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The physically-based scalable catchment and river runoff model application to the Latvian rivers

U. Bethers (1), J. Gaidelene (1), J. Sennikovs (1), **A. Timuhins** (1)

(1) University of Latvia, Laboratory for Mathematical Modelling of Environmental and Technological Processes (tim@modlab.lv)

The physically-based spatially and temporally distributed dynamic model of the catchment modeling and river runoff, and ground water level simulation is described. The surface water model, the groundwater model, the flow routing model, the lake model are the principal components of the model. The catchment is divided into hierarchical subbasins downscalable to the finite element level. The hydrological cycle is resolved for the lowest hierarchical level; the hydrological cycle modeling is coupled with the dynamic routing of the water flow through the network of streams. The surface water content depends on the precipitation, snowmelt, evaporation, infiltration, groundwater saturation and overland flow. Ground water model is used for calculation of the piezometric head in the upper layer. The ground water model is based on the balance of Darcy flow, infiltration from surface, overflow to surface water and directly to rivers, flow to/from lakes and storativity. Flow routing model solves for the river level and discharge. Staggered finite difference scheme (level at points, discharge at segments) is used for the solution of St Venant equations. Water inflow sources are surface runoff, groundwater overflow. Lake runoff and water level is described by the lake model. The model is applied for the Latvian river runoff calculation. Model setup includes several components: digital terrain model, river network, land use data [National CORINE Land Cover 2000 in Latvia], daily meteorological data. Daily observations of the river discharge and water level at multiple stations are used for the model calibration and for model verification. Long-time forecast is presented for the Latvian river runoff. The results of regional climate prediction models [PRUDENCE] are chosen and used as forcing data for these forecast.