

Abstract

Seasonal hydrological forecasts represent a very current topic, especially in the context of extreme hydrological events that have taken place at the end of the 20th and beginning of the 21st century. These events are represented by large scale floods and long lasting periods of drought. This has led to a need for the effective water management strategies. These management strategies have to be able to efficiently distribute water resources both in the space and time. Seasonal hydrological forecasting systems constitute an essential part of water management strategies, as they enable the runoff estimation in a sufficient advance.

This thesis deals with the seasonal hydrological forecasting system with a one month lead. The aim of this study is to apply three forecasting methods using an experimental watershed in the Czech Republic. The first method is represented by the reference climatology approach, the latter by the well-tested Ensemble Streamflow Prediction system (ESP), and the last by its newly proposed modification. This modification (modified ESP – mESP) is based on the restriction of input data established on their relations to the large scale climatological variables and patterns.

The first part of the thesis is focused on the investigation of possible relations among hydrometeorological series from two watersheds in the Czech Republic and large scale climatic predictors. The Blanice River in southern Bohemia and the upper Cidlina River in the eastern part of Bohemia serve as experimental areas. The large scale climatic predictors are represented by the sea level pressure, the sea surface temperature, two geopotential heights, and major teleconnection patterns. The analysis has shown that the hydrometeorological series might be more accurately estimated in the case of the Cidlina River basin. Concerning the Blanice River watershed, the influence of above mentioned predictors is less obvious, most probably due to the effect of the close Šumava mountain range. These predictors characterize the pressure field in the north Atlantic and southern Scandinavia region, which controls air masses movements from this area not only over the Czech Republic, but over entire Europe. Concerning the Cidlina River basin, the most useful predictive relations are restricted to seven months (December-March and June-August) of the year.

These newly identified relations served as the basis of the modified ESP approach. This modification restricts the number of input meteorological series based on the values of large scale climatic predictors, which were analysed in the previous part of the thesis. These restricted series are submitted to the hydrological model, which is adjusted to current moisture conditions in the catchment. Moreover, the mESP approach does not restrict historical meteorological observations, but synthetic weather series. These series were gained from the stochastic weather generator as being more representative than only the limited number of observed datasets. The hydrological forecasting system was tested on the four year testing period (2007-2010). Two ESP based methods proved to be more efficient in all selected months. The only exception was February, because of troublesome snowmelt simulations. Moreover, the mESP was more efficient than the original ESP method in the vast majority of months. Rare exceptions have been conditioned by not sufficiently restricted synthetic weather series. The improvement of the traditional ESP was most obvious in the narrower forecast interval of the expected runoff volume.