heavily populated or somewhat unique locations (figure 4). SafetyNet instruments are accurate and reliable, but in some cases do not meet research-quality standards. Many SafetyNet stations are located at State Police barracks and local OEM offices.

Over the past four years, seed funds to develop the NJWxNet communication, archival and dissemination infrastructure have been provided by Rutgers University. This modest support expires in June 2005. Additional support for partial SafetyNet operations and training has been received from the NJOEM. The NJ Department of Transportation provides some office operation support for the NJWxNet, as part of a project that ingests their Roadside Weather Information System data into the broader network. The US Forest Service is supporting the ingest of data into the NJWxNet from 5 stations located in the NJ Pine Barrens. The NJDEP is supporting Mesonet operations and maintenance.

3. THE NJ MESONET

The NJ Mesonet is the backbone of the NJWxNet. NJ Mesonet stations constitute the most evenly distributed, highest quality environmental monitoring network in the state. The instruments are of research quality and are similar or identical to those deployed in the most successful mesonets elsewhere in the nation (e.g. Oklahoma, High Plains). Variables monitored at all stations include surface air temperature, humidity, atmospheric pressure, incoming solar radiation, wind speed and direction at 10 meters, precipitation using a heated tipping bucket gauge, soil temperature at 5 and 10 cm under grass and bare ground and soil moisture at 10 cm under grass. In addition to observing shallow soil moisture, in cooperation with the NJ Geological Survey, at several sites, sensors have been placed at greater depths. A few of the stations also have acoustic gauges to monitor snow depth and inverted radiometers to measure reflected solar energy, thus permitting surface albedo to be calculated.

Station equipment includes a Campbell data logger that stores continuous instrument observations. Data are downloaded from the logger on an hourly basis (access frequency can be more frequent if requested) via cellular transmission (NJ SafetyNet data are similarly accessed). This has proven to be a highly reliable means of communication throughout New Jersey. Once Mesonet data have arrived at the ONJSC, processing occurs in a manner similar to that of data ingested from other NJWxNet sources.

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4. NETWORK MAPS

Examples of NJWxNet maps depict the density of stations as of spring 2005. Note that data from nearby states are also gathered and displayed in maps, tables and graphs. The quantity of such out-of-state data is expected to increase in the near future. Included here are temperature, wind gust and precipitation maps. While the database is maintained in metric units, English units are displayed on the public web site maps. A choice of either units is available in tables. The influence of cloud cover in reducing daytime maximum temperatures is seen by evaluating temperature and satellite maps (figures 5 and 6). The strength of spring sea breezes is visible in figure 7, where mid afternoon temperatures within NJ range from 52°F to 83°F. Wind gusts of variable strength are observed in the midst of a late May nor'easter (figure 8). Hourly precipitation totals observed at stations and estimated by radar show reasonable agreement in figures 9 and 10.

5. SUMMARY

ONJSC personnel have the technical expertise in station installation and maintenance, data management and display, and geographic information systems to operate a successful environmental network. They possess detailed knowledge of the weather and climate of their region and experience in working with and advising others how to best utilize network information for particular endeavors. Network observations are used for environmental monitoring, educational and applied climate purposes. The network also provides a wide range of decision makers with the information necessary to maximize the safety and security of lives and property in the Garden State.

To ensure NJWxNet reliability and accuracy, substantial annual support is needed for: a) scheduled, routine maintenance of instrumentation and station sites; b) emergency maintenance to minimize station down time; c) uninterrupted communication between stations and the NJWxNet operations center; d) ongoing operation and enhancement of the sophisticated data processing and archival system, including extensive data quality control; e) continued operation and improvement of the unique, customized information dissemination system; and f) frequent interaction between ONJSC staff and those who utilize the network. Finding such support is proving to be a challenge. Interactions with state and federal agencies have resulted in several modest grants. However more significant resources will be needed in the near future from these sources and corporate entities in order for the ONJSC to continue providing environmental information of a high quality for the 8.5 million citizens of the most densely populated of all states.

6. ACKNOWLEDGEMENTS

Appreciation is expressed to individuals at Rutgers University and within several state and federal agencies for supporting the development and operation of the NJWxNet. This includes Cook College/NJ Agricultural Experiment Station, Rutgers University; the NJ Department of Environmental Protection; the NJ Office of Emergency Management; the NJ Department of Transportation; and the US Department of Agriculture/Forest Service. My gratitude to all who have volunteered to host NJ Mesonet and NJ SafetyNet stations, and to those maintaining other networks and will to share data. Finally, tremendous thanks to those within the Office of the NJ State Climatologist for their dedication toward making the NJWxNet a reality, including Chad Shmukler, John Read, Christopher Duvall and Keerat Sharma; and Nick Stefano of Sussex County Weather, Inc.

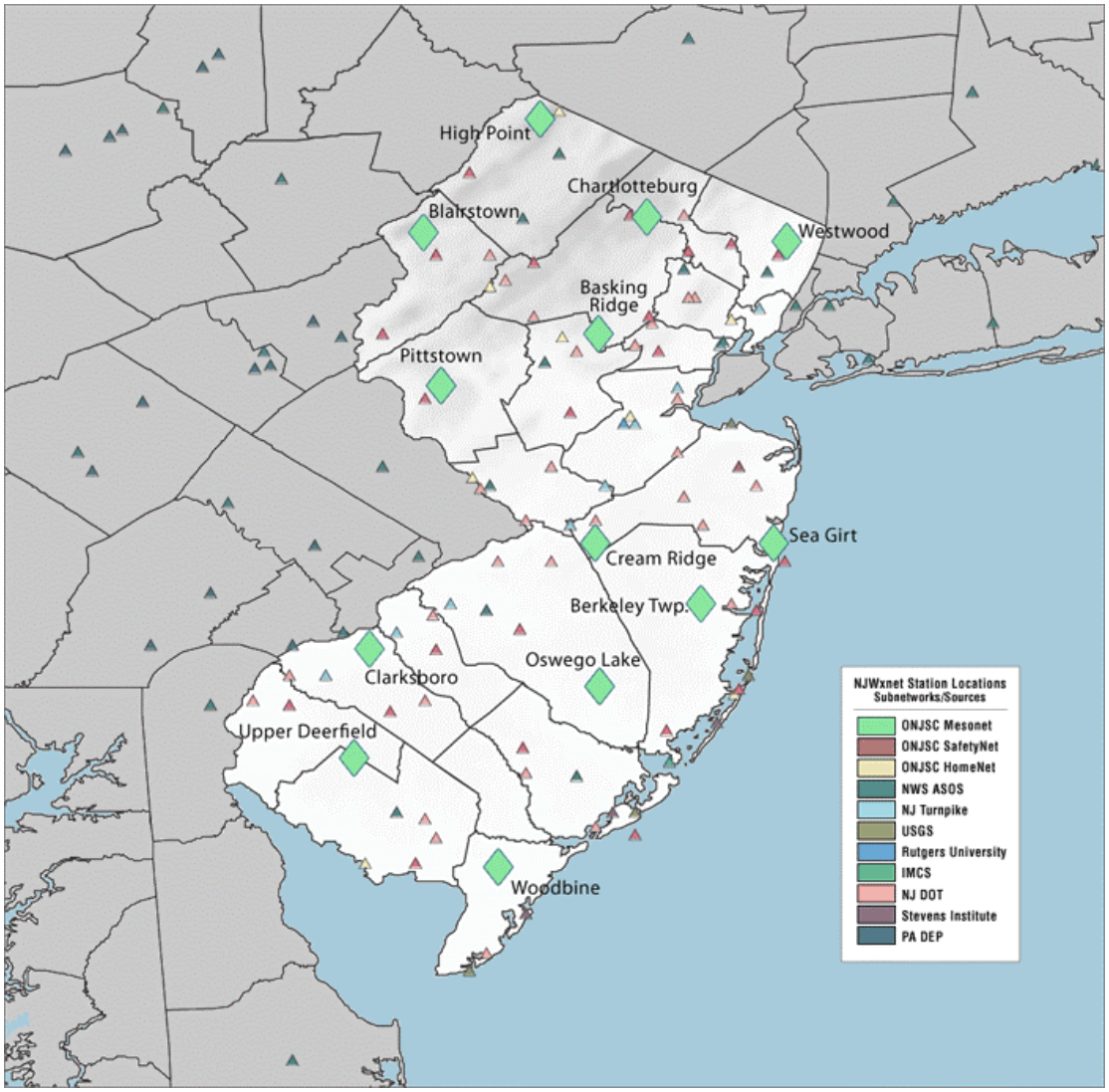

Figure 1. NJWxNet stations. Several newly installed stations in the Pine Barrens and elsewhere are missing from the map. The Westwood, Blairstown, Berkeley Twp and Clarksboro Mesonet sites are placeholders for stations planned to be installed this summer within or near these communities.

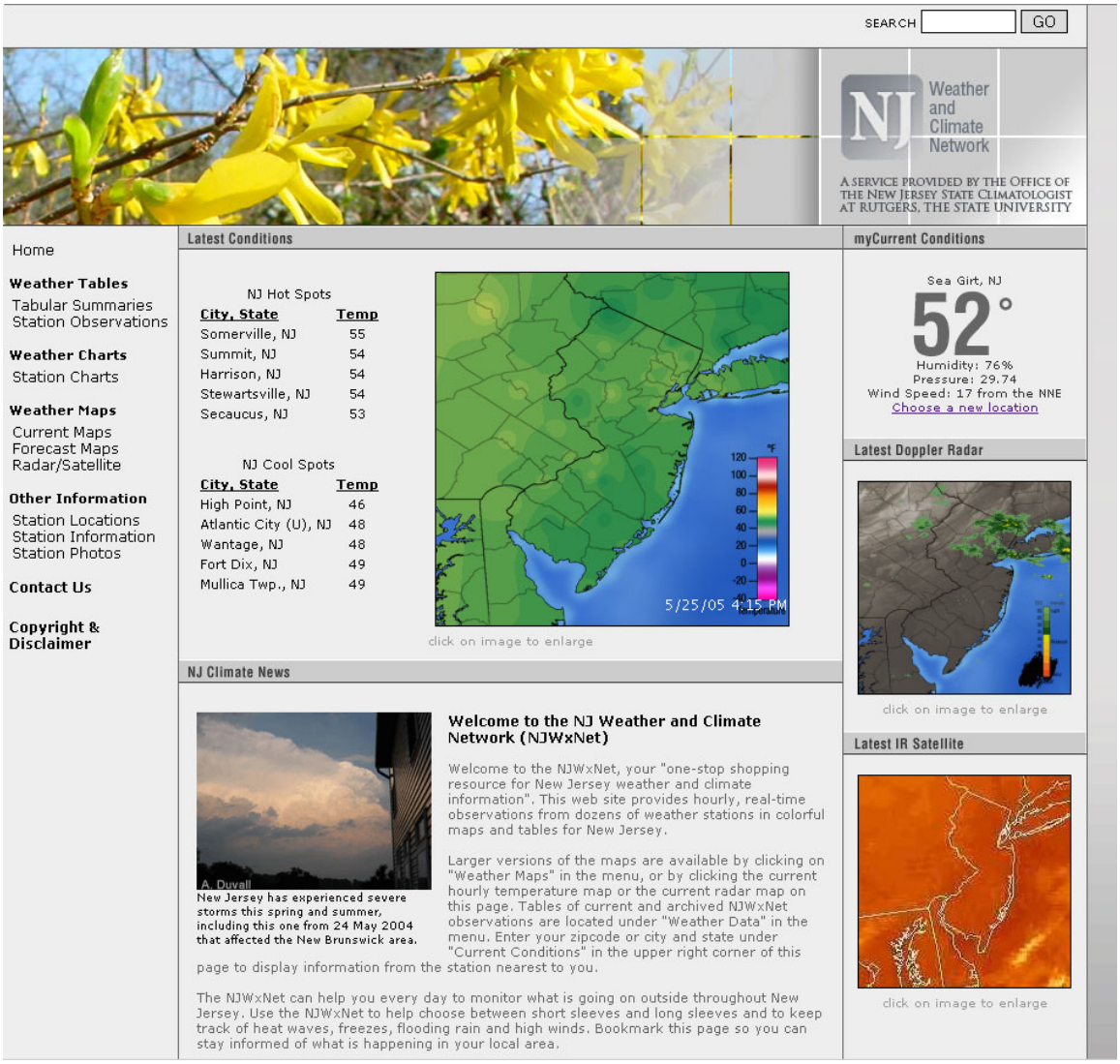

Figure 2. Sample NJ WxNet home page <http://climate.rutgers.edu/njwxnet>.

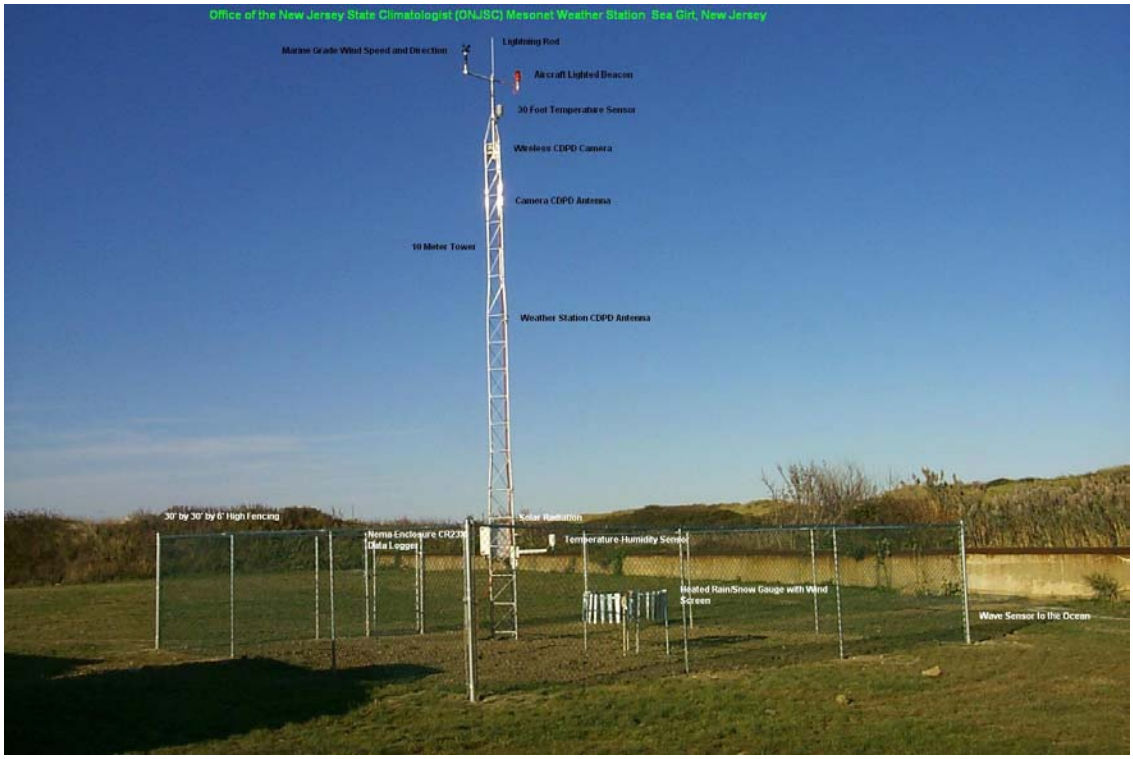

Figure 3. NJ Mesonet Sea Girt station. The Atlantic Ocean is several hundred yards to the right, behind the dune seen in this photograph. Most instruments are mounted on the 10-meter tower. The precipitation gauge is encircled by a wind reducing alter shield.

Figure 4. NJ SafetyNet Hillsborough/Belle Mead station. An anemometer is mounted on a nearby chimney.

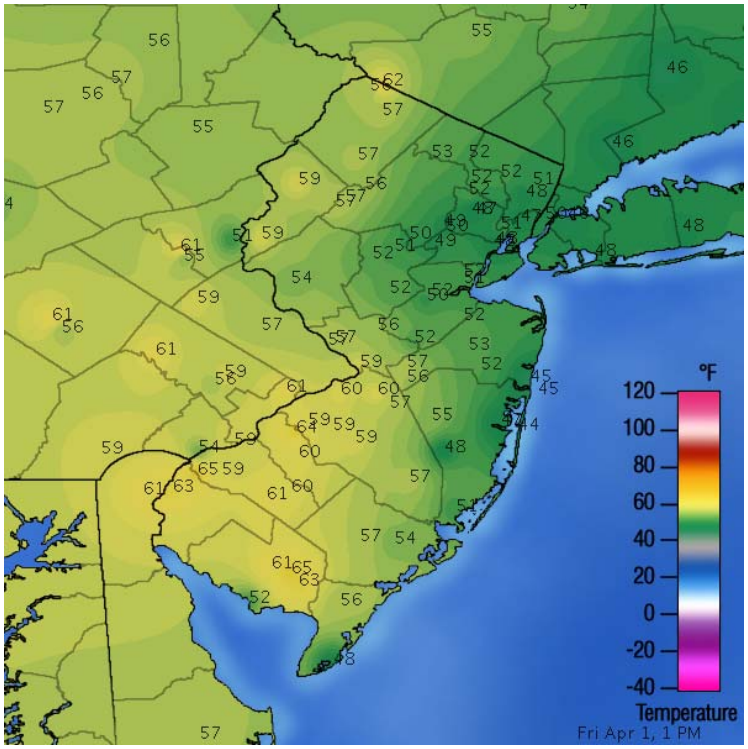

Figure 5. Surface air temperatures at 1 PM EST, April 1, 2005.

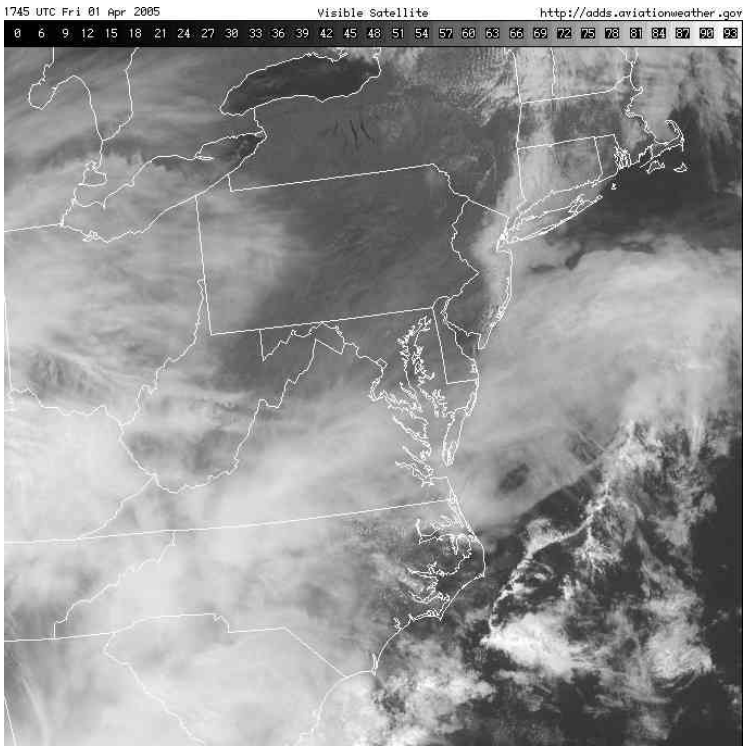

Figure 6. Visible satellite image at 12:45 PM EST, April 1, 2005.

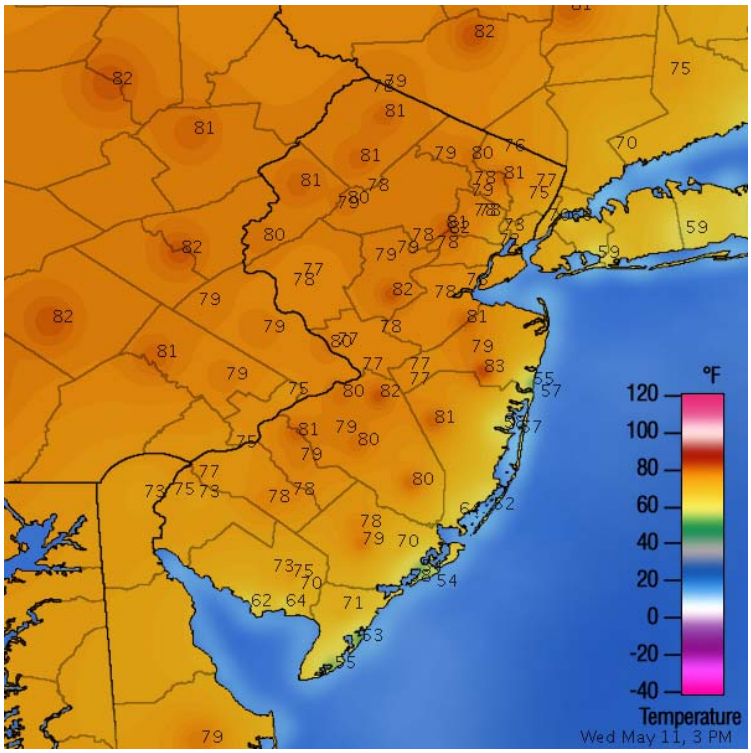

Figure 7. Surface air temperatures at 3 PM EDT, May 11, 2005.

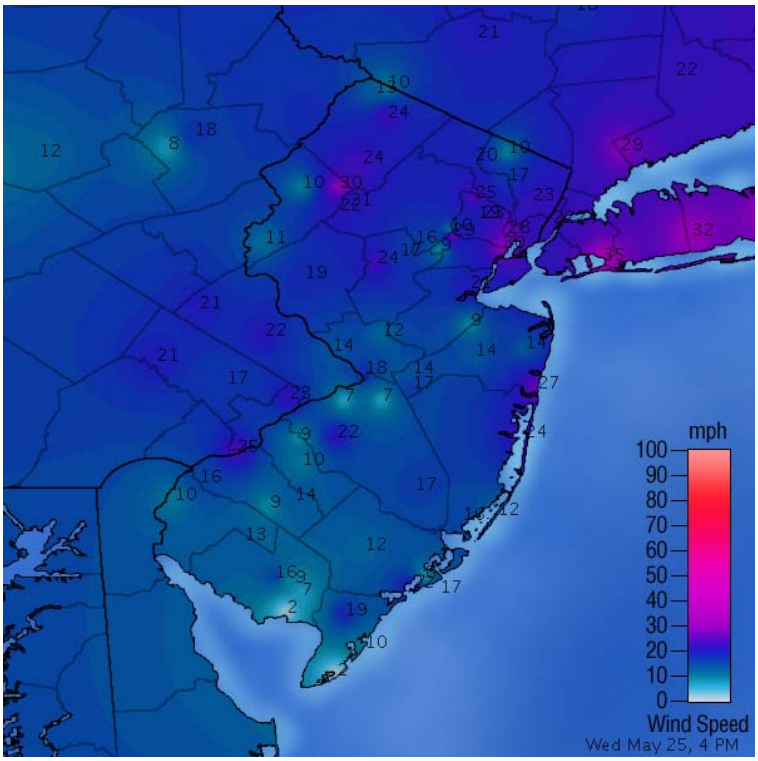

Figure 8. Wind gusts at 4 PM EDT, May 25, 2005. The variability in gust speed at nearby locations is a function of natural wind fluctuations and due to somewhat different methods used across networks to calculate gusts at or near the time of hourly observations.

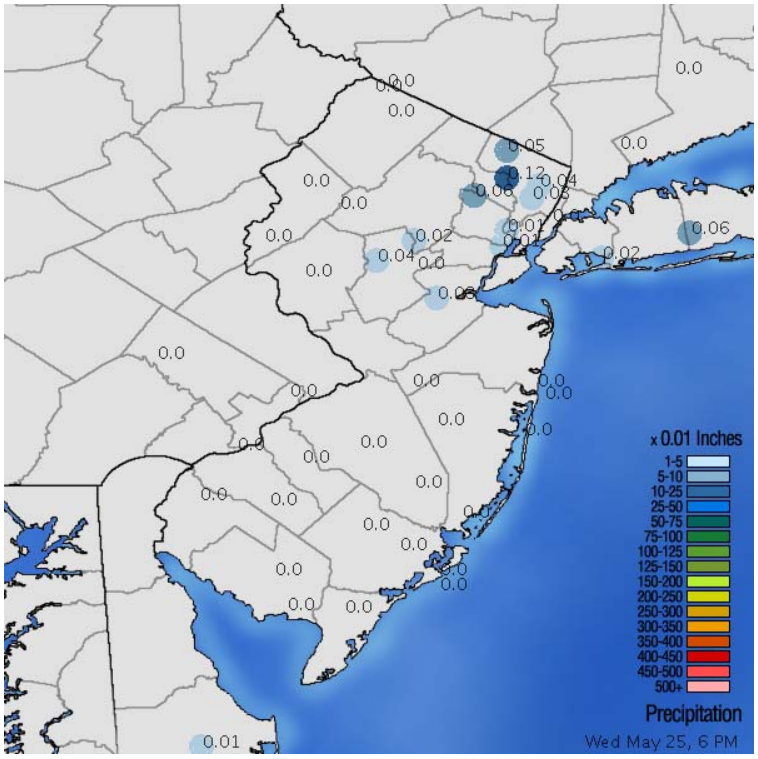

Figure 9. Rainfall observed at stations during the hour ending at 6 PM EDT, May 25, 2005.

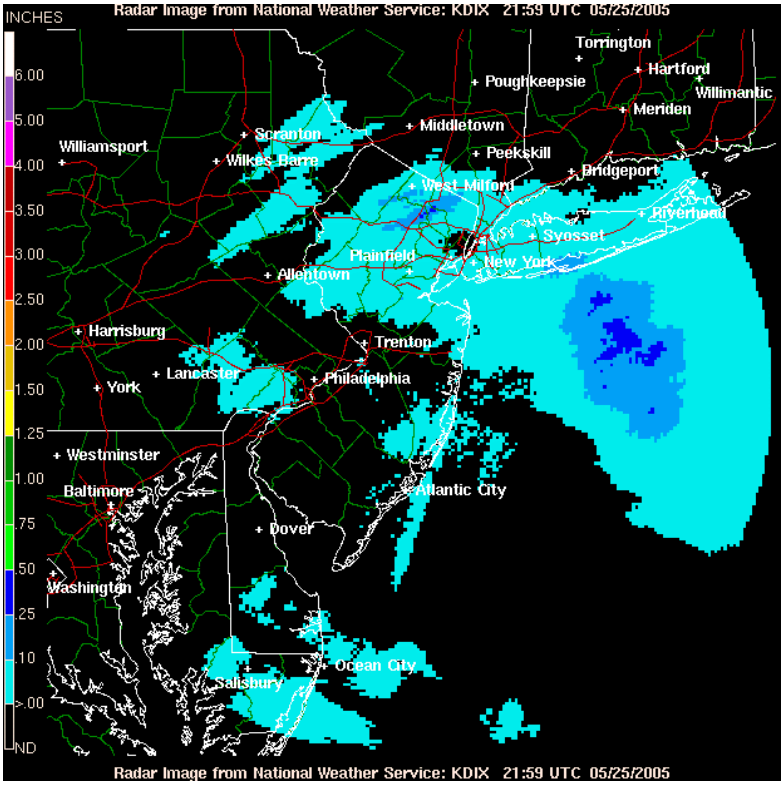

Figure 10. Radar-estimated rainfall during the hour ending at 6 PM, May 25, 2005.