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An automated system for detection and short-range forecast of convective clouds with the use of Meteosat multispectral imagery

Stavros Kolios
Hellenic Agricultural Organization – DEMETER, Greece (stavroskolios@yahoo.gr)

This study presents a fully automated system to detect and forecast convective clouds using Meteosat multispectral imagery. The domain of the system includes the greater areas of central and eastern Mediterranean and is focusing on the Greek periphery. There are two main parts of the system (the detection module and the forecasting module) and five channels of Meteosat imagery from the water vapor to thermal infrared spectral regions, are used.
For the detection of the convective cloud areas, a combination of temperature thresholds and parameters (e.g. brightness temperature and temperature differences, areal extent, cooling rates) are used to early detect any possible cloud pattern that can become convective in the next minutes (or hours).
After the detection of the potential cloud regions, the system provides analytic forecasts every 15 min, in pixel basis, for all cloud regions characterized as convective. Pixel-based and area-based techniques are combined to estimate convective the spatiotemporal evolution of the cloud pixels characterized as convective. During the development stage of this system, are also provided estimates about lightning activity, precipitation and hail. The forecasts, are using the combined information coming from conceptual models that depict the general evolution of parameters during a typical a lifetime of a convective cloud cell and non-linear, multiparametric equations in order to estimate the spatiotemporal evolution of the detected cloud pixels.
The first accuracy assessment results are considered satisfactory, allowing this system to be able to operate in real-time basis, providing realistic and accurate forecasts for the storm activity as well as for dangerous phenomena accompany convective clouds like lightnings, hail and heavy precipitation.
A basic part of the system is its graphical user interface which provides through images, graphs and statistics any relative information referring to the results of detection and forecasting procedures, giving to the potential end users all the appropriate information with a simple and easy way. All the results are stored in a database in order to be used further in accuracy assessment procedures and as a driver in the adaptation of strategies and legislations that concern the crop productivity, reimbursements, the sustainability of the environment and the improvement quality of lives through the efficient protection from convective phenomena and their impacts in the society.