GCLab

SOMOSPIE

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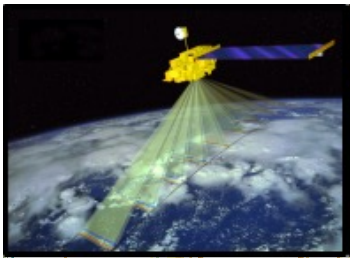
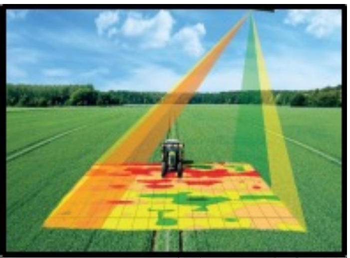
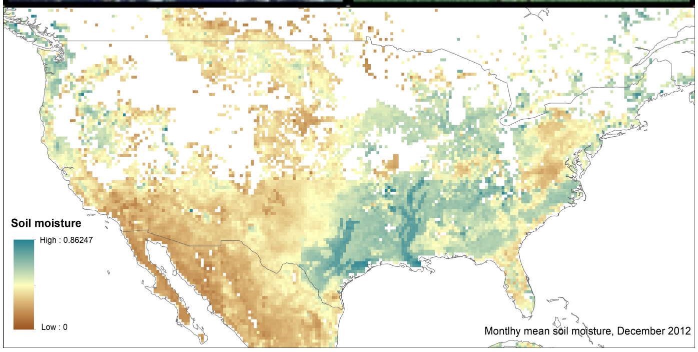
Project Overview

A UD+UTK collaboration, led by NSF-funded computer and environmental scientists, is developing SOMOSPIE—a SOil MOisture SPatial Inference Engine—for generating gap-free soil moisture information at finer resolution than available from satellite data. The engine consists of modular stages for processing spatial environmental data and generating predictions with machine learning techniques.







Motivation

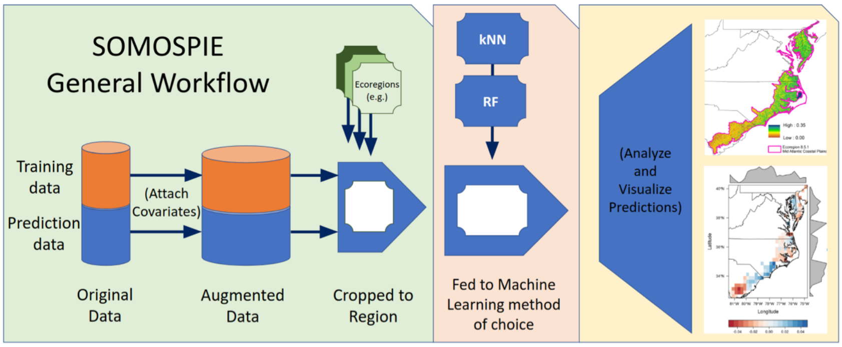
Spatial soil moisture data is relevant to environmental sciences (e.g., ecological niche modeling, carbon monitoring systems, and other Earth system models) and precision agriculture (e.g., optimizing irrigation practices and other land management decisions). The primary source of soil moisture data over large areas is satellite-borne, radar-based remote sensing technology. Though produced with daily measurement and global coverage, satellite soil moisture datasets have coarse resolution and often exhibit large spatial information gaps. Where data are too coarse or sparse for a given need (e.g., precision agriculture), we are leveraging machine-learning techniques coupled with other sources of environmental information (e.g., topography) to generate gap-free information at a finer spatial resolution.

Methodology

The engine begins its work with soil moisture values attached to the coordinates of the coarse data (i.e., training data) as well as spatial coordinates at the desired resolution (i.e., prediction data). These data are augmented with related spatial data (i.e., covariates) that are already available at the desired resolution, such as topographic parameters. Some additional preprocessing tools are available for this augmented data. The processed training data is then fed to machine learning method(s) of interest to generate a model on which the processed prediction data can be evaluated, producing a fine-grain, spatially complete soil moisture prediction.

Validation

Networks of ground sensors provide us with “ground truth” by which to validate both our final soil moisture predictions and the methods by which we produce the predictions.



T. Kitson, P. Olaya, E. Racca, M. R. Wyatt II, M. Guevara, R. Vargas, M. Taufer: Data analytics for modeling soil moisture patterns across united states ecoclimatic domains. BigData 2017: 4768-4770

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