REPORT FOR UNESCO

ABOUT THE INTERNATIONAL CONFERENCE ON FLOOD ESTIMATION

BERNE, 6-8 MARCH 2002

The objective of this report is to provide

- new ideas and technical methodologies for incorporating into both global FRIEND as well as FRIEND NE
- a list of prospective institutions/contact persons who could reinforce the implementation of FRIEND

on the basis of the contributions made to the Berne conference.

The main topics dealt with in the NE Project 4 Techniques for extreme rainfall and flood runoff estimation (NE Flood Group):

1. Continuous simulation, calibration, uncertainty (simulation of time series of precipitation and temperature; estimation of flood frequency using stochastic input simulators; simulation of discharge fields; quantifying uncertainty in runoff forecast)
2. inundation probabilities using flood routing models within GLUE uncertainty framework
3. floods on permeable catchments
4. Comparison of runoff responses on small catchments within a region and nested catchments

The members of the NE Flood Group gave the following presentations on the conference:

- paper: Skaugen, T., Langsholt, E.G., Astrup, M.: Using simulated time series of rainfall and temperature in rainfall-runoff models for design and long term flood warnings.
- poster: Blazkova, S., Beven, K.: Estimating extreme floods using various likelihood measures within the GLUE uncertainty framework
- poster: Werner, M.: Flood inundation modelling: a comparison of approaches through predictive uncertainties and the value of spatial data

During the conference a number of contributions have been presented which are relevant to the topics already dealt with within the NE Flood Group. Clearly it is very useful to invite the authors to take part in the activities of the group. Also some flood topics presented at the conference and not dealt with in the NE Flood Group work programme should be added.

The conference was divided into 5 topics: (1) Flood Measurement Techniques; (2) Process Analysis as a Basis of Flood Modelling; (3) Extreme Value Statistics; (4) Modelling and Regionalisation of Floods; (5) Overview of project of the International Commission for the Hydrology of the Rhine basin and a new Swiss tool for the practice. In the following paragraphs the contributions particularly relevant for the FRIEND project are briefly characterized.

Dr Sarka Blazkova, coordinator of the NE Flood Group, T.G. Masaryk Water Research Institute, Podbabska 30,
160 62 Praha 6, Czech Republic, tel. +420 2 20 197 222, fax:+420 2 24 31 86 56, email: sarka_blazkova@vuv.cz

New ideas and technical methodologies for incorporating into FRIEND NE

New ideas contributing to the existing topics of NE FRIEND Flood Group

Continuous simulation, calibration, uncertainty

Seibert, J. (Sweden): ***Does improved model calibration lead to more accurate flood estimation?***

Differential split-sample testing, e.g. calibration on years with lower runoff peaks and testing it on years with higher peaks, was used to evaluate model performance for the situation when the model has to be used to simulate runoff during conditions different from those observed during calibration. To asses the value of improved calibration the model performance was then compared to simulations derived from different calibration procedures such as, e.g. including groundwater-level observations. This research has been performed with the HBV model which is normally used e.g. to compute design floods for dam safety in Sweden.

Brath, A., Montanari, A., Moretti, G. (Italy): ***On the use of simulation techniques for the estimation of peak river flows***

Multivariate stochastic point processes have been used for the generation of synthetic rainfall data and distributed rainfall-runoff models for the obtaining synthetic river flows. The rainfall-runoff model can be parameterised even when historical river flows records are not available for the considered site. The model parameters are estimable by using upstream or downstream flows records. An application of the simulation technique to a small river basin (117 km^2) in Northern Italy has been presented.

Perrin, Ch., Michel, C. (France): ***Robustness of two flood estimation methods with data availability***

A rainfall-runoff model and a rainfall generator are first calibrated on the available rainfall-runoff record. Then long series of rainfall can be generated (e.g. more than 100 years) and used to feed the hydrological model which calculates the corresponding streamflow series. This evaluation can be carried out on a set of about 30 catchments located in the U.S. and France for which long rainfall-runoff records are available.

Comparison of runoff responses on small catchments

Scherrer, S. (Switzerland): ***A procedure for the identification of dominant runoff processes by field investigations to delineate the relevant contributing areas for flood modelling***

The dominant runoff processes have been mapped in more than 30 catchments between 1 and 250 km^2 in order to define flood contributing areas and to estimate finally flood magnitudes. A guideline has been developed for the administration of Rheinland-Pfalz (Germany), which is based on the actual knowledge of runoff processes and specific field assessments considering the relevant information on geology, soils, geomorphology,

Dr Sarka Blazkova, coordinator of the NE Flood Group, T.G. Masaryk Water Research Institute, Podbabska 30,
160 62 Praha 6, Czech Republic, tel. +420 2 20 197 222, fax:+420 2 24 31 86 56, email: sarka_blazkova@vuv.cz

vegetation properties. Intense field studies have been made applying sprinkling experiments with high intensities (55 to 100 mm/h) on natural hill-slope plots of 60 m^2 size.

Field Excursion: ***Torrent Studies on the Spissibach Catchment*** at the Department of Geography, University of Berne

On this small catchment (2.6 km^2) both theoretical work and field experimental work has been going on:

Use of TOPMODEL combined with a Geographical Information System GIS (Brunisholy, M., 1999)

Investigation of processes of runoff generation by means of sprinkling tests, soil moisture measurements and hydrological classification by vegetation and soil mapping (Judith Dobmann and Simone Hunziker, master theses in preparation)

New topics for the NE Flood Group

Regionalization

Report of the International Commission for the Hydrology of the Rhine basin (Nr I-19, in German but with English Summary) gives an overview and assessment of the flood prediction methods currently used. It discusses the relationships between the quality of results of various methods and their demands on time, financial and data resources. In the ***Swiss country report*** it presents an approach to flood estimation based on the spread of values of several simple models. The estimates of 100 year flood using 6 simple regional models compared to 2 extreme flood estimates using observed data were shown. On one test catchment the values are in good agreement, on another one the results show that further investigations are necessary.

Kuntner, R., Burlando, P. (Switzerland): ***Engineering oriented method to model the spatial distribution of runoff generation in mesoscale prealpine and alpine catchments***

The contribution reported on a modification of the SCS-CN method, aiming at improvement of its capability to perform adequately in mountainous and perimountainous regions to model correctly flood runoff generation. The proposed methodology aims first at investigating how the SCS-CN method performs with respect to field experiments in pealpine and alpine catchments that are reported in the literature. The revised approach is then upscaled to match the scale of raster-based distributed rainfall-runoff models. Some validation tests have been carried out for a few meso-scale catchments and subcatchments.

Niggli, M., Talamba, D., Hingray, B., Musy, A. (Switzerland): ***Regionalisation of annual flood – An adaptive method to errors and data uncertainities (AMED)***

Dr Sarka Blazkova, coordinator of the NE Flood Group, T.G. Masaryk Water Research Institute, Podbabska 30,
160 62 Praha 6, Czech Republic, tel. +420 2 20 197 222, fax:+420 2 24 31 86 56, email: sarka_blazkova@vuv.cz

A methodology combining several already existing methods for flood discharge assessment has been proposed. The basic idea of the combination is to define a weighted average of different proposed models, where the weight w_i of the model i is inversely proportional to the model error. The resulting combination can be considered as a linear empirical Bayes estimator of the flood quantiles. Example has been presented with two different regional methods, i.e. the flood index methods and the generalised rational method. Confidence intervals have been provided both for the individual models and for the combination model. For the latter they were generally smaller.

Risk assessment

Merz, B., Thieken, A., Blöschl, G.(Germany): ***Uncertainty analysis for flood risk estimation***

In order to asses the uncertainty of the flood risk estimation complex deterministic models are complemented by stochastic models. The simple stochastic parameterisations are calibrated against the corresponding complex models. The simple stochastic approach allows a large number of simulation runs in a Monte Carlo framework. These simulations are used to derive uncertainty bounds of the risk estimates. Additionally, the contributions of individual processes to the uncertainty of the risk estimation are identified.

New methodologies

Sulzer, S., Rutschmann, P., Kinzelbach, W. (Switzerland): ***Inverse modelling to estimate flood discharge in rivers***

Discharges are determined through the combination of non-intrusive measurements of surface velocities and water level with a numerical code and an inverse optimisation algorithm. The inverse model can be combined with several numerical simulation programs. It has been tested with a 2D Navier-Stokes code in a vertical plane, a 2D Shallow-Water code and a fully 3D code. Two laboratory tests have been described.

Ruiz, A., Gonzáles, X., Roca, A., Cortada, F. (Spain): ***Flood risk mapping based on airborne laser scanner data: Case of the Llobregat River***

Light Detection And Ranging (LIDAR) technology is becoming more and more popular. LIDAR has proved to be an accurate and practical alternative to conventional methods of generating Digital Elevation Maps and for developing risk maps.

Wiesmann, A. Wegmuller, U., Honikel, M., Strozzi, T., Werner, C.L. (Switzerland): ***Flood measurement techniques with satellite based synthetic aperture radar.***

Flood measurement techniques with SAR (synthetic aperture radar) and InSAR (interferometric SAR) can be used on one hand for the direct mapping of flood extent and duration and on the other hand to get input for flood and risk modelling such as digital elevation models and landuse maps. Spaceborne SAR data are well suited for the flood

Dr Sarka Blazkova, coordinator of the NE Flood Group, T.G. Masaryk Water Research Institute, Podbabska 30,
160 62 Praha 6, Czech Republic, tel. +420 2 20 197 222, fax:+420 2 24 31 86 56, email: sarka_blazkova@vuv.cz

mapping application due to their "all weather" and day/night capability and the sensitivity to change.

New ideas and methodologies for global FRIEND

The topics dealt with by other groups have to correspond to the current problems which the respective group is facing. A very good overview of the available approaches is given in the above mentioned ***Report of the International Commission for the Hydrology of the Rhine basin.*** The discussion of the relationships between the quality of results of various methods and their demands on time, financial and data resources is particularly relevant. From the experience of the members of the NE Flood Group it is important to stress that the use of any method should be connected with some sort of uncertainty estimation. It concerns not only sophisticated computer models but also the simplest procedures like empirical formulas. Several methods (models, formulas) should be used at the same time. The comparison provides some estimation of prediction limits and reveals inconsistencies requiring further investigations. The additional investigation should narrow the prediction limits. The above mentioned contributions interesting for the NE Flood Group can be interesting also for other groups, depending on their priorities.

List of prospective institutions (contact persons) who could reinforce the implementation of FRIEND

- Swiss Federal Institute of Technology Zurich, Institute of Hydromechanics and Water Resources Management (S. Sulzer et al., P. Burlando et al.)
- Simon Scherrer and the German Institutions operating the experimental catchments mentioned in his contribution
- Swedish University of Agricultural Sciences, Department of Environmental Assessment, Uppsala (J. Seibert)
- DGR-IATE/HYDRAM, Ecole Polytechnique Federale de Lausanne, Switzerland (B. Hingray)
- GeoForschungsZentrum Potsdam, Germany (A. Thieken)
- Institut fur Hydraulik, Gewasserkunde und Wasserwirtschaft, Technische Universitat Wien, Austria (G. Bloschl)
- DISTART, University of Bologna, Italy (A. Montanari)
- Cemagref, Parc de Tourvoie, France (C. Perrin)
- Cartographic Institute of Catalonia, Barcelona, Spain (A. Ruiz)
- Gamma Remote Sensing, Switzerland (A. Wiesmann)
- University of Berne, Dept. of Geography, Group of Hydrology, Switzerland (R. Weingartner et al.)

Dr Sarka Blazkova, coordinator of the NE Flood Group, T.G. Masaryk Water Research Institute, Podbabska 30,
160 62 Praha 6, Czech Republic, tel. +420 2 20 197 222, fax:+420 2 24 31 86 56, email: sarka_blazkova@vuv.cz