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Development of a Frost Risk Assessment Tool in Agriculture for a Mediterranean ecosystem Utilizing MODIS satellite observations Geomatics and Surface Data

Panagiota Louka (1), Ioannis Papanikolaou (1), George Petropoulos (2), George Migiros (1), and Ioannis Tsiros (1)

(1) Dep. of Earth and Atmospheric Sciences, Agricultural University of Athens, Greece, (2) Dep. of Geography & Earth Sciences, University of Aberystwyth, Wales, United Kingdom

Frost risk in Mediterranean countries is a critical factor in agricultural planning and management. Nowadays, the rapid technological developments in Earth Observation (EO) technology have improved dramatically our ability to map the spatiotemporal distribution of frost conditions over a given area and evaluate its impacts on the environment and society.
In this study, a frost risk model for agricultural crops cultivated in a Mediterranean environment has been developed, based primarily on Earth Observation (EO) data from MODIS sensor and ancillary spatial and point data. The ability of the model to predict frost conditions has been validated for selected days on which frost conditions had been observed for a region in Northwestern Greece according to ground observations obtained by the Agricultural Insurance Organization (ELGA). An extensive evaluation of the frost risk model predictions has been performed herein to evaluate objectively its ability to predict the spatio-temporal distribution of frost risk in the studied region, including comparisons against physiographical factors of the study area. The topographical characteristics that were taken under consideration were latitude, altitude, slope steepness, topographic convergence and the extend of the areas influenced by water bodies (such as lake and sea) existing in the study area. Additional data were also used concerning land use data and vegetation classification (type and density).
Our results showed that the model was able to produce reasonably the spatio-temporal distribution of the frost conditions in our study area, following largely explainable patterns in respect to the study site and local weather conditions characteristics. All in all, the methodology implemented herein proved capable in obtaining rapidly and cost-effectively cartography of the frost risk in a Mediterranean environment, making it potentially a very useful tool for agricultural management and planning. The model presented here has also a potential to enhance conventional field-based surveying for monitoring frost changes over long timescales.
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