Ag Blog 24 May 2021

During the 2021 growing season, Dr. Eric Hunt of Atmospheric and Environmental Research, Inc. will be providing weekly updates of the soil moisture index (SMI) from the Noah-MP version 4.0.1 land surface model in the NASA LIS framework for the entire U.S. and regional analysis of the SMI over the four regions of U.S. where the majority of corn, soybean, wheat, and cotton production occurs. Additionally, soil moisture index maps of South American and western Russia are provided at the end of the blog. The analysis is intended to provide the larger agricultural and meteorological communities insight as to areas where soil moisture is excessive or deficient compared to average for that location and what that may mean for impacts. It is my goal that these maps can be an early warning signal for flash drought development or where flash flooding could be likely in the coming week if heavy precipitation materializes. Please be advised that the SMI should be viewed as complementary, not a substitute, to the U.S. Drought Monitor (USDM) and that declarations of drought or flash flood potential for a particular location should never be based on the SMI alone. The Evaporative Stress Index (ESI) and VegDRI will included in our analysis a bit later this season. Various other maps that help give insight into current conditions across the U.S will also be shown as needed.

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Order of Maps and Tables in today's Ag Blog

- Figure 1. CONUS Soil Moisture Index map
- Figure 2a. Driest Grid Points
- Figure 2b. Wettest Grid Points
- Figure 3. Flash Drought Watch update
- Figure 4. U.S. Drought Monitor
- Figure 5. South America Soil Moisture Index map
- Figure 6. Western Russia/Ukraine Soil Moisture Index map

Narrative:

Figure 1 shows that much of the country continues to be quite dry, with a majority of grid points featuring an SMI under 0. Unfortunately for most of the upper Midwest, the western U.S. and the middle Atlantic region, the SMI is indicative of existing drought or that it may be imminent without rainfall in the near future. Some places have seen some needed relief since the cutoff for this week's maps, especially across southern Minnesota and parts of northern Iowa and southern Wisconsin. Unfortunately, this relief has yet to be extended into the Great Lakes region, with very dry conditions continuing across the northeastern corner of Illinois into Michigan (Figure 2a), setting up a very sharp gradient with the abnormally moist conditions just 100 miles to the southwest in western Illinois (Figure 2b). The forecast continues to be promising in the drought-

stricken region of the Great Lakes for rain but that also has been true at various other points in recent weeks, with generally no substantial precipitation to show for it. So for the time being we have a situation where a portion of the Corn Belt is too dry and another (highly important) area of the Corn Belt is too wet.

This week's Ag Blog features the first "Flash Drought Watch." This is intended to be a good example of putting recent research into action. In this case it is to apply a portion of the Flash Drought Intensification Index from a paper led by my University of Wisconsin colleague, Dr. Jason Otkin, into action. The criteria in Figure 3 are set to show only grid points where the 0-40 cm SMI has dropped by at least -3 (or 30 percentile points) over the previous three weeks AND has a current SMI of -2. In other words, it shows where there has been a rapid decline in soil moisture and where the soils are currently pretty dry (i.e., no better than an SMI of -2). So if it's already been dry for a while or if the rapid drop in soil moisture was from a very wet point (in which case it's likely welcomed), the grid point will not show up on the map. Ideally the Flash Drought watch maps will show areas that are not currently in drought but are close to being there without decent precipitation. In this case, the area identified in Figure 3 is mostly across northern Wisconsin and northern lower Michigan and into east central Minnesota and is just outside the region classified as in drought on the last U.S. Drought Monitor (Fig. 4). It is my sincere hope that this is a useful product for anyone that cares about the impacts of drought in general, but specifically on what it may mean for crops and to other ecosystems.

Figures 5 and 6 show the current SMI values across South America and western Russia. Drought continues over some of the better farmland in southern Brazil and conditions have deteriorated pretty rapidly across some of the spring wheat's more productive ground in western Russia, particularly over the Chelyabinsk and Bashkir oblasts.

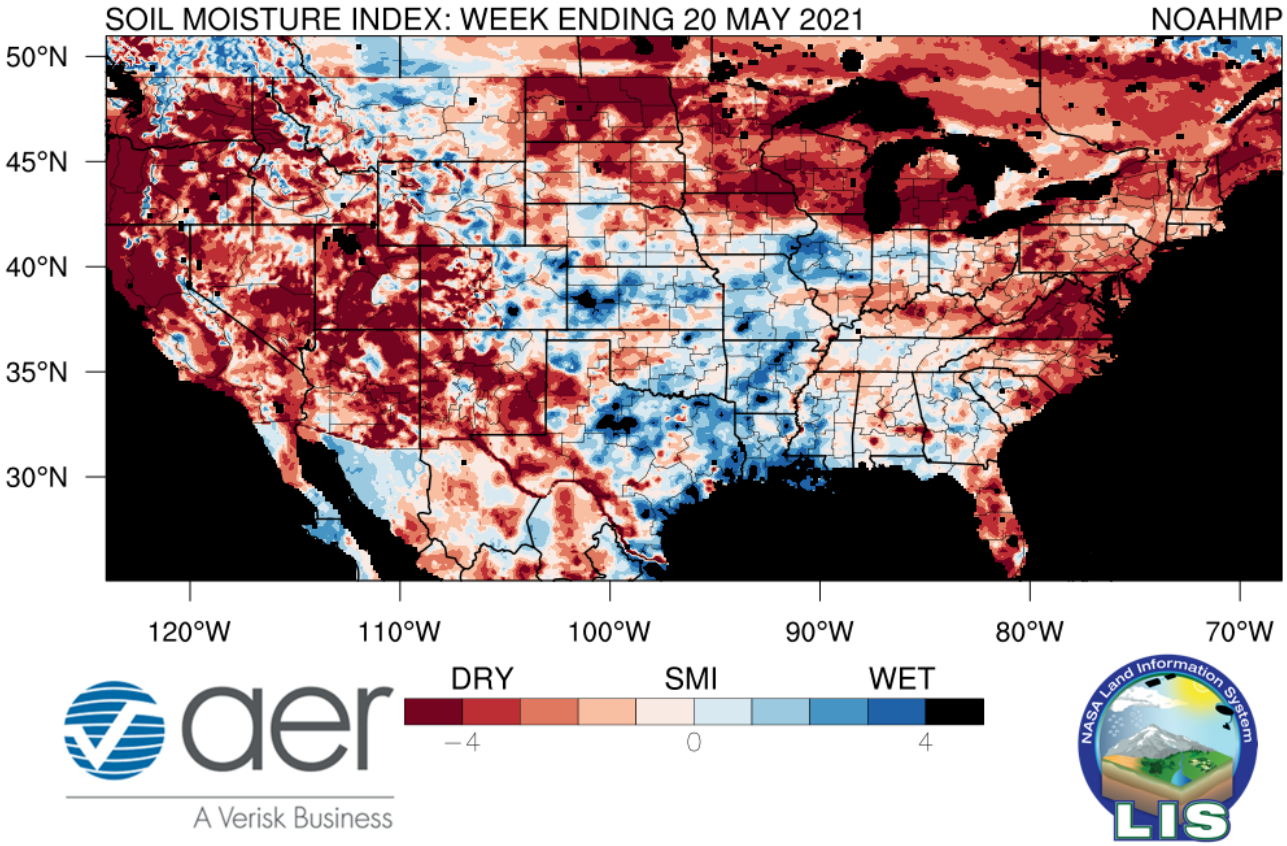

Figure 1. The Soil Moisture Index (SMI) for the 7-day period ending 20 May 2021. Results are based on output from the 0-1 m (surface to 3.23 feet) layers in the Noah-Multiparameterization (Noah-MP) land surface model. Noah-MP is run in the NASA Land Information System (LIS) framework with the North American Land Data Assimilation Version 2 (NLDAS-2) forcing dataset. The SMI calculation is based on the soil moisture index created in Hunt et al. (2009) such that '5'(dark blue) is the wettest and '-5' (dark red) the driest for the period of record. The period of record used calculate the SMI for the current map is 1979-present.

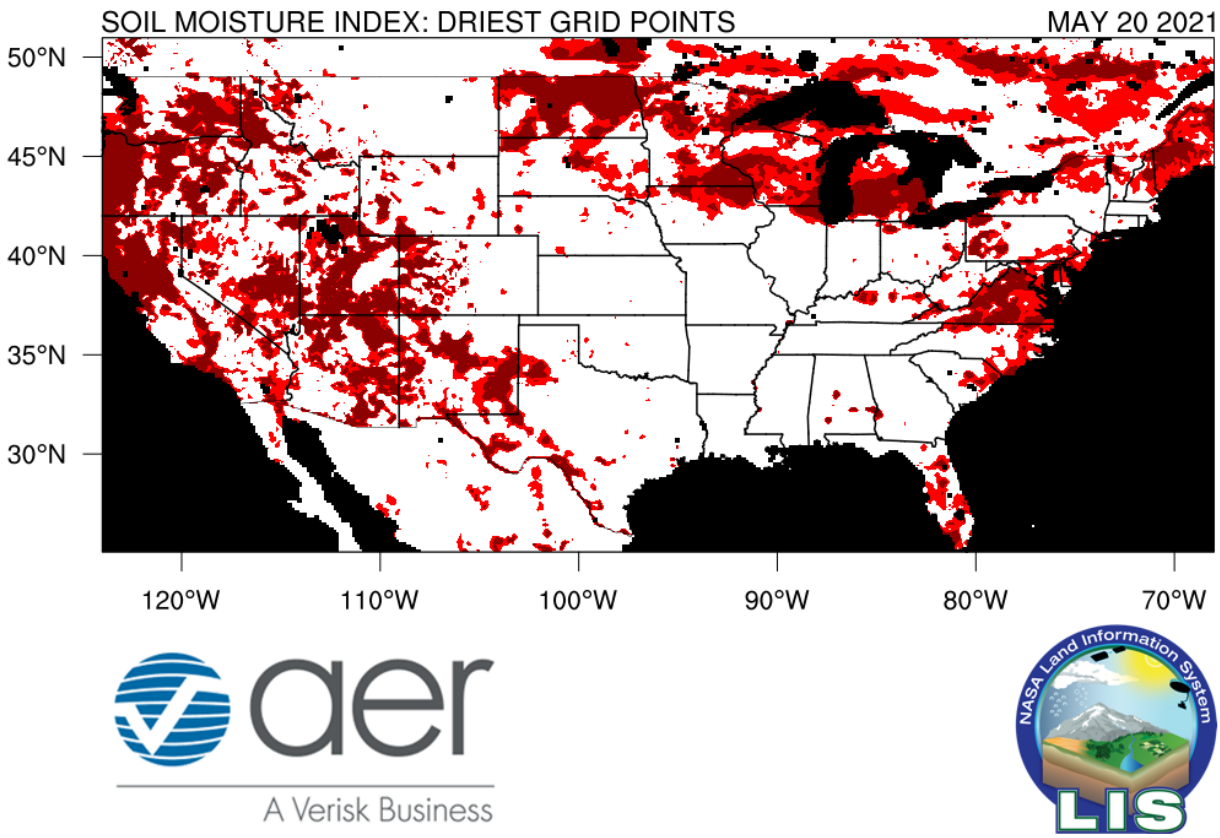

Figure 2a. Lowest 20th (10th) percentile of soil moisture as depicted by red (dark red) pixels for the week ending 20 May 2021.

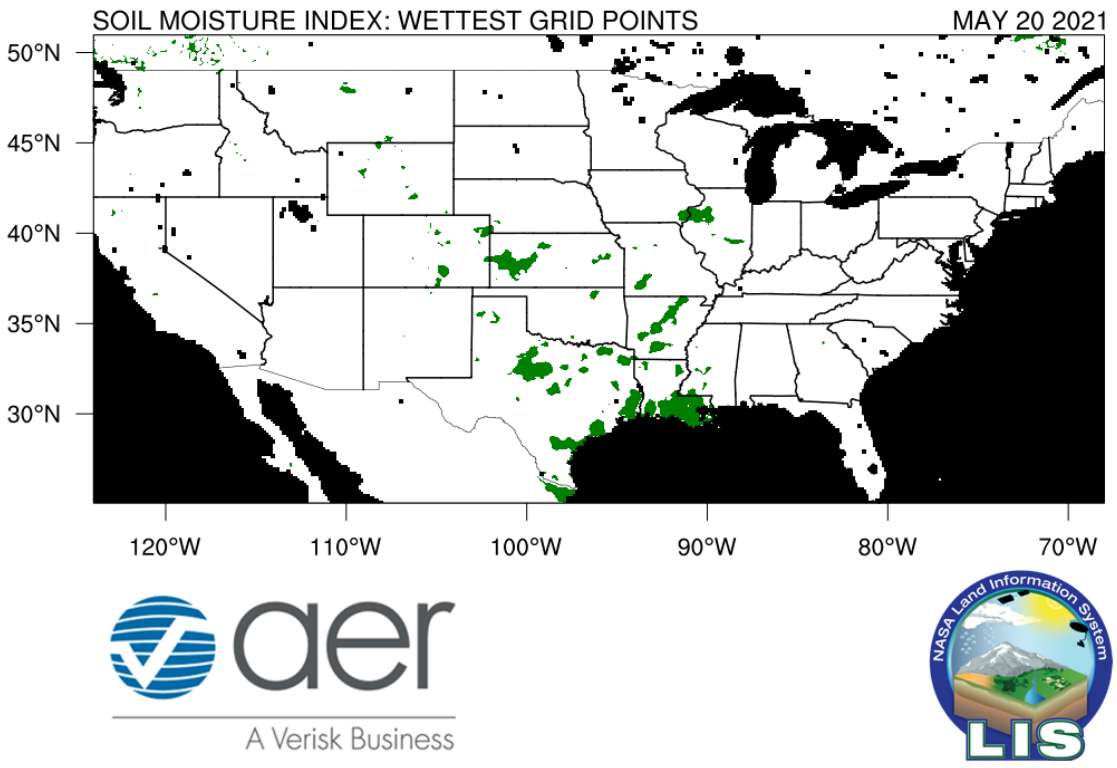

Figure 2b. Highest 20th (10th) percentile of soil moisture as depicted by green pixels for the week ending 20 May 2021.

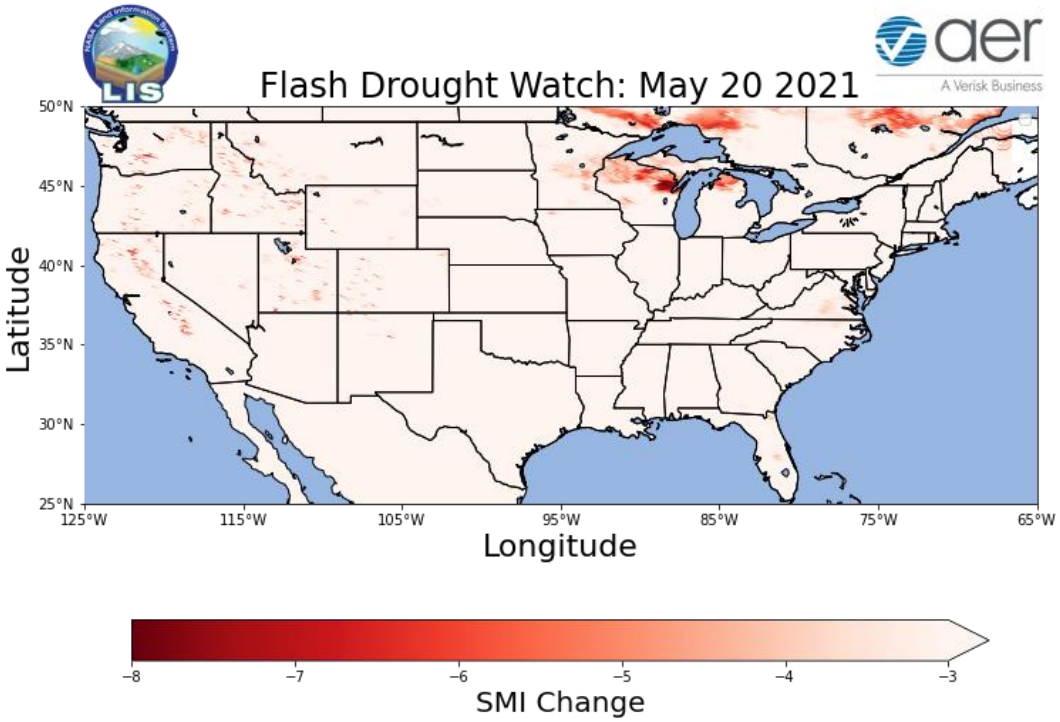

Figure 3. Flash drought watch as of 20 May 2021. The experimental product is based on a portion of the Flash Drought Intensification Index, which was proposed in a paper in review by Otkin et al. The criteria are as follows: A minimum drop of -3 in the SMI over previous 3 weeks and a current SMI of < -2. In this case, the SMI is based on the 0-40 cm layers from NASA LIS. For more information, refer to Figure 1.

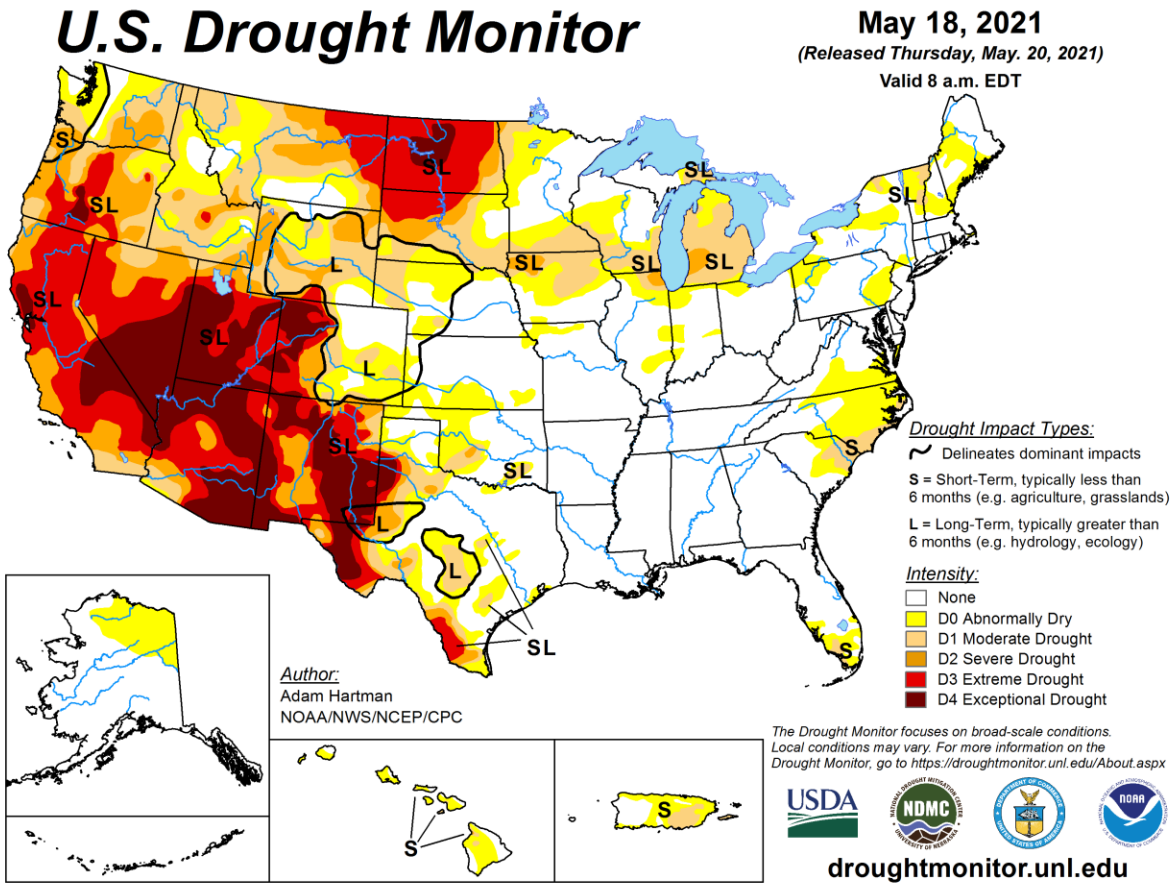

Figure 4. U.S. Drought Monitor map as of 18 May 2021. Map courtesy of the National Drought Mitigation Center.

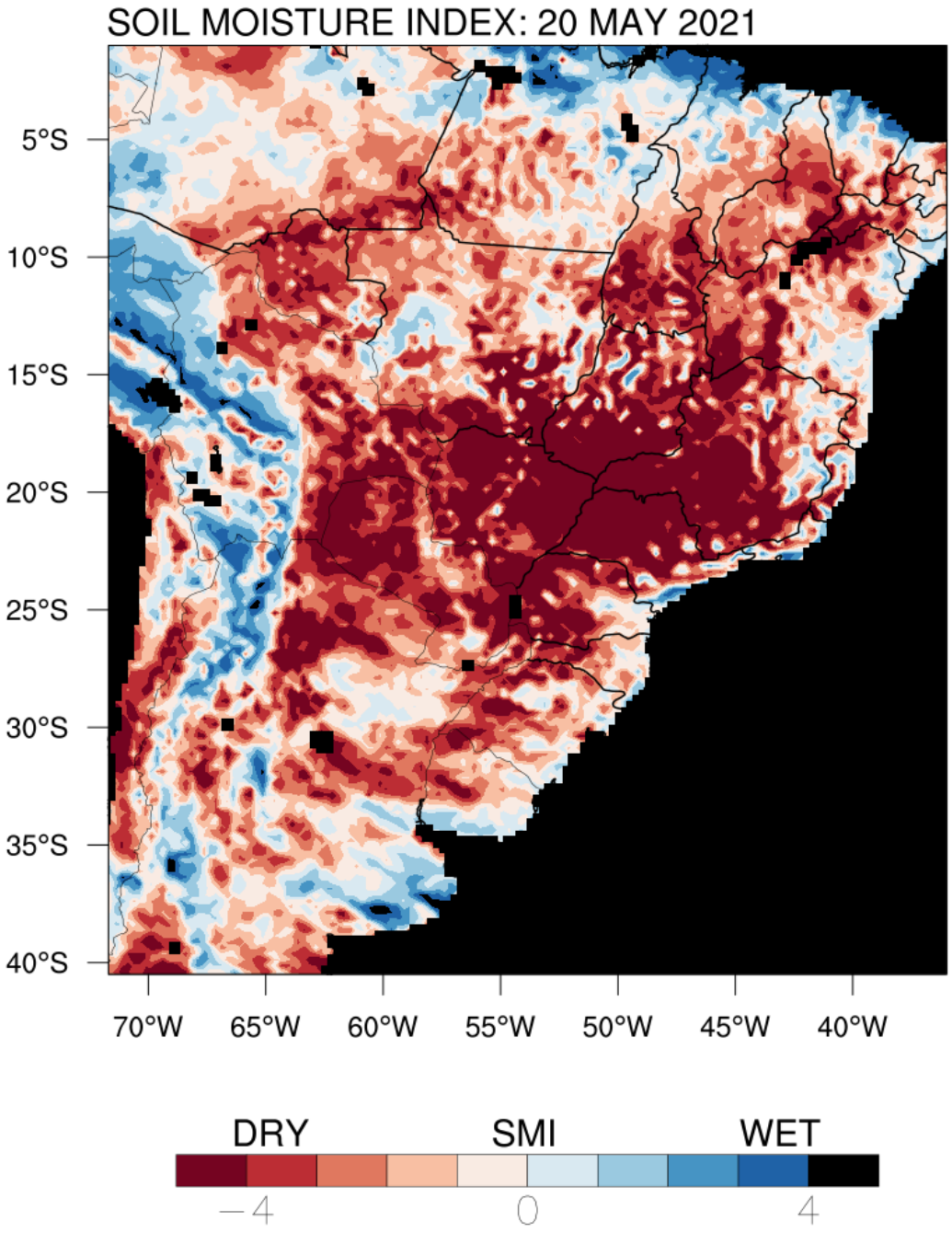

Figure 5. Soil moisture index (SMI) map) for the 7-day period ending 20 May 2021 over South America. Refer to the caption in Figure 1 for more details.

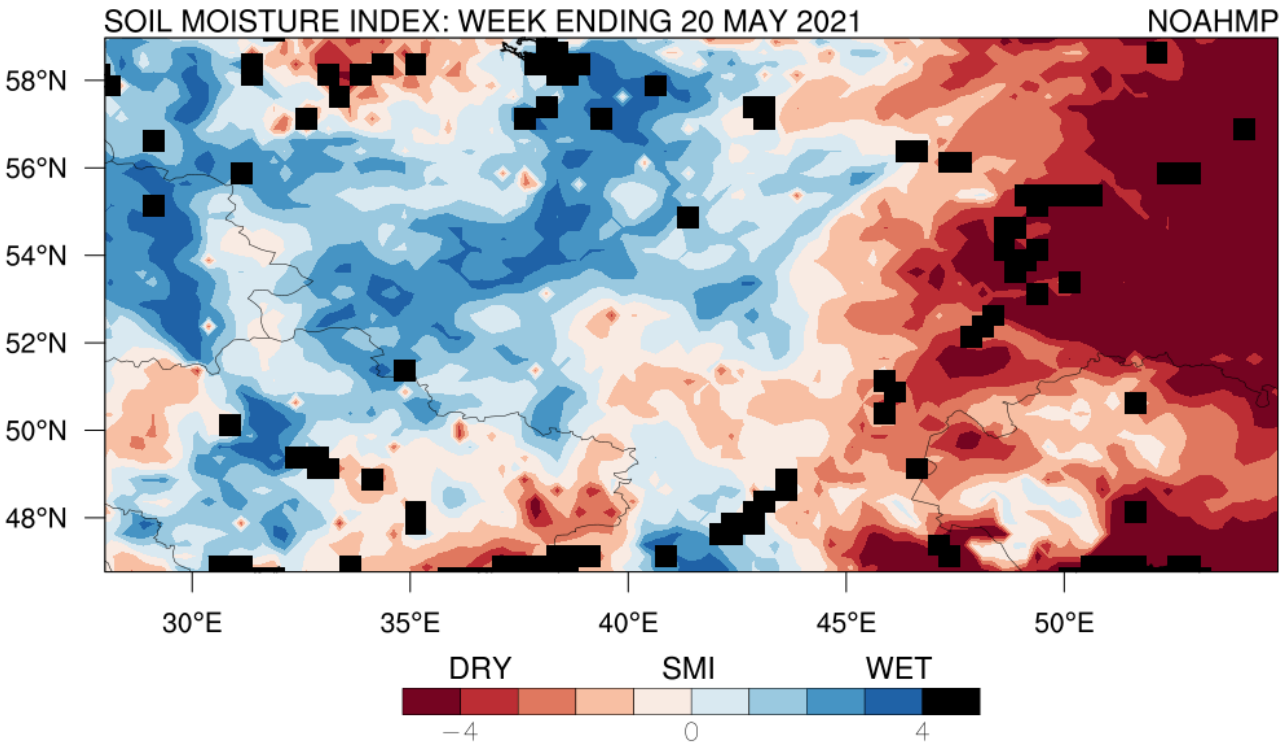

Figure 6. Soil moisture index (SMI) map) for the 7-day period ending 20 May 2021 over western Russia, Ukraine, and northwestern Kazakhstan. Refer to the caption in Figure 1 for more details. Black squares are missing data points.

About the author:

Eric Hunt is an agricultural climatologist from Lincoln, NE and has several members of his extended family actively farming in Illinois and Nebraska. Eric has been with AER since 2012 and received his Ph.D. from the University of Nebraska. Among other activities, he is currently working on NASA funded projects to study the evolution of flash drought. He routinely blogs about agriculture and weather on the AER website. He can be reached via email at ehunt@aer.com and @DroughtLIS on Twitter.

About AER:

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