Introduction

The U.S. Department of Agriculture (USDA) is an export market for U.S. agricultural products and support global economic development. The USDA World Agricultural Outlook Board (WAOB) supports this goal by coordinating with national Agricultural Outlook Board (AOB) for the U.S. and major Agricultural producing countries. Because weather has a significant impact on crop progress, conditions, and production, WAOB monitors global weather through a 3B42 dataset from NASA's SeaWIFS on a daily basis for monitoring drought conditions and impacts.

Data – Surface, Satellite, Model

Station-based precipitation: Regional time series are derived by averaging daily cumulative precipitation from multiple rainfall observation stations distributed evenly throughout each study area. (Panama, Brazil) – 8 stations from World Meteorological Organization (WMO) network, Brazil, U.S. – 5 stations from NOAAS/AWS Cooperative Observer Program (COOP) network. Sioux Co., Iowa – 6 stations from NOAA/AWS COOP network.

Crop yield: Brazil – annual (Panama soybean stats obtained from Instituto Brasileiro de Geoografía e Estatística, U.S. – annual county and state-level corn stats for Iowa obtained from USDA National Agricultural Statistics Service (NASS).

TIRMM Multi-satellite Precipitation Analysis (TMPA, 3B42-VE): (Huftalin et al., 2007) 0.25-day; daily (averaged from 3-hourly); source data sets merged (TIRMM, AMSR-E, SSM/I, others); temporal coverage 1998-present.

AMSR-E surface soil moisture (AE_Land3) (Njoku et al., 2003): 0.25-day; daily (sec, dec.); EOS Aqua; temporal coverage 2002 to present.

Remote-sensed soil water (RWSW) from EPIC (Williams et al., 2006; 2008): Comprehensive crop growth and environmental assessment model developed by the USDA-ARS. Provides continuous daily simulation of the growth of many crops, soil moisture profile, hydrology, evapotranspiration, and management practices and their impacts on crop growth and environment sustainability.

Analog Year Analyses Results (cont.)

Giovanni Soil Moisture

Analog Year Analyses Results

Panana, soybeans

Sioux Co., Iowa, corn

Analog Year Comparisons for Crop Yield Forecasts

Study areas

2 major agricultural regions worldwide for validation of project results

Methods

Project benchmarking is based on retrospective analog analyses of WAOB’s analog year comparisons, between a given year and historical years with similar weather patterns. Below is an example from New South Wales, Australia.

In 2008, drought in New South Wales threatened a reduction in winter wheat yields estimated by WAOB meteorologists to be similar to that of 2002, based on analog analyses of cumulative time series. Indeed, following the harvest, wheat yields were found to be well below the trend. Although the weather was similar in both years, yields differed. This variability can be attributed to a number of factors, including subtle differences in the timing of the rainfall, variability of wheat planted, and amount of wheat grazed versus harvested.

Historically, WAOB meteorologists have identified analog years through visual inspection of these data. Although such techniques have been beneficial in identifying years with similar weather patterns, the qualitative nature of these analyses sometimes precludes the definitive identification of the best analog year, especially when multiple similar analog years exist. A goal of this study is to introduce a more rigorous approach to be used for identifying analog years. Several quantitative methodologies are currently being explored, including a combination of correlation coefficients, differencing techniques, and weighting functions.

Summary

• Satellite data are complementary to weather station data, in identifying analog years, although the performance of satellite precipitation products varies with location.

• Though preliminary, these results point towards the possibility of calibrating the analog analysis methodology in station-rich areas, to be then applied in station-poor areas of the world.

• Use of retrospective analog analysis as a metric for assessing the effect of integrating NASA data into WAOB seems feasible.

Project Status – What Else and What’s Coming

• Continued LPRM, GOES, and AMSR-E soil moisture data, satellite precipitation, and AMSR E surface temperature.

• Operational release – spring 2011.

• Initial parameters include LPRM soil moisture, AMSR-E soil moisture, satellite precipitation, and AMSR E surface temperature.

• Assist assimilating AMSR-E into EPIC

• Improved global soil moisture with high temporal resolution in Amazon/Amazon, Southeast Asia, for the first time of Environmental Policy Integrated Climate model.

• More rapid L2 product base release “early 2011” L3 gridded daily product to be released “late spring 2011”.

• Plan to release L3 product.

• Plan to release L2 product.