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Assessment of model land skin temperature and surface-atmosphere coupling using remotely sensed estimates

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The coupling between land surface and the atmosphere is a key feature in Earth System Modelling for exploiting the predictability of slowly evolving geophysical variables (e.g., soil moisture or vegetation state), and for correctly representing rapid variations within the diurnal cycle, particularly relevant in data assimilation applications. Land Surface Temperature (LST) routinely estimated from Meteosat Second Generation (MSG) by the LandSAF is used to assess the European Centre for Medium-range Weather Forecasts (ECMWF) skin temperature. LST can be interpreted as a radiative temperature of the model surface, which is close to the ECMWF modelled skin temperature. It is shown that the model tends to slightly overestimate skin temperature during night-time and underestimate daytime values. Such underestimation of daily amplitudes is particularly pronounced in (semi-)arid regions, suggesting a misrepresentation of surface energy fluxes in those areas.
The LST estimated from MSG is used to evaluate the impact of changes in some of the ECMWF model surface parameters. The introduction of more realistic model vegetation is shown to have a positive, but limited impact on skin temperature: long integration leads to an equilibrium state where changes in the latent heat flux and soil moisture availability compensate each other. Revised surface roughness lengths for heat and momentum, however, lead to overall positive impact on daytime skin temperature, mostly due to a reduction of sensible heat flux. This is particularly relevant in non-vegetated areas, unaffected by model vegetation. The reduction of skin conductivity, a parameter which controls the heat transfer to ground by diffusion, is shown to further improve the model skin temperature. A revision of the vertical soil discretization is also expected to improve the match to the LST, particularly over sparsely vegetated areas. The impact of a finer discretization (10-layer soil) is currently ongoing; preliminary results suggest a warmer Tskin over dryland.