The Veg3d Soil Vegetation Model

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The Veg3d soil vegetation model has been continuously developed at the Institute of Meteorology and Climate research since 1989 (Schädler, 1990), mainly to provide realistic lower boundary conditions for mesoscale atmospheric models. It consists of one vegetation layer ("big leaf" approach) and several (usually about 8 to 10) soil layers (mainly in the unsaturated zone) of adjustable thickness; if snow exists, it is distributed over two extra layers on top of the soil layers. Here, the term "vegetation" includes also urban land use. The soil, snow and vegetation layers have their own energy and water balances each, from which soil, snow and canopy temperature and moisture, as well as heat and moisture fluxes (with stability dependent transfer coefficients), are calculated. There exists a single column offline version, a multiple column offline version, and a multiple column version which can be coupled to an atmospheric model via the OASIS coupler. More information can be found in the references.

Features of the vegetation layer:

- "big leaf" approach
- interception and dew formation
- transpiration with root uptake via root density distribution
- freely definable land use classes with seasonal variation of plant related parameters

Features of the soil layers:

- heat transport equation for soil temperature (including anthropogenic heat), Richards equation for soil moisture. All parameters soil moisture dependent
- liquid and solid soil water, freezing
- ponding, slope and roughness dependent runoff (surface and subsurface)
- two-layer snow store
- accounting for soil horizons and macropores
- choice of different parameterisations (Cosby, van Genuchten, …)
- user definable soil types, additionally glaciers, rock, and water
- choice of lower boundary conditions for temperature and moisture (constant, no flux, no flux gradient, …)

New features:

- adapted for parallel architectures
- interface to OASIS coupler

Validation:

VEG3D has been validated in several field experiments like LOTREX, AMMA (Kohler et al., 2012) and the SnowMIP Project (Rutter et al., 2009).

References:

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