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Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

Evaluating a tiled land surface model with multi-site energy flux observations

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The resolution of numerical weather prediction (NWP) models is usually not sufficient to resolve the fine scale land surface heterogeneity e.g. due to small lakes and urban areas. The ECMWF (European Centre for Medium-Range Weather Forecasts) model represents heterogeneity by coupling a number of tiles (surfaces with different characteristics) with the same atmospheric column. However, very little evaluation has been performed so far with this type of coupling.

The surface—atmosphere coupling through energy fluxes was measured for three distinct surface types in 2006. The study sites cover a lake (Valkea-Kotinen), a forest (Hyytiälä) and an urban site (Helsinki) which all are situated in the boreal region in Finland. The turbulent fluxes of sensible and latent heat were measured with the eddy-covariance technique, and also data on net radiation and heat storage change are available.

The Tiled ECMWF Scheme for Surface Exchanges over Land (HTESSEL) was run offline using near-surface meteorology and radiation forcing from the ERA-Interim reanalysis (1989—2005). The lake model FLake was incorporated into the system to provide estimates for the lake site. The model validation includes the comparison of the surface energy balance components, near-surface meteorology, lake surface temperature and forest floor moisture profile. An urban scheme is not part of HTESSEL yet, but the measurements from Helsinki clearly show a large contrast in the surface energy balance with the forest and lake sites. The importance of night-time evaporation from lakes, the role of transpiration in forests and the effect of impervious surfaces at an urban site are emphasized. Furthermore, the thermal inertia exerted by lake water and large differences in surface roughness are shown to have crucial roles in determining the surface energy balance. Consequently, our results stress the need for tiling in numerical weather prediction models.