EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00346, 2007
7th EMS Annual Meeting / 8th ECAM

Estimating crop parameters from satellite data by the SAIL+PROSPECT coupled model

A. Nertan, **G. Stancalie**, A. Irimescu

National Romanian Meteorological Administration, Bucharest, Romania

(gheorghe.stancalie@meteo.inmh.ro / Fax : +40-21-3167762 / Phone: +40-21-3166098)

Collecting agrometeorological data is critical for running different crop weather-yield, irrigation and pest/disease models to assess the actual state of crops make decisions on crop treatment and forecast their yields. In this regard, the satellite systems present a wide range of new capabilities that can be used to assess and monitor the actual conditions of agro-ecosystems since information can be obtained on remote, wide-area, non-destructive and/or real-time bases. Information on the ecological and physiological condition of crops is essential for growth diagnostics and yield predictions, especially in the context of precision agriculture.

Over the last years, the climatic conditions across Romania have favoured the aflatoxine contamination of crops, especially during years of high-temperature coupled with water-stress. In this regard, a study on elaborating an integrated system for maize aflatoxine contamination risk during vegetation phase has been financed by the Romanian Ministry of Education and Research within the RISAFLAPOR project. This study aims to set up a methodology that will be useful in monitoring and evaluating the state of maize crops across Romania.

This paper presents the method to estimate maize crop parameters from multi-spectral optical satellite data, using a physical model of the vegetation reflected field in the visible and near infrared spectral domains. The vegetation reflectance model is the SAIL+PROSPECT coupled model, based on radiative transfer theory and on the concepts developed by the turbid models. This coupled model takes into account the connections between the biophysical parameters of a vegetation canopy, reflected radiation flux in different spectral channels and the geometrical and radiometrical factors that characterize interaction processes in the atmosphere-vegetation-soil system. The model input data were obtained from ground measurements, satellite images and simulated data (gathered in different natural conditions). The elaborated algorithm computes bidirectional reflectances as a function of the optical properties of vegetative elements (especially leaves), such as the factors defining the architecture of vegetation: density, orientation and spatial distribution of these elements. Using this procedure, estimates of the vegetation reflectance field in visible and near infrared channels, operated by some of the most used satellite sensors (SPOT, LANDSAT –TM, TERRA –MODIS, TERRA – ASTER, etc) have been obtained. Multispectral satellite imagery also proved accurate in identifying maturity variations of maize crops as well as regions of high aflatoxin risk.

Hyper-spectral reflectance measurements of growing maize leaves in the 350 – 2500 nm domain were used to predict the kernel maturation stage as well as the incidence of aflatoxin within silk and cob. It has been found that two NIR reflectance spectral bands centred at 700 nm and 1000 nm could correctly identify the asymptomatic kernels and 90% of kernels showing extensive discoloration and infected with aflatoxins. Histogram features from three transmittance images in blue, red and near infrared channels allow us to determine 90% of infected kernels with extensive discoloration from 97% of asymptomatic kernels.

The paper emphasizes the advantage of using the PROSPECT+SAIL model in monitoring maize aflatoxine contamination risk during vegetation phase.