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## SEMINAR

<i>Date</i>	<i>Tuesday, October 13, 2009, at 3 pm</i>
<i>Meeting Room</i>	<i>ETH Hönggerberg, HIL G 36.1</i>
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### **Hydrological Real-Time Modeling Using Remote Sensing Data: A Case Study on the Kafue River, Zambia**

#### Abstract:

With a watershed area of about 150'000 km<sup>2</sup> and a length of roughly 1000 km, the Kafue River is the largest tributary of the Zambezi river. The river basin covers one fifth of the area of Zambia shared among the North-Western, Copperbelt and Central Province. Along its course it flows through two major wetlands, the Lukanga Swamps and the Kafue Flats, and a reservoir system consisting of two dams embracing the Kafue Flats, the Itezhi-Tezhi dam and the Kafue Gorge dam. Economically the river is very important in view of several aspects. The water of the Kafue is used for irrigation large farming schemes along the river, the wetlands provide the most important fishing grounds of Zambia and the reservoir system is producing power for an emerging economy. The ecosystems of the two large wetlands, sustaining a very rich wildlife such as the indigenous Lechwe antelope and numerous birds, are heavily dependent on seasonal flooding. However, these water uses are prevalently conflicting. A better informed operation of the two reservoirs based on the prediction of inflows to the upstream reservoir (Itezhi-Tezhi) can make a contribution to minimize these conflicts.

This study presents a prediction framework for river discharge based solely on remotely sensed data, a simple conceptual model and data assimilation techniques. The availability of the input data in real-time allows the model to be operated in real-time, thus allows to have a prediction for discharge each time new input data is available. When observation data is available the model state is updated using sequential data assimilation techniques (Ensemble Kalman Filtering). This update step allows the model to be relatively simple.

To model the discharge of the Kafue river two remote sensing data products are used: Precipitation data obtained from the Famine Early Warning Systems Network (FEWS NET) and Soil Water Index (SWI) data derived from ERS scatterometer data by the Institute of Photogrammetry and Remote Sensing at the Vienna University of Technology. In the Kafue River Basin the SWI showed a good correlation with the runoff upstream the Itezhi-Tethi reservoir if a time lag of 30 days is applied, therefore this data is considered to be suitable for predictive hydrological modeling.

A simple conceptual model is used to derive discharge from the SWI and the precipitation data. At each time step where observation data (runoff) is available the groundwater/surface water storage is updated using Ensemble Kalman Filtering, a new prediction of runoff.

It is shown that this method can predict the runoff for the next month including the uncertainties of the prediction. This allows a water manager to take a decision how to operate the reservoirs based on a short term forecast.