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Spatial climatology of surface solar radiation in Slovenia based on satellite and in-situ measurements

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Information on solar radiation is important for a variety of economic and technological areas. The availability of observed in-situ solar radiation measurements proved to be spatially inadequate for numerous of potential applications. Our aim was to improve the availability of spatially dense information of surface solar radiation for Slovenia with a combination of satellite and in-situ measurements. While in-situ measurements provide solar radiation data with very high accuracy for specific points, they are not dense enough to cover very high spatial variability of solar radiation in complex terrain such as Slovenia. On the other hand, satellite measurements provide the information about spatial distribution of solar radiation, with limited spatial resolution and accuracy.

To improve spatial representation of surface solar radiation the two types of measurements were combined using different spatial interpolation approaches. Time series of 29 station measurements with length from 6 to 22 years were used in the analysis. The down-welling short-wave irradiance at the Earth's surface is provided by different EUMETSAT Satellite Application Facilities (SAFs). For our study, CM SAF SARAH climate data record of surface incoming shortwave radiation (SIS) was chosen due to its characteristics such as temporal homogenity and high spatial resolution (0.05° x 0.05°). The merging exercise was performed on different time scales (from monthly to long term means) taking into account different number of ground station data, which was highly variable through the treated period (1994-2015), which was chosen according to CM SAF SARAH dataset availability and in-situ measurements availability. The performance of different interpolation methodologies and the influence of in-situ data density on the interpolation results was assessed by leave-one-out cross-validation.