

The Romanian Soil Moisture & Temperature Observation Network for Satellite Soil Moisture Products Validation

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INTRODUCTION

As satellite soil moisture (SSM) products are looking more and more promising for a wide range of applications, the Romanian Met Service (NMA) decided to explore the potential of space borne microwave data derived soil moisture products in practical applications. A crucial step in the evaluation of SSM products is the validation with modeled, in-situ data or other satellite products. Validation of SSM products with in-situ data depends on the existence of adequate ground based soil moisture measurements. While NMA is operating a network of 158 weather stations (mostly automatic), soil moisture is only manually measured every 10 days at 55 of the above stations for agro-meteorological applications. At 247,000 km² – the areal extent of Romania, the resulting average spacing of 67* km² could be a good starting point provided that the measurements are more frequent and the topography and land cover less diverse. Adding soil moisture & temperature sensors to the existing weather stations can result in a fairly adequate soil moisture network for minimal costs. Furthermore, the network density can be easily increased using cheap in-house developed SM mobile stations, allowing for the flexibility needed to design validation campaigns for different satellite sensors. The Romanian Soil Moisture & Temperature Observation Network (RSMN) is made up of a "static" component – the SM & T probes at the 20 weather station locations and of a mobile component – 30 autonomous, easy to deploy SM stations. The design and implementation of the RSMN are discussed together with the planned configuration for the validation of SMOS soil moisture products.

OBJECTIVES

The present study is part of the ASSIMO (Assessment of Satellite Derived Soil Moisture Products over Romania) Project.

In the present study the next objectives were followed:

- (1) To create the framework for the validation & assessment of SSM products;
- (2) To contribute with validation of the SSM over temperate / continental area (little studied until now);
- (3) Contribute to the International Soil Moisture Network (ISMN).

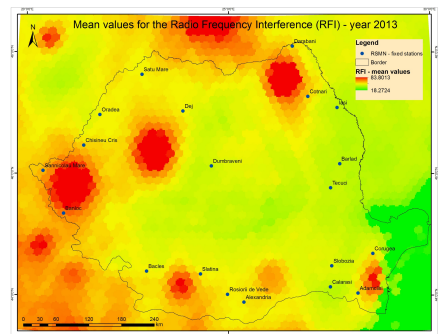
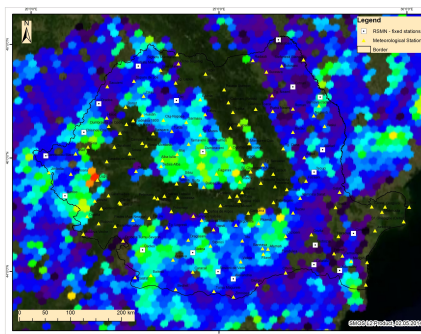
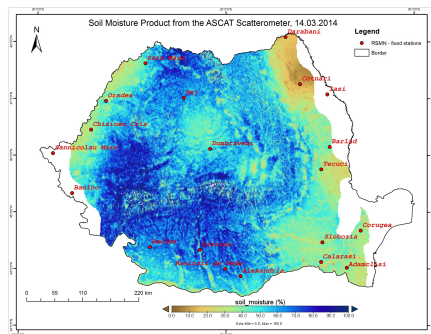
MATERIALS AND METHODS

Raster data (satellite soil moisture products)

- (1) SMOS - the reprocessed L2 product that provides volumetric Soil Moisture Content (SMC);
- (2) SRTM 30 - digital elevation model.

Vector data

- (1) administrative limits;
- (2) results of buffer calculations;
- (3) weather stations location.



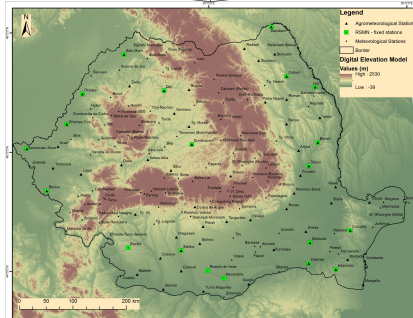
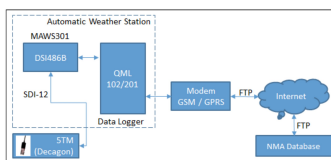
RSMN Design - the fixed component

In order to select the most suitable locations, the following criteria and information had been taken into consideration:

- existing weather stations locations;
- site elevation <300-500 m;
- minimal forest, water and localities coverage;
- small amount of argill soil;
- reduced RFI interference.

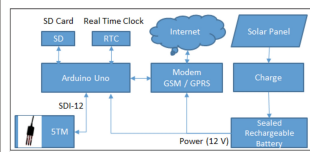
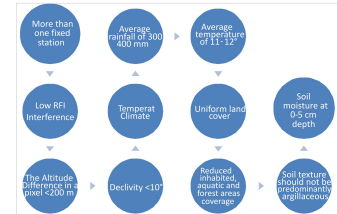
20 locations have been found to correspond to the above criteria. The 5TM Decagon soil moisture and temperature sensors have been already installed at 11 locations.

At the existing weather stations location the 5TM probes will be interfaced with the existing automatic weather station data loggers (Vaisala/Logotronic).

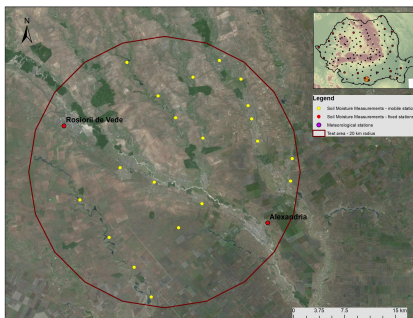


RSMN Design - the mobile component

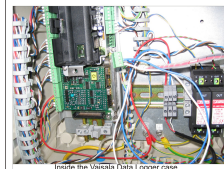
Its meant to allow for easy reconfiguration of the soil moisture network depending upon the satellite product to be validated. 30 autonomous mobile stations will be deployed in different areas according to the scheme below.



The mobile stations are built around the Arduino Uno board fitted with a GSM shield, for communication and powered by a solar panel and battery. One 5TM Decagon sensor is used at a depth of 0-5 cm.



Example of RSMN configuration for SMOS Soil Moisture validation.



Year	Station 1	Station 2	Station 3	Station 4	Station 5
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS
2010/01/01	SMOS	SMOS	SMOS	SMOS	SMOS

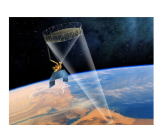
The volumetric content in water	Temperature
Accuracy: ±0.01 vol% / ±0.2°C	
Resolution: 0.01 vol% / 0.1°C	
Domain: 0 - 1 vol% / 40°C to -10°C	
Meteorological Characteristics of the 5TM sensor	

PERSPECTIVES



This study is a preliminary phase towards the validation of a SMOS, ASCAT and Sentinel-1 over temperate continental regions of Romania. The upcoming steps:

- (1) RSMN ready for operational use;
- (2) Define a validation scheme of ASCAT/SMOS/Sentinel-1;
- (3) Implement a validation module and processing chain for the experimental validation of ASCAT/SMOS/Sentinel-1 soil moisture products;
- (4) Evaluate the performance of satellite moisture products compared with in-situ data from RSMN.



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