



# HYDROLOGIE



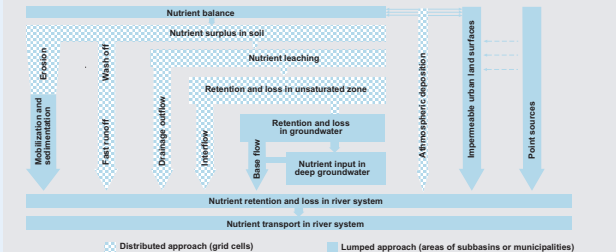
## ALBERT-LUDWIGS-UNIVERSITÄT FREIBURG i.Br.

### Assessment of nutrient budgets at regional scales based on spatially distributed water and nutrient balances

#### Objectives

The nutrient balance model MONERIS (Modelling Nutrient Emissions in River Basins) is widely used as a tool to quantify nutrient emissions in river basins according to the European Water Framework Directive. To quantify and assess the amount of nutrient emissions and their effect on water quality in relation to land use practices and hydrological properties a spatially differentiated description of the diffuse nutrient mobilization is required. For this reason parts of the model concept of MONERIS were transferred into a distributed approach. The distributed approach was applied to the river basins of Baden-Württemberg in South-West-Germany (36000 km<sup>2</sup>).

#### Model concept

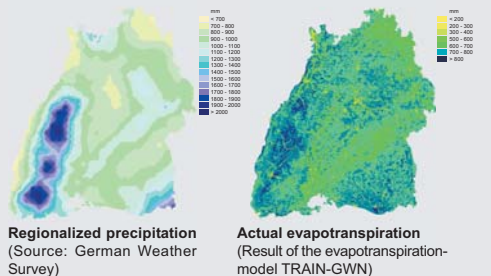


#### Input Data

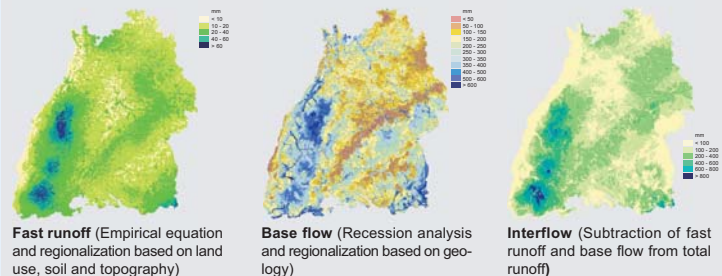
Hydrometeorology  
Stream flow  
Topography  
Land use  
Soil properties  
Geology  
Agricultural and municipal statistics

Spatial resolution of calculation  
50 m x 50 m

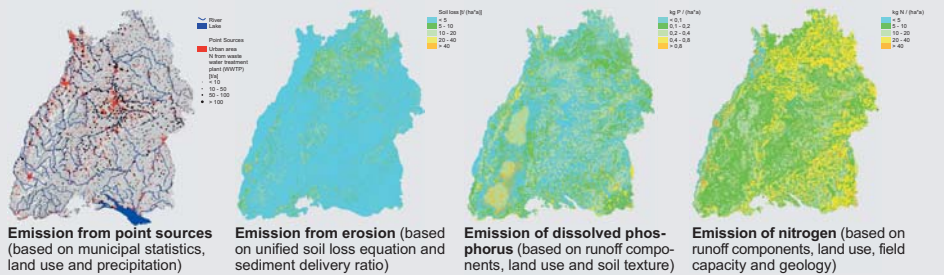
#### Water balance



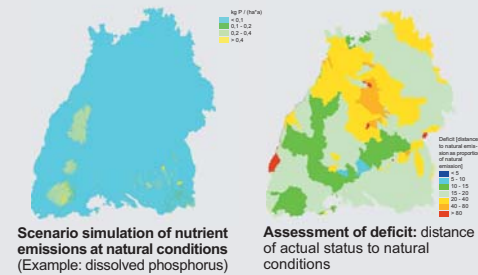
#### Separation of runoff components



#### Calculation of nutrient emissions

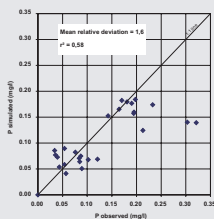
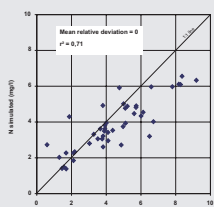


#### Assessment



#### Results

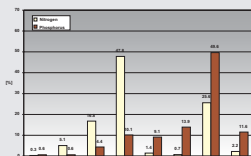
Simulation of mean concentration levels for the period 1993 to 1996



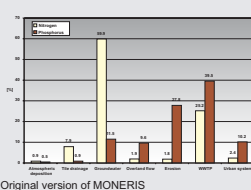
#### Sensitivity analysis

Description	Number of calibrated parameters	Sensitivity
Nitrogen retention	2	high (N)
Sediment delivery ratio	4	high (P)
Enrichment in sediment	2	high (P)
Sewage overflow rate	1	medium (P)

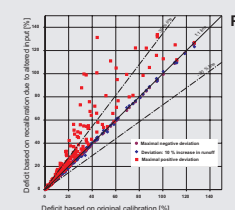
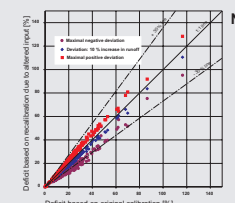
#### Emission via different pathways



#### Distributed model



Estimate of uncertainty for the calculated deficits due to calibration and potential errors in water balance and nutrient input



#### Discussion and conclusion

- The distributed model shows good results for the concentration levels in surface water. After the integration of the water balance and the new calibration the division of the total emission into different pathways has slightly changed compared to the original model version.
- To account for data restrictions in macro-scale applications the model is based on simple conceptual approaches resulting in a limitation of accuracy. Due to the distributed approach the spatial accuracy of the results is increased.
- Regarding the assessment of nutrient emissions into surface waters compared to natural conditions the estimated uncertainty ranges from +10 to +50 %.
- The uncertainties in the deficit calculation for phosphorus emissions show an irregular distribution as a consequence of restrictions in calibration.