

Estimation of soil moisture using satellite information and hydrological modeling

How can one estimate the amount of water in the soil? This is one of the questions the thesis “*Estimating soil moisture from space - A comparison between soil moisture estimates based on satellite retrievals and the E-HYPE model under drought scenarios in France year 2003 and 2011*”, performed by the student Erik Sönegård at Lund University, looks into while also studying different types of approaches to do so; looking at hydrologic modeling as well as estimates based on satellite information.

Soil moisture is referring to the amount of water in the soil between the ground surface and the ground water table. When looking at water needed for agricultural demand one often talks of the amount of water which has reached the ground surface in the form of rain, however, soil moisture not only depends upon how much rain that has fallen, but also on variables such as soil texture (the type of soil) and the plants living of the soil. Plants have roots that go down in the soil and then transport the available water in the ground to different parts of the plant. Soil can store a considerable amount of water and therefore act as a reservoir for plants during periods of drought, when there has fallen less rain than normal. So the question can be, if there have not been rain for a while and one has plants using the water from the soil to its different needs, how much is left?

Estimation of soil moisture can be done in a number of different ways. The thesis looks at modeled soil moisture estimates from the E-HYPE model and two satellite products called the Copernicus Soil Water Index (Copernicus SWI) and the ESA Climate Change Initiative Combined Soil Moisture product (ESA CCI SM). The thesis shows that when comparing the E-HYPE model to these satellite derived products one can find similarities between them, even though they estimate the soil moisture in different ways. The thesis also shows that one can analyze drought events using the E-HYPE model and the ESA CCI SM product. As an example of what can be seen one can look at Figure 1.

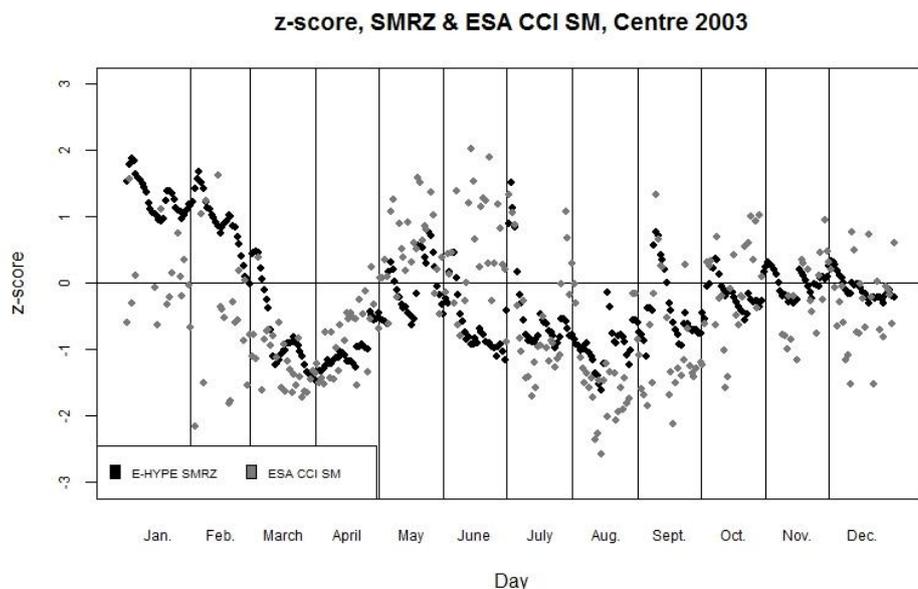


Figure 1 - Soil moisture estimates, as deviation from the mean, for the E-HYPE model (black) and the ESA CCI SM product (gray) for an area in the Centre region in France, year 2003

The two estimates show similar deviations from their means for the months March until the end of May, while for June showing quite contradictory behavior, the E-HYPE model indicating declining soil moisture estimates below average compared to the mean, while the ESA CCI SM product is pending mostly above the expected mean. The conclusion is thus that it is possible to analyze a drought event using the two above mentioned products, and that they possibly could be used together to complement one another, in situations when the one of the estimates deviates from the other.