



## **Scale-consistent two-way coupling of land-surface and atmospheric models**

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Processes at the land surface and in the atmosphere act on different spatial scales. While in the atmosphere small-scale heterogeneity is smoothed out quickly by turbulent mixing, this is not the case at the land surface where small-scale variability of orography, land cover, soil texture, soil moisture etc. varies only slowly in time. For the modelling of the fluxes between the land-surface and the atmosphere it is consequently more scale consistent to model the surface processes at a higher spatial resolution than the atmospheric processes. The mosaic approach is one way to deal with this problem. Using this technique the Soil Vegetation Atmosphere Transfer (SVAT) scheme is solved on a higher resolution than the atmosphere, which is possible since a SVAT module generally demands considerably less computation time than the atmospheric part. The upscaling of the turbulent fluxes of sensible and latent heat at the interface to the atmosphere is realized by averaging, due to the nonlinearities involved this is a more sensible approach than averaging the soil properties and computing the fluxes in a second step.

The atmospheric quantities are usually assumed to be homogeneous for all soil-subpixels pertaining to one coarse atmospheric grid box. In this work, the aim is to develop a downscaling approach in which the atmospheric quantities at the lowest model layer are disaggregated before they enter the SVAT module at the higher mosaic resolution. The overall aim is a better simulation of the heat fluxes which play an important role for the energy and moisture budgets at the surface.

The disaggregation rules for the atmospheric variables will depend on high-resolution surface properties and the current atmospheric conditions. To reduce biases due to nonlinearities we will add small-scale variability according to such rules as well as noise for the variability we can not explain. The model used in this work is the COSMO-model, the weather forecast model (and regional climate model) of the German and other European Weather Services. Training and validation of the scheme is based on high-resolution model runs (400 m grid spacing) with the fully coupled model, this fine-scale information is compared with averaged coarser scale information (2.8 km). The final model will run with a horizontal resolution of 2.8 km for the atmosphere, coupled to a 400 m SVAT module.

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