CHAPTER 2
EXISTING METADATA GUIDELINES

Consistency within metadata collection and reporting is critical, especially in instances where monitoring data are utilized for purposes beyond their original intent, and correct interpretation of data depends upon the accuracy of metadata fields (Sprague et al., 2017). A handful of metadata collection and reporting standards have been developed in recent years, though few guidelines exist explicitly for soil moisture monitoring sites. Many existing networks provide various types of metadata for soil moisture monitoring sites, but since no widely-accepted guidelines are available, the reported information and methods used to determine that information vary from network to network.

American Association of State Climatologists (AASC)

In 2019, the AASC approved a document developed by its Mesonet Committee that outlined best practices for mesonets, including metadata guidelines for station and sensor siting, sensors and calibration procedures, station maintenance, and network quality assurance/quality control. To date, this is the most comprehensive document regarding suggested metadata reporting practices. However, this document addresses the full range of environmental monitoring, of which soil moisture monitoring is only one component. The AASC guidelines specify little soil-related information that should be reported: the only recommendations are that soil texture and underground infrastructure information be shared.

Upper Missouri River Basin (UMRB)

Recently, work has been done to install new and retrofit existing monitoring stations within the Upper Missouri River Basin (UMRB) with soil moisture and snowpack sensors. During this process, recommendations have been made for the collection of metadata relevant to soil moisture monitoring within this network. Recommended soil metadata include soil type, soil textural class, soil structure, erodibility and erosion characteristics, vegetation description, bulk density, water retention, particle size fractions, geomorphic characteristics, permeability and porosity, saturated water content, hydrologic soil group, and saturated hydraulic conductivity. However, these recommendations are currently still under development and are not yet generally available.

New York State Mesonet (NYSM)

Muller et al. (2013) documented metadata protocols for urban meteorological networks, drawing on current recommendations for urban climate stations and identified best practice in existing networks, to improve the quality and applicability of the increasing amount of data gathered by high-resolution urban networks. The New York State Mesonet adopted these practices across their network, which include monitoring soil moisture and temperature at three depths. Soil texture and classification, along with site photos and other information are publicly available on the New York Mesonet webpage on station information.

Kentucky Mesonet

The Kentucky Mesonet is a research-grade weather and climate observation network that monitors the near-surface atmosphere at over 70 locations. The network maintains a detailed database of station metadata that includes instrument and site maintenance history (Mahmood et al., 2019). Metadata also include a collection of directional site photographs. One half of Kentucky Mesonet sites currently monitor soil moisture and temperature at 5, 10, 20, 50, and 100 cm depths.

Other Guidelines

Several other networks have internally consistent metadata available through their websites. For example, the USDA Soil Climate Analysis Network (SCAN) provides detailed descriptions of soil conditions, including links to laboratory data, photos, sensor inventories, and maintenance history for every site visit (Schaefer et al., 2007). For the Oklahoma Mesonet, Fiebrich et al. (2006) note the importance of documenting each visit and recommend technicians perform three seasonal maintenance visits. Previous documents from the NCSMMN (Caldwell et al., 2022; Cosh et al., 2021; NIDIS, 2021) provide general guidance on metadata requirements for network details, site information, soil moisture sensors, and soil characterization.

This document builds on these resources to present a more detailed, systematic outline of soil moisture metadata.