

MAY 2021

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# Executive Summary: A Strategy for the National Coordinated Soil Moisture Monitoring Network

Coordinated, High-Quality, Nationwide  
Soil Moisture Information for the  
Public Good



Prepared for NIDIS by the  
Executive Committee of the  
National Coordinated Soil  
Moisture Monitoring Network







## EXECUTIVE SUMMARY

Soil moisture is a critical land surface variable, impacting a wide variety of climatological, agricultural, and hydrological processes. As a result, soil moisture measurements are needed for applications ranging from agricultural monitoring, to weather prediction, to drought and flood forecasting. At the same time, the means and methods of monitoring soil moisture are undergoing rapid growth and innovation with the advent of new in situ and proximal sensors, new remote sensing technologies, and enhanced modeling capabilities. Despite these opportunities, there is currently no coordinated national strategy for the deployment and maintenance of soil moisture networks, or for the development of nationally-integrated soil moisture data products.

Sponsored by the National Oceanic and Atmospheric Administration's (NOAA) National Integrated Drought Information System (NIDIS), the National Coordinated Soil Moisture Monitoring Network (NCSMMN) is a collaborative effort among soil moisture scientists, mesonet<sup>1</sup> operators, and other

interested individuals to plan for and support nationally coordinated soil moisture monitoring and data assimilation. As a key milestone of this effort, and in direct response to the NIDIS Reauthorization Act of 2018 (Public Law (P.L.) 115-423)<sup>2</sup> call for a national soil moisture strategy, the NCSMMN community has prepared this document, with the goal of identifying a roadmap forward and the resources needed for implementing a coordinated national network; specifically, a network that will provide coordinated, high-quality, nationwide soil moisture information for the public good.

This strategy document includes: a summary of current in situ networks as well as remote sensing and model resources, a discussion of network design considerations, guidance for in situ network installation and quality assurance/control, and the implementation strategy for the proposed NCSMMN. The following recommendations are detailed as a part of the implementation strategy:

<sup>1</sup> A mesonet is a regional network of observing stations (usually surface stations) designed to diagnose mesoscale weather features and their associated processes (<https://forecast.weather.gov/glossary.php?letter=m>).

<sup>2</sup> <https://www.congress.gov/115/plaws/publ423/PLAW-115publ423.pdf>

**1. Determine Home Agency and Management Structure for the NCSMMN.**

It is recommended that NIDIS continue as the near-term “home” for the NCSMMN, and that a review be undertaken of models and best practices across the Federal Government to inform the choice of a formalized management structure for the NCSMMN going forward.

**2. Establish a Web Presence and Formalize Communication & Outreach Planning for the NCSMMN.**

A visible, user-friendly website for the NCSMMN is important for both communication and product delivery. In addition, the NCSMMN will need to do broader communications and outreach planning. As a cornerstone engagement activity, the NCSMMN will continue to host an annual meeting of soil moisture monitoring experts from across the United States.

**3. Formalize Partnerships with the National Mesonet Program and Existing Monitoring Networks.**

To obtain in situ soil moisture data from existing monitoring networks across the country, the NCSMMN should formalize a partnership with NOAA’s National Mesonet Program (NMP) and establish Memoranda of Understanding (MOUs) with networks outside of the scope of NMP.

**4. Develop a Set of Criteria for High-Quality Data Sources.**

It is proposed that a set of criteria be established to qualify an in situ soil moisture network as producing high-quality versus moderate- or provisional-quality data. These criteria will be developed in coordination with the research, data provider, and user communities.

**5. Support Research Necessary to Develop or Improve NCSMMN Methodologies.**

Although preliminary research and demonstration projects have shown the feasibility of the envisioned NCSMMN products, further research is required to enable the creation of these products at the national scale and to rigorously quantify the uncertainty in those products.

**6. Increase In Situ Soil Moisture Monitoring Nationwide.**

There is a clear need to increase the number of

long-term, high-quality, in situ soil moisture monitoring stations across the United States, especially for underrepresented regions, such as in forests, grazing lands, and croplands. The NCSMMN will work with partners from across the country to optimize locations of new monitoring stations to meet Federal and state goals.

**7. Explore Increasing Partnerships with the Private Sector.**

A concerted effort must be made to engage with private sector weather and soil monitoring network operators not only to expand the impact of monitoring efforts from all sources, but also to share methodologies and validation protocols developed by the NCSMMN community.

**8. Engage with the Citizen Science Community.**

One potential way to increase in situ soil moisture monitoring – as well as public support for such monitoring – is to invite the participation of citizen scientists, particularly through collaboration with groups such as NOAA’s Cooperative Observer Program (COOP) and the Community Collaborative Rain, Hail, and Snow Network (CoCoRaHS).

**9. Develop, Release, and Promote NCSMMN Products.**

The aim of the NCSMMN effort is to provide coordinated, high-quality, nationwide soil moisture information for the public good. This will require developing, releasing, and promoting new, nationwide point-based and gridded soil moisture data products that meet the needs of diverse end-user groups, and that support crucial applications such as drought and flood monitoring, fire danger ratings, and streamflow forecasting.

Implementing these recommendations will provide a unifying structure for the national soil moisture community, not only enhancing in situ monitoring activities, but complementing remote sensing and modeling activities as well. Through efforts to: 1) develop a strong organizational home; 2) engage in communication and outreach; 3) establish partnerships and build out the network; 4) conduct needed research; and 5) develop and refine data collection, integration, and quality standards, the NCSMMN will be positioned to deliver transformative soil moisture products to the Nation.

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