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Operational Estimation of Daily Dead Fuel Moisture Content (DFMC): The case of Greece

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Over the past years, the Mediterranean areas have been experiencing more frequent and more severe wildfires. In this context, the estimation of dead fine fuel moisture content (DFMC) has become an integral part of wildfire management since it provides valuable information for the flammability status of the vegetation. The aim of this study is to evaluate effectiveness of Nolan et al.'s (2016) recently developed DFMC model in the light of operational use, for a Euro Mediterranean region (Greece). To do so, we tested and compared two existing approaches for estimating daily DFMC. In the first approach (MODIS DFMC model), we calculated daily DFMC from MODIS remote sensing data, using the DFMC calibrated model of Nolan et.al (2016) at regional and national level. In the second approach (AWSs DFMC model), we produced daily DFMC maps at country level from meteorological data using Nolan's model as well. Then, we validated the satellite-based DFMC thematic maps (MODIS DFMC maps) that were produced at sub-regional level using meteorological data obtained from the dense network of NOANN surface weather stations operated by the National Observatory of Athens (NOA). Due to a lack of DFMC field measurements, the validation of the weather-station based DFMC maps was not feasible (AWSs DFMC maps). Finally, we compared the two approaches in order to identify which is the most appropriate for operational fire management in Greece.

Results show that, in general, the satellite-based model achieved satisfactory accuracy in estimating the spatial distribution of the DFMC during the examined fire events. More specifically, the validation of the satellite-derived DFMC against the weather-station based DFMC indicated that, in all cases examined, the MODIS DFMC model tended to underestimate DFMC, with MBE ranging from -0.3% to -7.3%. Moreover, in almost all the cases examined, the MAE of the MODIS DFMC model was less than 2.2%. The good performance of the satellite based DFMC model indicates that the estimation of DFMC is feasible at various spatial scales in Greece. A closer examination of the analysis results revealed poor estimation of the satellite-derived vapor pressure deficit (D), and subsequently of DFMC, in arid and semi-arid regions. D's poor estimation can be explained by the fact that the LST, retrieved by MODIS data, depends on the accuracy of the surface emissivity.

Examination and visual interpretation of the derived maps from both approaches suggest that the

AWSs DFMC maps show higher spatial continuity in comparison to that derived from the MODIS-based approach. This is attributed to the gap problem in the satellite images.

Finally, the examination and comparison of the two approaches regarding their use on operational basis shows that the two models present some implementation challenges. Nevertheless, the AWSs DFMC model meets the requirements for operational DFMC mapping to a higher degree compared to the MODIS DFMC model, in Greece. **This work was conducted in the frame of CLIMPACT – National Network on Climate Change and its Impacts, a flagship initiative on climate change to coordinate a Pan-Hellenic network of institutions.**