IMPLEMENTATION OF TWO RESEARCH BASINS IN STYRIA (AUSTRIA) TO SUPPORT THE DEVELOPMENT OF FLOOD FORECASTING SYSTEMS AT THE SUB-CATCHMENT SCALE.

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Hydrologists from "*Amt der Steiermärkischen Landesregierung - FA19A*" (Austria) have promoted, since 2004, the setup of two flood forecasting systems for large river basins (Mur River: around 10000 km² in Styria and the Enns River: around 4000 km² in Styria). Both setups are built on hydrological modelling at the sub-catchment scale where the largest gauged hydrological unit is around 300 km². This makes it possible to retrieve outflow values for each hydrological unit and for each model run. However, discharge simulation at the sub-catchment scale doesn't display the same quality as on the main rivers, i.e. on Mur and Enns.
One obvious reason is that both systems are running in a continuous mode. To do so, some input variables like the potential evapotranpiration must be calculated continuously using simplified equation or long term mean monthly values because only few variables are available online. Also precipitation variation in space cannot be acquired exactly. All input variables are known to vary significantly in time and space, especially in mountainous areas (Ambroise, 1995). These facts make it necessary to implement an automatic forecast correction also referred to as data assimilation. There exist different approaches to correct the simulation results (Reefsgard, 1997; Drabeck, 2006). In the Mur and Enns Flood Forecasting Systems it was decided to adjust the simulations results at the gauging stations located on the main Rivers. Using these stations data as reference or "exact" values, water is than added or subtracted from the modelling system. Consequently, with this construction, errors made at the sub-catchment scale are of relatively minor importance for the overall forecast quality.
Forecasting systems for relatively small hydrological units face the major problems that the concentration time is short and that generally, hydro-meteorological stations are sparse so that it is nearly impossible to adapt or correct the simulated values to measured ones in a real time or quasi real time manner. For example, in most cases only one gauging station exits at the catchment outlet. Thus, the forecast quality depends primarily on the rainfall-runoff model performances and therefore on the input data quality (precipitation, air temperature, potential evapotranspiration). The obvious need for improving flood forecasting in relatively small, i.e., fast responding river catchments of less than 500 km² is one priority of the European Research Program Floodsite.
To face the challenge of flood forecasting for medium size basins some well instrumented and observed research areas are needed where it will be possible to develop and compare new methodological approaches. It was therefore decided to setup in Styria two experimental basins (catchment Lieboch and Leibnitz Sulm, see Fig.1) for these specific researches. Because flood forecasting setups are complex systems starting at the data measurement and communication, ending at the development of evacuation plans, it is decided, in this first stage to limit the research areas to: (1) data transmission, and (2) hydrological modelling.

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The present paper illustrates the structure of the experimental river basin chosen to enhance flood forecasting system quality for medium size units as well as preliminary modelling results. Two neighbouring watersheds with similar structural conditions (land-use, geology, topography, morphometry…) have been retained for this research work: Sulm River (1100 km²) Kainach River (760 km²).
All in all 8 gauging stations are installed whereas 5 only are online. This permits to delimitate 6 sub-cachments and to obtain a nested structure that is very important to understand and simulate the flood wave formation and propagation. Furthermore precipitations are measured at 44 stations (24 are online) and finally air temperature is measured at 25 stations (14 are online). This dense measurement network allows a good estimation of (1) the sub-catchments precipitation and (2) the distribution of snowfall versus rainfall that is also very important to simulate flooding due to snowmelt processes and model the correct water balance distribution in time.

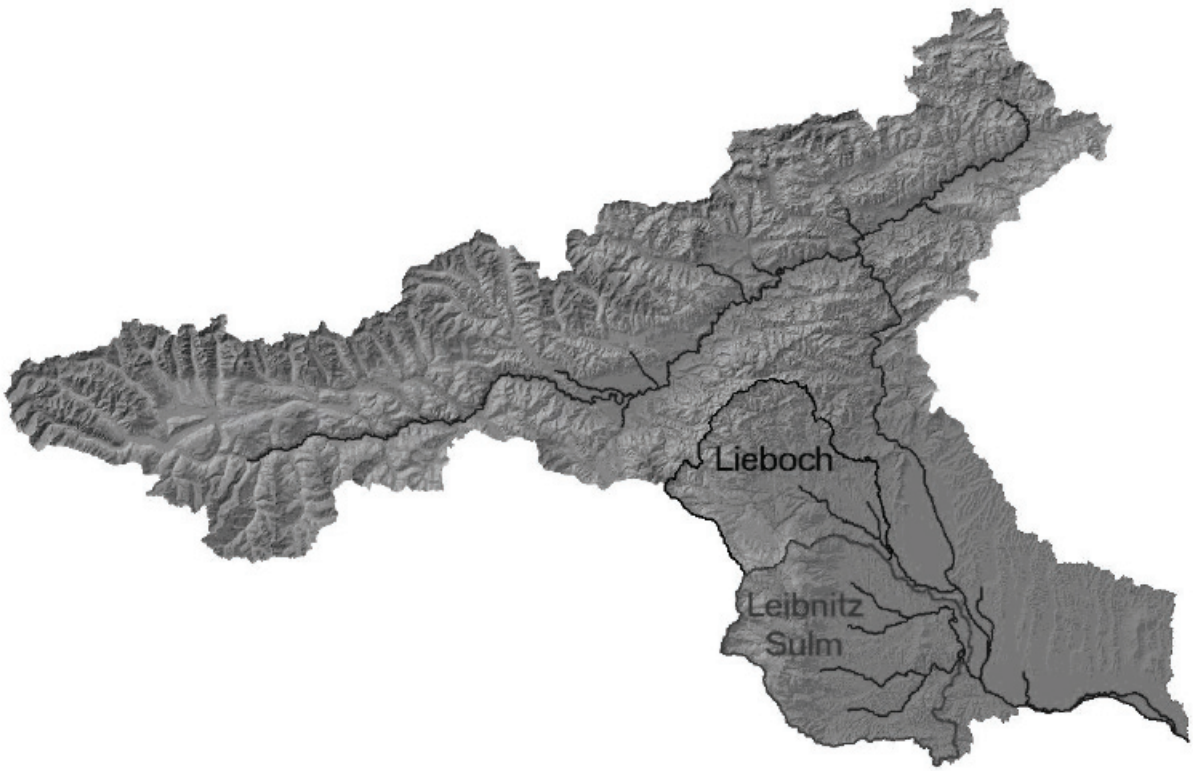

Fig. 1 The research catchments Lieboch and Leibnitz Sulm located in the Mur river watershed

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