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USE OF A LUE MODEL TO ESTIMATE GPP OF AN ALPINE FOREST ECOSYSTEM AND TO IDENTIFY ITS MAIN ENVIRONMENTAL DRIVERS

Forest models have been increasingly used in the last decades to study carbon fluxes and productivity of very different forest ecosystems all over the world. These models are often quite complicated from a mathematical point of view, require many input data that are often difficult and expensive to collect, and give many outputs, most of them not of interest when a model is needed for practical reasons and not for research. Therefore, they are rarely applied by foresters and technicians outside academia. The need of very simple and "easy to use" models have become clear over the last two decades, and some have been developed for this purpose, keeping in mind that successful management requires an understanding of the most important drivers of forest productivity. Here we apply a very simple Light Use Efficiency (LUE) model to the eddy-covariance site of Lavarone (TN, Italy) over several years, to estimate Gross Primary Production (GPP) and to assess model potential in identifying its main drivers. Four environmental variables have been considered as drivers of daily GPP: air temperature, vapour pressure deficit (VPD), absorbed PAR and soil water content (SWC). SWC has been found not to be relevant as a driver of daily GPP in previous studies by the same model, but there is evidence in the data suggesting that SWC is a powerful driver in Lavarone: therefore, two separate simulations have been carried out, one considering and one without considering the effects of SWC. Model estimates of daily GPP over the entire period of simulation are accurate in both cases, but the assessment of the relative importance of individual drivers is cause of some concern. While GPP estimates show only minor differences between the two simulations, the analysis of the modifiers for each driver shows that the SWC is always treated as a non-limiting factor, which causes the model to fail to reproduce high values of daily GPP in periods when the SWC is particularly high. The introduction of the SWC modifier, however, led the model to change its assessment of the role of other environmental variables. In conclusion, this semi-empirical model appears to be suitable for estimating daily and annual forest GPP, but its results must be treated with due caution, as the response to environmental factors is not properly and unequivocally described. In this respect, a more detailed process-based description of the response to environmental variables could be preferable, even if less user-friendly.

Parole Chiave: Gross Primary Production, Semi-empirical Model, Environmental Drivers, Lavarone

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