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Temperature patterns of land use types in the Elbe River basin – Application of remote sensing data for refined hydrological modelling on the regional scale

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Many processes of importance for hydrology and thus for process-based modelling are extensively governed by surface temperature. Evapotranspiration has to be named first in this context, but also plant growth or microbial activity which play a decisive role in many eco-hydrological models (e.g. SWAT or SWIM) are strongly coupled to temperatures at the ground. This study reveals a strong interrelationship of land use and surface temperatures, which is scarcely found in commonly used air temperature observations. Therefore it recommends correcting temperature input data accordingly for modelling surface processes.

The area of investigation is the Elbe River basin, covering about 150 000 km^2 in central Europe. Temperature maps derived from NOAA-AVHRR measurements have been combined with the European land use data base CORINE. Also regarded was the influence of elevation ranging from sea level to 1602 m above; here, data from the Shuttle Radar Topography Mission (SRTM) were used. The most frequent land use classes within the area are non-irrigated agriculture (44.2 %), forests (28.9 %, thereof $^3/_4$ evergreen), meadow and pasture (9.1 %), and settlements (5.4 %). While agriculture surfaces are about 1 K warmer than the mean at daytime and 1 K colder at nighttime, the forests turned out to be significantly warmer at night (also about 1 K), and to have strong cooling effects at daytime during the warm season (typically about 3 K).

Other micro-climatological effects like heating of settlements or temperature hysteresis of water bodies (affecting their neighbourhood) could be quantified for modelling purposes. The relevance for the water balance will be shown by the model SWIM, which is currently used for the Elbe basin within the German GLOWA-Elbe project.