

Monitoring of soil moisture for drought risk assessment over the Brazilian semiarid region

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Soil moisture is being monitored over the Brazilian semiarid since 2014 using a network of 595 stations. The network was implemented by Cemaden, the National Center for Monitoring and Early Warning of Natural Disasters, with the objective of monitoring of spatial and temporal patterns of soil water and potential impacts on the region's agriculture activities. The Brazilian semiarid is the poorest in the country and hosts most of the family owned farms in Brazil. Crops such as maize and beans are mostly planted over small properties with no irrigation.

In this work, agricultural risk is assessed using measurements of soil moisture which are presented in formats that highlight spatial, temporal and short-term variability. The Soil Moisture Index (SMI), based on a normalization of soil moisture by field capacity and wilting point, is used to characterize the current soil moisture conditions in a scale proportional to the water available to plants. The temporal evolution of SMI is used to visualize trends in short-term drought and response to rainfall events at daily time steps or recent weeks. A novel index based on continuous exposure to critical SMI is developed to help bring awareness of real time risk of water stress over the region: the Index of Stress in Agriculture (ISA). The index takes into account continuous exposure to a critical value of SMI (assumed as 0.4), below which water stress is expected to be triggered in plants. The index was tested during a short-term drought over the region and successfully identified locations under water stress for periods of three days or more. The monitoring tools presented here help to describe the real time conditions of drought over the region using daily observations. These tools are expected to be implemented over an online platform hosted at Cemaden's website.