

## **CONCLUSIONS AND RECOMMENDATIONS**

The following conclusions and recommendations have been reached by the workshop participants:

### **A. Cooperation; Hydrological Forecasting Capabilities in the Region**

- 1) It is important to continue improving cooperation among hydrological and meteorological services .
- 2) Introduce and strengthen further hydrological forecasting capabilities of NMHSs in the region.
- 3) Development of the forecasting and warning system for the Sava river basin is seen as a priority by all the Sava riparian states as well as by the International Sava River Basin Commission.

### **B. Real Time Monitoring Network**

- 4) Real time monitoring networks should be expanded further in the region.
- 5) Expansion should focus on non- real time hydrological stations as well as the precipitation station network.
- 6) Design of the data acquisition systems should reflect the final objectives and be based on optimization principles.
- 7) Sustainability is of vital importance in particular with regard to maintenance of hydrological and meteorological monitoring networks.

### **C. Data Exchange, Database & Data Management Systems**

- 8) The importance of data availability and data exchange in the region has been stressed, as well as promotion of knowledge and use of WMO standardized data exchange codes.
- 9) Operational database should provide for both automated and man-supervised data pre-processing and quality control, using graphical and statistical data-validation procedures, and possibly involve options for temperature and precipitation gridding.
- 10) Data bases should include all available historical data necessary for calibrating hydrological and hydraulic models.
- 11) Reliable real time data management systems are essential for flood forecasting services.

## **D. Quantitative Precipitation Estimates & Forecasts ( QPE & QPF)**

- 12) More accurate QPE & QPF in mountainous regions are of paramount importance for improving hydrological forecasts and reducing predictive uncertainty in small river basins.
- 13) Improvement of QPE and QPF accuracy could be achieved by better representation of topography and its effects, and further improvement of microphysics parameterization.
- 14) Higher accuracy of QPE and QPF also requires higher level of integration between atmospheric and hydrological modelling systems, which should ultimately result in higher accuracy of hydrological forecasts.
- 15) Appropriate techniques should be used for integration of radar and rain gauge data so as to improve further QPE and QPF.

## **E. Hydrological Forecasting Systems**

- 16) Clarification of the difference between emulation uncertainty and predictive uncertainty is a fundamental step further in improving flood forecasting.
- 17) The use of different hydrological models of different nature is advocated in order to benefit from the alternative characteristics (physics based, conceptual, empirical and data driven) in order to reduce predictive uncertainty.
- 18) There is a need to clarify better the use of predictive uncertainty in operational decision making and of its communication to decision makers and stakeholders.
- 19) Extension of hydrological models to un-gauged catchments requires models based on physically meaningful parameters at finer scales.
- 20) An integrated system based on hydraulic and hydrological models, must be designed in such a way to enable interactive real time operations.
- 21) A national system should be based on an open and flexible structure allowing the introduction and the upgrading of software, models, procedures, new configurations, etc.

## **F. General Concluding Statement**

- 22) The participants highly appreciated the workshop organisation and its professional level - with an inspiring mix of modellers, software developers and operational forecasters - and the achievements reached at the gathering. In the same vein, they unanimously concluded that the workshops of this type should be repeated in the near future so as to further boost interest in, and stimulate expansion of, hydrological forecasting and flood warning systems in the region.