Motivation and Aims

Climate variables like precipitation, temperature or humidity are usually measured at individual points. For ecohydrological modelling these variables are needed on subbasin basis, which requires spatial interpolation. For this task several well-established and more or less sophisticated interpolation methods are available. Depending on certain conditions like climate network density or subbasin heterogeneity, the quality of the interpolated data varies and thus yields different modelling results when used as input. The purpose of this study was to examine the influence of four different interpolation methods (nearest neighbor, inverse distance, ordinary kriging, external drift kriging) on the modelling results of discharge and nitrate load in the river in a mesoscale river catchment.

Methods and Data

- The study was carried out for the upper part (~1,000 km²) of the Leine river catchment, which is a subcatchment of the river Aller with a total area of about 15,000 km² (Fig. 1).
- Climate data was available for the whole Aller catchment (Tab. 1). All measurements are daily values.
- All point data were interpolated using the four interpolation methods nearest neighbor (NN), inverse distance (ID), ordinary kriging (OK), and external drift kriging (EDK) (Gooverts 1997).
- All climate variables were interpolated for the modelling time period (Nov. 1990 – Dec. 1995) using the NN and ID methods and the climate stations relevant for the study area.
- For OK and EDK, variograms were calculated for each variable using all available stations and a longer time period. Then Interpolation was carried out employing the variograms. As secondary information for EKD the terrain elevation was used.
- For each interpolation method and each climate variable the interpolation yielded 10 time series corresponding to the 10 subbasins of the study area.
- Sunshine duration was converted to radiation after interpolation.
- Simulations were carried out with the Soil and Water Assessment Tool SWAT (Neitsch et al. 2005).
- The model was not calibrated other than to produce discharge and nitrate load of reasonable levels. For all runs the same model parameter set was used.

Results and Outlook

- Cross validation clearly showed the different performance of the interpolation methods (Fig. 2).
- Deviation in nitrate dynamics between interpolation methods and between subbasins originates from the crop growth module within SWAT, which is very sensitive to climate input.
- Relative deviation in nitrate load over the whole modelling period at the catchment outlet is significant (16% between ID and EDK), and can be much higher in individual months and smaller subbasins.
- Deviation in modelling results is much higher than deviation in climate input resulting from the different interpolation methods (e.g. Tmax <4%, Pcp <2%, average over whole catchment).
- Model performance still has to be compared when calibrating the model with observed data for each set of climate data.
- Dependence of interpolation quality on network density has not been investigated and might further influence the performance of each interpolation method.

Literature
