JP2.25

AN OVERVIEW OF THE WEST TEXAS MESONET

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1. INTRODUCTION

The West Texas Mesonet (WTM) originated in 1999 as a project of Texas Tech University to provide real-time weather and agricultural data (Schroeder et al., 2005). Funding was provided by a Texas Economic Development grant (formerly the Texas Department of Economic Development) for an initial outlay of twenty-eight surface meteorological stations in a twenty-eight county area of western Texas known as the South Plains. Since 1999 the WTM has expanded to include counties in the Panhandle and Rolling Plains regions of western Texas; the number of surface meteorological stations has expanded to forty-five, and the number of counties served has grown to thirty-one (see Figure 1). Other observational systems include two atmospheric profilers and one upper air sounding system.

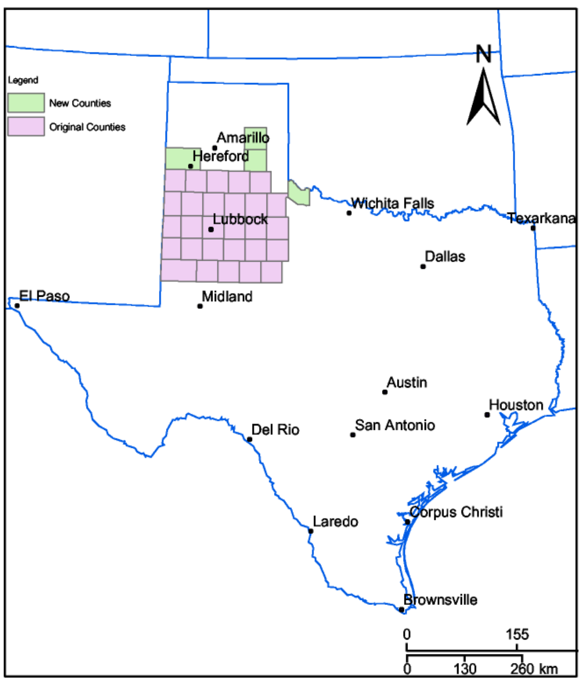

Figure 1. Regional map of the WTM domain.

Meteorological/agricultural data is transmitted every 5/15 minutes back to a base station located at Reese Technology Center (formerly Reese Air Force Base). Real-time data is available on our web site at http://www.mesonet.ttu.edu.

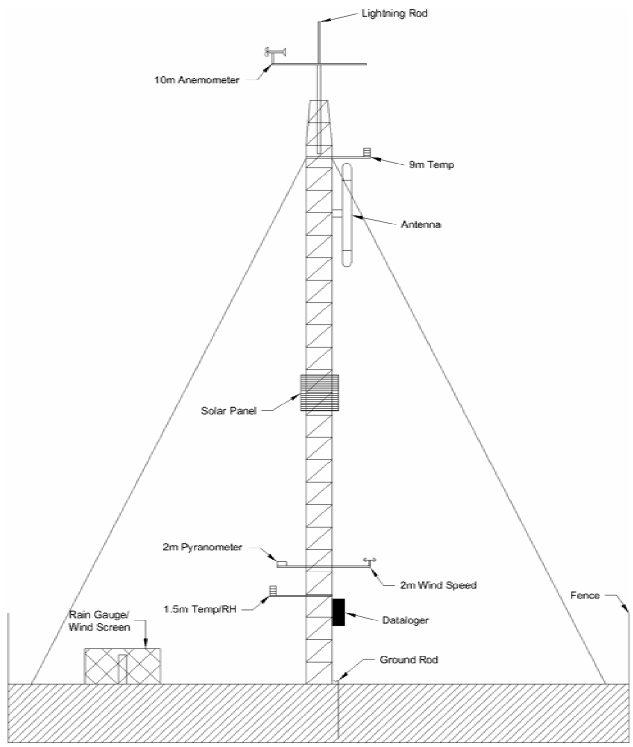

Figure 2. Elevation view of a typical WTM station. Adapted from Schroeder et. al., 2005.

The WTM, originally intended to be a pilot project for a statewide Texas Mesonet, is a joint partnership between the Wind Science and Engineering Research Center and the Atmospheric Science Group at Texas Tech University.

2. WEST TEXAS MESONET SURFACE OBSERVATION SYSTEMS

The WTM is closely modeled after the Oklahoma Mesonet (Brock et al. 1995). Site selection specifications, layout, and instrumentation

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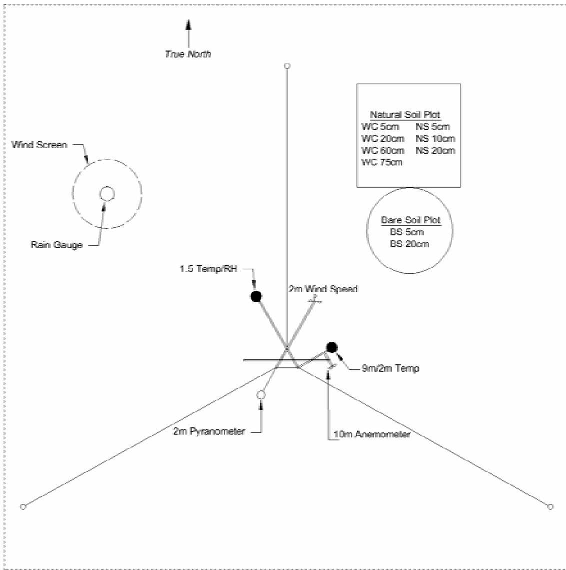

Figure 3. Plan view of a typical WTM station. Adapted from Schroeder et. al., 2005.

selection are nearly identical to those of the Oklahoma Mesonet (Schafer 1993) (Figures 2 and 3).

Three main constraints determined site selection. The first, and most difficult constraint, was maintaining a station spacing of approximately 35 km while being mindful of a line-of-site radio network. Acceptable site characteristics, such as good wind exposure and site slope, were the focus of the second constraint. The third constraint was selecting sites with no financial obligation. Approximately two-thirds of the WTM stations reside on public land owned by a local municipality or county. The remaining WTM stations are on privately owned land.

Each station has a fenced 10 m by 10 m plot of land with a 10 m tall, guyed aluminum tower. The tower is hinged and can easily be lowered by two personnel for sensor replacement and maintenance. A 70 cm wide by 70 cm deep concrete base was used to secure the tower with three guy wires used for additional support.

Each station uses solar panels to charge several deep-cycle gel type marine batteries for power. The number of solar panels and batteries at a site will vary depending on the amount of radio repeater traffic at the individual location. An average site will have two 20 W solar panels and two deep-cycle marine batteries. Several major repeater sites have two 50 W solar panels and four deep-cycle marine batteries for power. To minimize shading on sensors, the solar panels are mounted approximately half way up the tower. No more than two 50 W solar panels are mounted on the tower due to wind loading concerns. If additional solar panels are needed, they are mounted at ground level approximately 6 m away from the tower itself.

The rain gauge (with a wind screen), soil temperature and moisture content sensors are the only instruments not attached directly to the tower. The other sensors are mounted on boom arms at different levels on the tower. All wiring from the off-tower sensors is routed through PVC pipe and buried underground. The rain gauge is mounted to a 45 cm square concrete pad that is 20 cm above ground level to minimize flooding problems from heavy rainfall events. Natural and bare soil temperature/moisture content plots are marked with treated lumber to identify their location during mowing.

The majority of the WTM sites are located in rural areas, which at times are surrounded by cattle. Therefore, the fences had to be made of barbwire with stout fence posts. All fence posts are anchored into the ground with concrete and additional dead-man braces are added for support. For those sites with no cattle, regular hog-fencing was used with minimal fence posts. Tumbleweeds accumulate both inside and outside the fenced-in area. These tumbleweeds can accumulate to significant depths inside the fenced-in area during the spring months. At times, tumbleweeds have blocked rain gauges and broken low-level sensors at several WTM locations. Tumbleweed removal is therefore part of the maintenance schedule for each site. Animal damage to low-level sensors and wiring is a major problem. Predatory birds and Black-tailed Prairie Dogs have a tendency to chew through any exposed wiring.

Technicians visit WTM stations on a regularly scheduled two month rotation. Scheduled maintenance includes mowing the grass, removing debris, testing and calibrating instrumentation, and downloading data from the datalogger. Downloaded data are considered to be apart of the official data archive, as data are occasionally lost during radio and phone transmissions.

3. COMMUNICATIONS

One goal of the WTM is to make real-time meteorological and agricultural data freely available every 5 and 15 minutes, respectively. The State of Texas was approached by the WTM to use the Texas Law Enforcement Telecommunications System (TLETS), but the proposal was denied, and an alternative communications system became necessary. At the time of the proposal, recurring costs were not part of the WTM budget. So any communications system used by the WTM would have to meet the real-time data requirements, but not involve recurring costs.

Extended line-of-site (ELOS) radio was the first and most obvious choice to meet our goal. ELOS radio provided the necessary "store-and-forward" and "over the horizon" capability necessary to build a suitable radio network.

The WTM employs additional communication systems where appropriate. Because of the potential for recurring costs, cell and landline phone connections are used as little as possible for WTM stations that exist beyond the ELOS radio network. A favorable service plan with a local cellular phone company and a cooperative agreement with a local government agency has made cell and landline phone connections affordable, but calls are typically made on an hourly or half-hourly basis. The most promising communications technology takes advantage of ubiquitous Internet connections throughout West Texas. Three WTM stations take advantage of internet connections and allow for real-time data collection outside of the ELOS network.

4. DATA DISTRIBUTION

Another important WTM goal is to make data easily available to all interested parties through the internet via the World Wide Web (WWW) on our web site located at http://www.mesonet.ttu.edu. Other methods of data distribution such as File Transfer Protocol (FTP) and Unidata's Local Data Manager (LDM) are also used (see Figure 4).

Archived WTM data will soon be available to the public via web-based forms pending successful beta testing. All data is archived and will hopefully be available by the end of summer 2005.

5. QUALITY ASSURANCE

Quality assurance/control (QA/QC) software flag suspect data for manual review by a decision maker. If necessary, any QA/QC flags and review decisions will be added to the database. Please see JP1.28 in this conference ("The Enhancement of QA/QC Tests for West Texas Mesonet Wind Parameters") that documents the WTM QA/QC process more thoroughly.

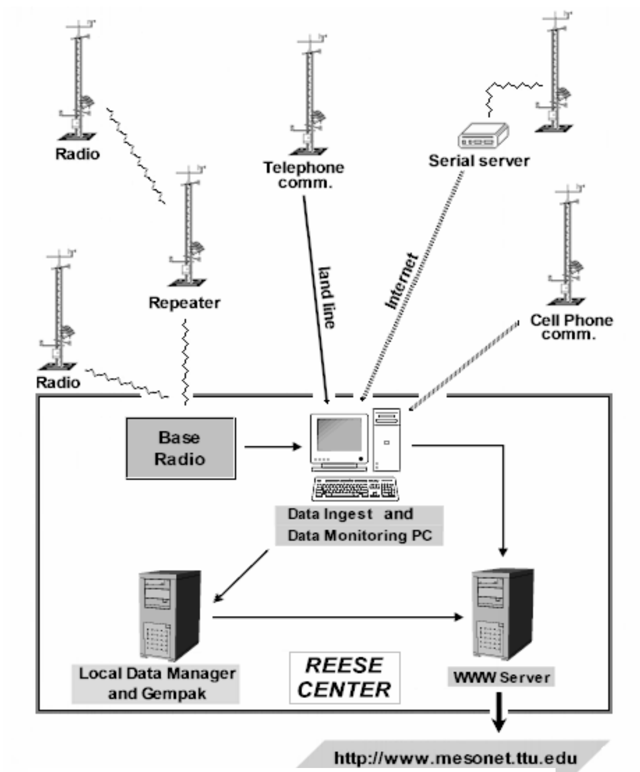

Figure 4. West Texas Mesonet data flow from remote stations to users. Adapted from Schroeder et. al., 2005.

6. Summary

The WTM now maintains 45 surface meteorological stations across several geographic regions of western Texas. Each station records five-minute meteorological data and transmits, in real-time, via ELOS radio, cell or landline phone, or through an Internet connection back to a base at Reese Technology Center. Agricultural data is recorded and transmitted back to base every 15 minutes. Real-time data is available and archived data may be requested, but an online database will be available in the near future for all archived data requests. WTM data is distributed through the Internet via the WWW, FTP, and LDM. All suspect and/or bad data is flagged by a set of Fortran routines and a human decision maker will make final conclusions as to the validity of the data.

6. References

Brock, F. V., K. C. Crawford, R. L. Elliott, G. W. Cuperus, S. J. Stadler, H. L. Johnson, and M. D. Eilts, 1995: The Oklahoma mesonet: A technical overview. *J. Atmos. Oceanic Technol.,* **12,** 5-19.

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Shafer, M. A., T. Hughes, and J. D. Carlson, 1993: The Oklahoma mesonet: Site selection and layout. Preprints, *Eighth Symp. on Meteorological Observations and Instrumentation, Anaheim, CA, Amer. Meteor. Soc., 231-236.*