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ABSTRACT

Being able to map the spatiotemporal distribution of frost is a very important task for agricultural management and decision making. Yet, it is a very difficult task to be performed, particularly so using field-based studies due to the high spatio-temporal variability of the parameters involved in its estimation. Earth Observation (EO) technology provides today perhaps the only viable solution towards obtaining accurately, timely and in a cost-effective way information on the spatiotemporal distribution of frost conditions, particularly over large and otherwise inaccessible areas.

The present study aimed at developing a model frost risk prediction model for agricultural crops exploiting primarily EO data from MODIS sensor and ancillary data. Evaluation of our model has been performed for a region in central Greece for selected days on which frost conditions were observed independently by the Agricultural Insurance Organization (ELGA). The agreement between the model predictions and the reference frost data was evaluated thoroughly including in our analysis different aspects related to the variability of site characteristics such as land cover and topography.

Overall, results evidenced the ability of the model to produce reasonably well the frost conditions, at least this appeared to be the case in our study site, indicating the potential value of the model developed in mapping and monitoring frost conditions. Implementation of our proposed frost risk model is based primarily on satellite imagery analysis provided nowadays globally at no cost. It is also easy and computationally inexpensive to be applied for small scale studies, requiring much less effort in comparison for example to field surveying. From an algorithmic perspective, a further advantage is the methods' dependence to a small number of input parameters that is also resulting potentially in highly robust and accurate results, even in highly fragmented and dynamically changing landscape environments such as the ones of our test site. Finally, the method is also adjustable to be potentially integrated with other high resolution data available from both commercial and non-commercial vendors.

Keywords: Frost mapping, GIS, remote sensing, MODIS, Greece