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Thermal remote sensing data enhancement over Alpine Vegetated Areas for evapotranspiration modelling

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The main objective of this study is to exploit thermal remote sensing data for evapotranspiration (ET) modelling in the European Alps. This geographic region has been noted as a hot spot of climate change triggered by increasing number of drought events in recent years, with impacts on natural and agricultural vegetation. Evapotranspiration is considered as one of the major indicators for examining water anomalies in plants. The state-of-art ET models exploiting thermal remote sensing data have shown a large potential in water cycle monitoring. However, existing satellite-derived products do not provide adequate spatial resolution for mountain ecosystems affected by complex orography, common overcast and land-cover heterogeneity. Even though fine resolution imagery fills the gap regarding non-homogenous areas, its long revisit time and frequent cloud contamination hamper spatially continuous ET modelling. In this context, our aim is to overcome these limitations by downscaling and gap-filling 1-km MODIS LST (MOD11A1) to retrieve daily LST maps at 250 m spatial resolution, which can be considered a reasonable scale in the selected area. Firstly, we downscale MODIS LST images with the Random Forest (RF) algorithm by exploiting the relationship between coarse resolution MODIS LST and 250-m explanatory variables, including digital elevation model and normalized difference vegetation index. The 1-km MODIS LST and the downscaled product were compared with fine resolution Landsat LST images. The random forest results show an improvement of about 20% in the agreement between Landsat and 250-m MODIS LST compared to statistics obtained for MOD11A1. Secondly, we propose to recover missing values of LST pixels beneath the clouds. Considering local-scale climate variability of the study area, we present a novel approach based on investigating the relationships between LST and meteorological data under clear- and cloudy-sky conditions. The abovementioned improvements are planned to be used for energy balance modelling of ET with relevant implications on water availability assessment in the Alpine region.