

Dense hydrological networks for high resolution soil moisture product validation

Anna Balenzano (1), Francesco Mattia (1), Giuseppe Satalino (1), Francesco Lovergine (1), Michele Rinaldi (2) and M. H. Cosh (3)

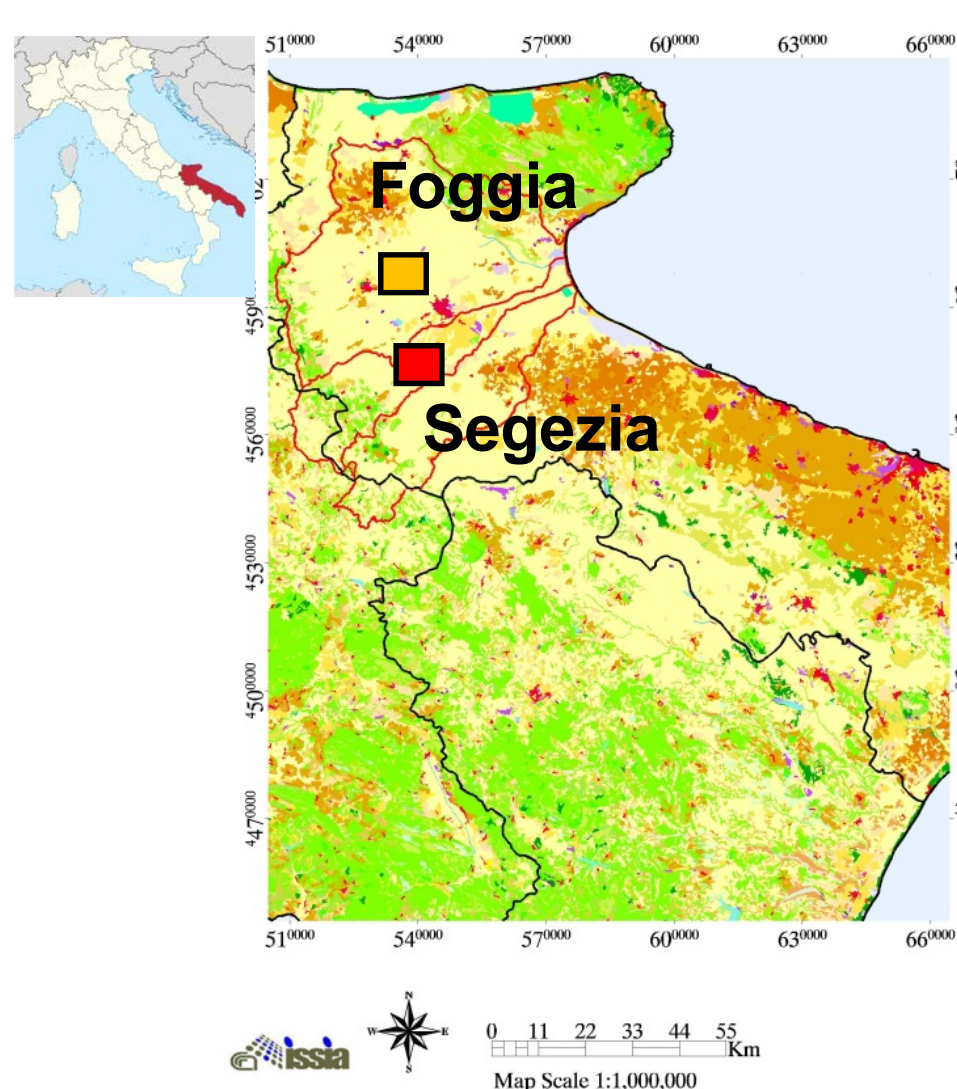
(1) Consiglio Nazionale delle Ricerche (CNR) - Istituto per il Rilevamento Elettromagnetico dell'Ambiente (IREA), sede di Bari, via Amendola 122/D - 70126 Bari, Italy.

(2) Consiglio per la ricerca in Agricoltura e l'analisi dell'Economia Agraria (CREA), (3) USDA, Agricultural Research Service, Hydrology and Remote Sensing Laboratory, Beltsville, MD, USA

Email: anna.balenzano@cnr.it

Abstract The increasing availability of soil moisture (SM) products provided by present satellite missions, e.g. the ESA SMOS, EUMETSAT ASCAT and the NASA SMAP missions, has stimulated the creation of long-term and accurate in situ SM networks at a global scale, to support calibration and validation activities. As SM products are currently operationally derived by microwave radiometers and scatterometers, many efforts have been made to identify strategies to deal with the scale-mismatch between the satellite coarse spatial resolutions (e.g. 25-36km) and the point measurements on the ground, e.g. upscaling observations from sparse networks. Recently, the use of ESA Sentinel -1 observations to support systematic SM product generation at regional/continental scale has risen the needs to tailor the validation strategy to high spatial resolution SM product (e.g 1km). This includes setting up ground networks purposely designed for validating SSM products at such a higher spatial resolution This poster presents two dense hydrological networks of 3-4km² extent, located in the Capitanata plain (Southern Italy). The Capitanata plain, stretching on 4000 km² (i.e. the second largest plain in Italy), is a crucial area for the durum wheat production in Italy and presents important challenges for the water management, as the area is prone to flash-flood/drought events and needs accurate yield forecast.

APULIAN TAVOLIERE SITE (JECAM SITE)



- 4000 km² (i.e., the second largest plain in Italy)
- semi-arid Mediterranean climate (annual rainfall about 550 mm)
- almost flat topography
- main crops: durum wheat, barley, oat, tomato, chickpea, broad bean, sunflower
- Agricultural areas (CORINE)

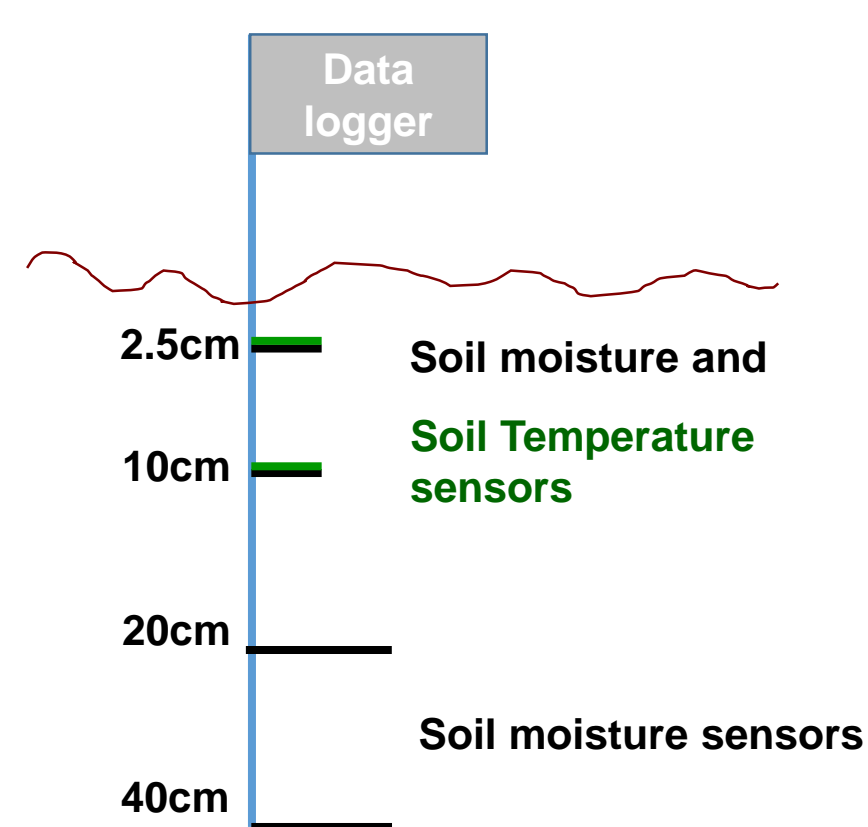
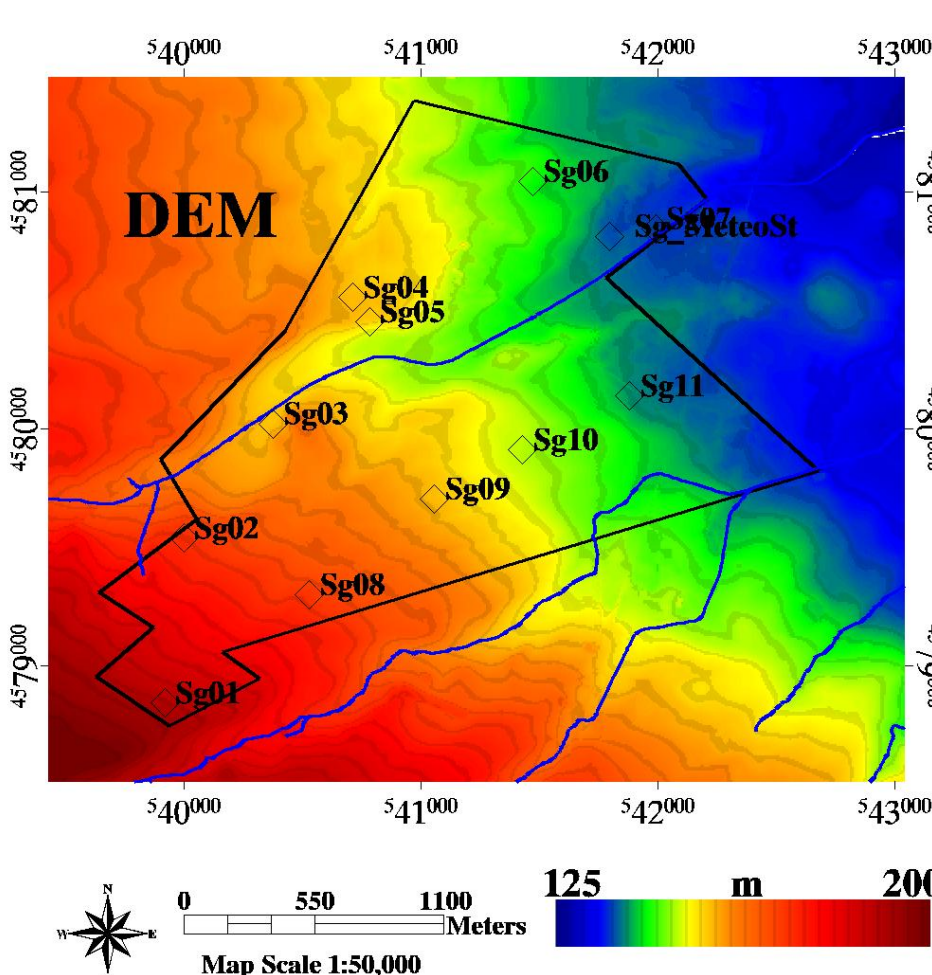
□ highly anthropogenic environment & increasing evaporative demand
→ significant reduction in water availability & increased water demand (e.g. irrigation, energy, industry, etc.) → **risk of future yield loss**

GROUND NETWORKS



- Segezia experimental farm of approx. 4km² located in the Cervaro basin
- main crops: cereals (durum wheat, barley, oat) and pasture
- 11 soil moisture stations installed in Feb. 2014
- ✓ Each station: EM50 datalogger & Decagon **5TM & 10HS** capacitance devices installed horizontally at **2.5cm, 10cm, 20cm and 40cm** depths, respectively
- 1 meteo station
- soil specific calibration

The stations are distributed with an **average spacing** of approximately **0.5km** considering the **hydrographic network and the topography**

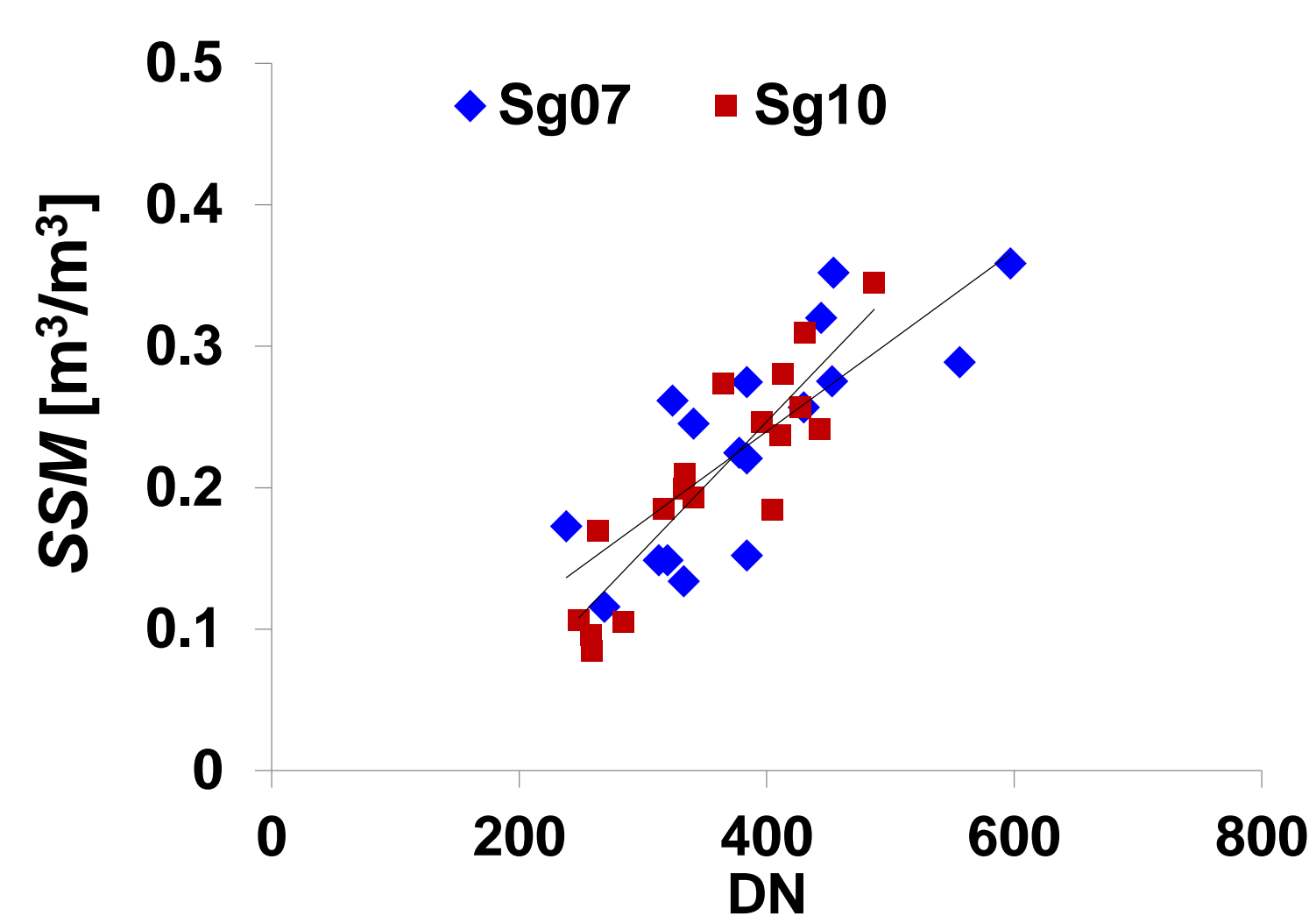


- Foggia experimental fields in an area of approx. 3km² located in the Candelaro basin
- main crops: durum wheat and tomato
- network of 10 ground soil moisture stations + pluviometer, installed in June 2017
- Calibration in progress

SOIL SPECIFIC CALIBRATION

17 Kopechy ring SSM measurements co-located with the stations vs sensor DN

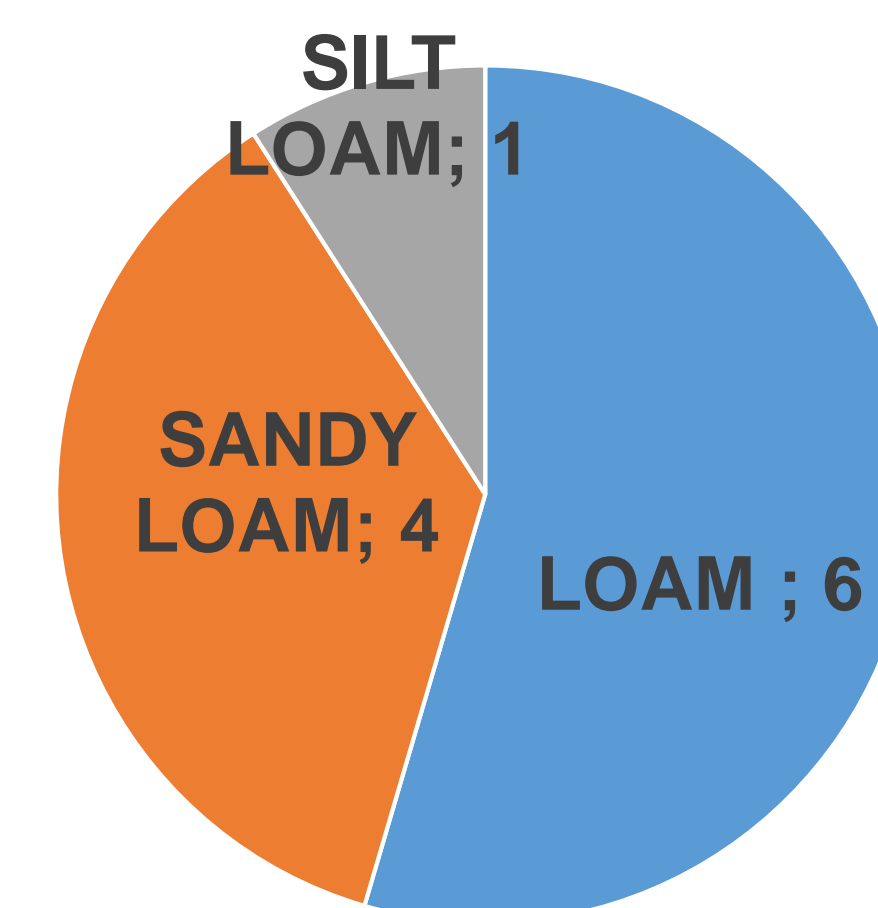
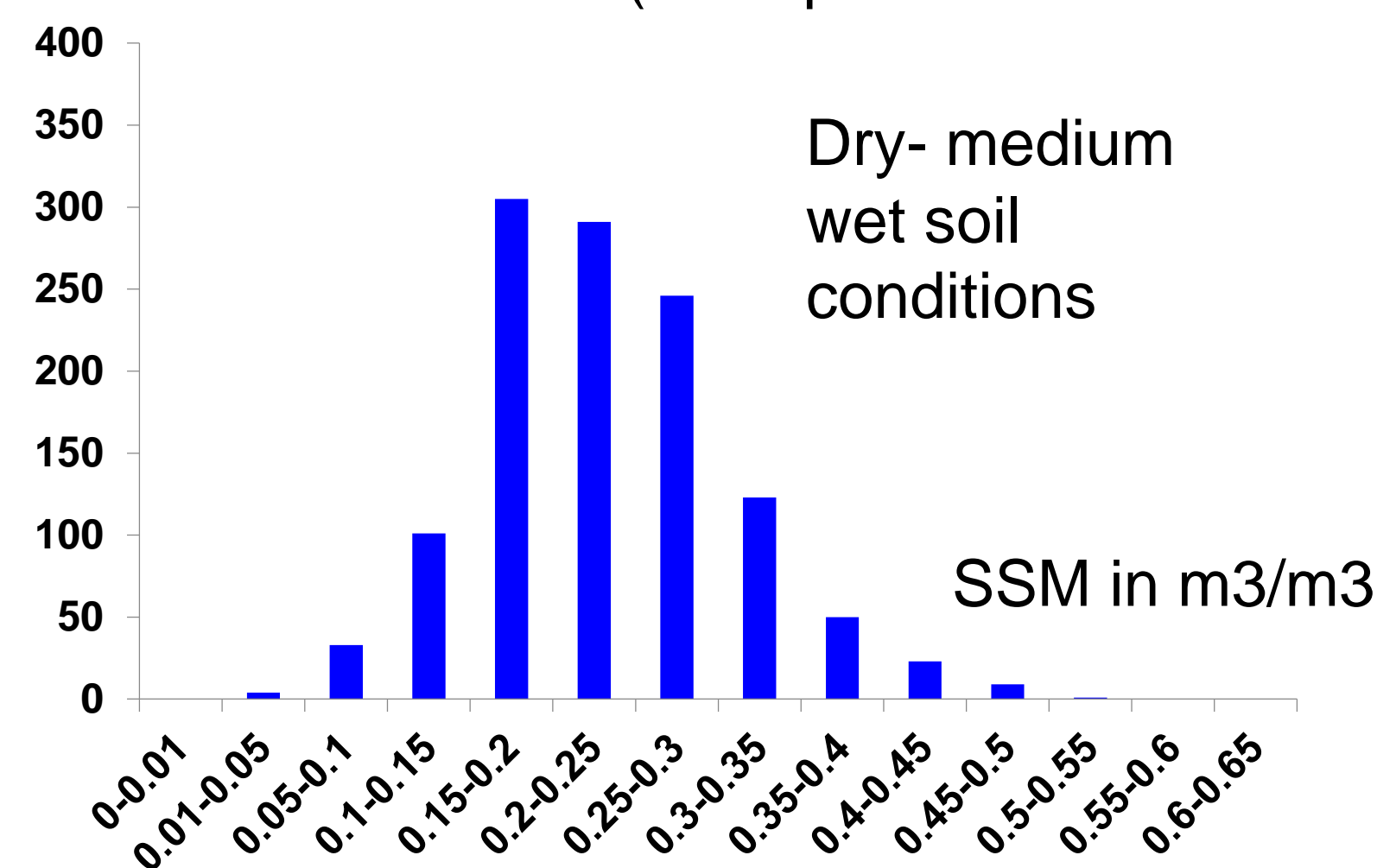
Calibration error (0.03m³/m³ in average) and correlation (0.86 in average)



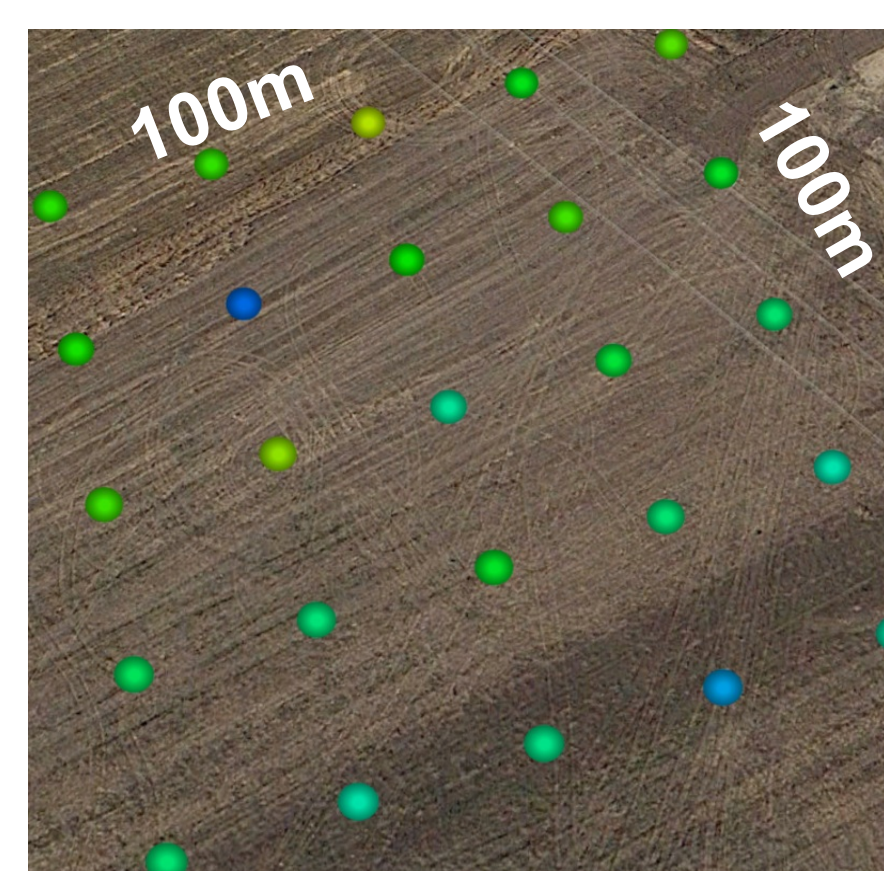
Sg	rmse	R
1	0.030	0.81
2	0.026	0.93
3	0.056	0.76
4	0.023	0.94
5	0.027	0.86
6	0.033	0.85
7	0.043	0.81
8	0.033	0.84
9	0.044	0.89
10	0.028	0.93
11	0.035	0.82

SOIL MOISTURE CONDITION AND SOIL TEXTURE

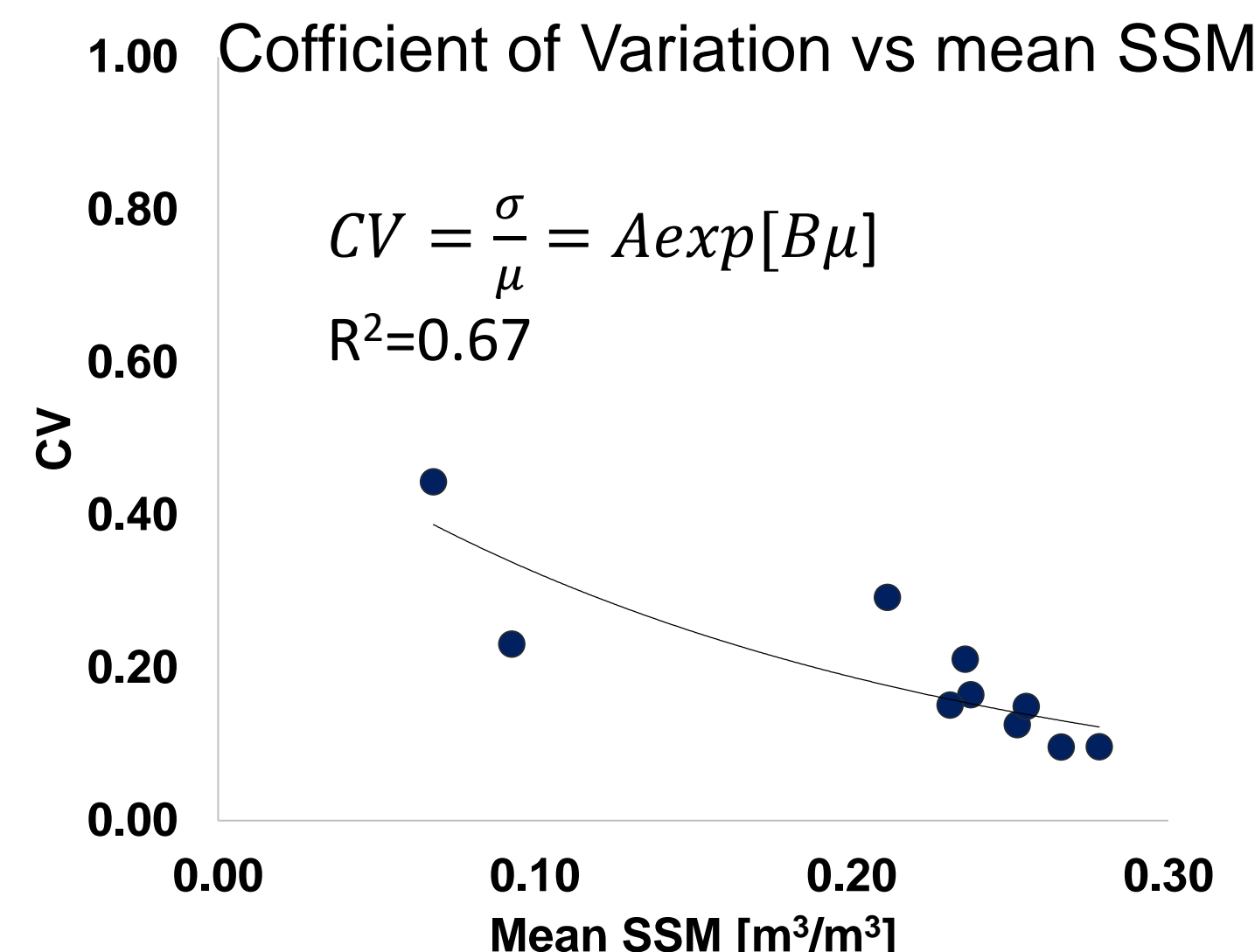
Histogram of the surface soil moisture (SSM) measurements collected by the ground stations on the S-1 (A146) acquisition dates from 2015 to 2017. (1190 points)



REPRESENTATIVENESS OF POINT SCALE MEASUREMENTS AT 100m RESOLUTION



Example of SSM sampling grid of 5x5 point measurements



Measuring sampling error

