J3.9 USING SATELLITES TO MONITOR SURFACE WETNESS

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1. INTRODUCTION

A land surface wetness product was derived from the Special Sensor Microwave Imager (SSMI). The Defense Meteorological Satellite Program flies this sensor on polar orbiting satellites with global coverage. The frequencies observed by the Special Sensor Microwave Imager are sensitive to liquid water near the earth's surface. The index quantifies the magnitude of the near surface wetness from precipitation, snow-melt, and irrigation. The signature of liquid water can originate from water: intercepted by the canopy, stored in the leaves, pooled on the surface, melting snow, and/or in the upper few centimeters of the soil (Basist et al. 1998). The product represents an integration of all of these sources of liquid water, and is based on variation from a mean value with no smoothing performed.

2. POTENTIAL APPLICATIONS

We have been working in conjunction with the U. S. Department of Agriculture to identity the potential utility of the wetness product for real time monitoring of crop conditions around the world. We are also collaborating with the World Bank, the United Nations and various other national and international organizations to utilize the product for near-real-time assessment of surface conditions that impact transportation, economics and human health. We demonstrate the benefit of satellite observations over modeled or interpolated values and provide examples showing how satellite derived observations provide a more realistic spatial structure of surface wetness conditions in areas where *in situ* observations are limited. Moreover, due to the scarcity of observations in many rural and poor areas of counties with limited infrastructure, extreme events are frequently undetected. Satellite observations of the spatial distribution of water near the surface in near real time can support timely distribution of resources to mitigate the spread of water borne diseases, identify if conditions are conducive to drought or flood, as well as address the accessibility of a region due to washed-out roads. In addition, we demonstrate that the surface wetness product has a strong correspondence with the upper level soil moisture at many locations. Analysis of the wetness values over an extended period can usually indicate an association with deeper soil moisture (Basist et al. 2001). For example, if it was excessively wet two weeks ago one might infer that deep soil moisture is probably abundant, although it appears that the surface has dried out (we will provide an example). Since this product is unique, we demonstrate how the observations can be used to enhance monitoring activity, validate global circulation model output, and/or be assimilated into analyses involving energy or water budget balances.

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3. TECHNIQUE

The relationship between brightness temperatures at different frequencies is used to dynamically derive the amount of liquid water in each SSM/I observation; i.e. there are no static *a priori* assumptions in the computation of the wetness values. Estimates are derived at $1/3^0$ latitude and longitude resolution, and have been has been calibrated and validated using independent high resolution *in situ* observations. A 15 year climatology (1988 to 2002) serves as the base period for monthly and weekly anomalies. The wetness product assumes the data have a gamma distribution and uses a pixel specific standardized cumulative probability (in %) to represent the anomalies. The standardization procedure accounts for variation in surface features around a region (i.e. forest, lakes, farm land, mountains), time of year (i.e. wet versus dry season), and soil type (i.e. clay versus sandy soil).

4. DATA AVAILABILITY

The wetness products are provided on the National Climatic Data Center web site in near-real-time at www.ncdc.noaa.gov/ssmi.html. The product is available on a weekly and monthly basis for 12 different regions of the world. In addition, global data sets are also provided in a format that can be directly ported into GIS (ARC INFO®) software. Moreover, we assist users in the interpretation of this wetness climate product.

5. REFERENCES

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