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Combining Remote Sensing imagery of both fine and coarse spatial resolution to Estimate Crop Evapotranspiration and quantifying its Influence on Crop Growth Monitoring.

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This study has been carried out in the framework of the GLOBAM -Global Agricultural Monitoring system by integration of earth observation and modeling techniques- project whose objective is to fill the methodological gap between the state of the art of local crop monitoring and the operational requirements of the global monitoring system programs. To achieve this goal, the research aims to develop an integrated approach using remote sensing and crop growth modeling.

Evapotranspiration (ET) is a valuable parameter in the crop monitoring context since it provides information on the plant water stress status, which strongly influences crop development and, by extension, crop yield.

To assess crop evapotranspiration over the GLOBAM study areas (300x300 km sites in Northern Europe and Central Ethiopia), a Soil-Vegetation-Atmosphere Transfer (SVAT) model forced with remote sensing and numerical weather prediction data has been used. This model runs at pre-operational level in the framework of the EUMETSAT LSA-SAF (Land Surface Analysis Satellite Application Facility) using SEVIRI and ECMWF data, as well as the ECOCLIMAP database to characterize the vegetation. The model generates ET images at the Meteosat Second Generation (MSG) spatial resolution (3 km at subsatellite point),with a temporal resolution of 30 min and monitors the entire MSG disk which covers Europe, Africa and part of Sud America .

The SVAT model was run for 2007 using two approaches. The first approach is at the standard pre-operational mode. The second incorporates remote sensing information at various spatial resolutions going from LANDSAT (30m) to SEVIRI (3-5 km) passing by AWIFS (56m) and MODIS (250m). Fine spatial resolution data consists of crop type classification which enable to identify areas where pure crop specific MODIS time series can be compiled and used to derive Leaf Area Index estimations for the most important crops (wheat and maize). The use of this information allowed to characterize the type of vegetation and its state of development in a more accurate way than using the ECOCLIMAP database. Finally, the CASA method was applied using the evapotranspiration images with FAPAR (Fraction of Absorbed Photosynthetically Active Radiation) images from LSA-SAF to obtain Dry Matter Productivity (DMP) and crop yield.

The potential of using evapotranspiration obtained from remote sensing in crop growth modeling is studied and discussed. Results of comparing the evapotranspiration obtained with ground truth data are shown as well as the influence of using high resolution information to characterize the vegetation in the evapotranspiration estimation. The values of DMP and yield obtained with the CASA method are compared with those obtained using crop growth modeling and field data, showing the potential of using this simplified remote sensing method for crop monitoring and yield forecasting. This methodology could be applied in an operative way to the entire MSG disk, allowing the continuous crop growth monitoring.