

## Preface

*“During the early periods of cultural development, man’s relationship with water was largely determined by mythology. Natural manifestations such as storms, thunder, lightning, rain, floods and natural phenomena such as moon, sun, sea and springs were personified by gods and demons who were superior to man, in whose hands he was and whom he feared, as their behavior was neither understandable nor predictable. Despite this mythological attitude man understood well how to use pragmatically the unpredictable element water for his purposes, compelled to do so in order to ensure and maintain his existence. The immense water development systems and hydraulic engineering structures from these times are proof of the excellent engineering achievements in early history. Only in the period of natural philosophy following natural mythology did man begin to explore the laws of nature through philosophical meditation (reflection, speculation). Natural philosophy inquired into interrelations and tried to find explanations of the phenomena observed. The aim was to deduce natural processes by rational approaches to the basic principles. Natural philosophy has its origins in Greek antiquity about 600 B.C. (Thales of Milet). About 300 years later, it reached its apex with Aristotle and then dominated man’s understanding of nature until the Renaissance. Only in the 15<sup>th</sup> and 16<sup>th</sup> century A.D. did speculation and inspiration begin to be replaced by scientific investigation and by the computational and quantitative understanding of natural phenomena. Well-aimed experiments and logical cause/effect interpretation of observations were the new scientific tools. Natural mythology was gradually replaced by natural sciences.” (Garbrecht, 1987)<sup>1</sup>*

The enhancement of scientific tools and the understanding of processes governing fluvial hydraulics is still an important objective of today's hydraulic research. In fact, such knowledge is required by the modern engineer in order to improve the quality of man’s life in accordance with nature. Various examples for the realization of these principles can be found, for instance, in the work of the Federal Waterways Engineering and Research Institute (Bundesanstalt für Wasserbau, BAW) along the inland waterways of Germany. Inland navigation constitutes a significant portion of long-distance goods transport in Germany. In 2004, goods with a total tonnage of 235.9 million tons were transported on the country’s inland waterways. Therefore, the immense importance of the waterways - and the need to maintain the associated infrastructure while continuing to improve it to meet demand - is beyond dispute.

However, one should not forget that waterways are often also natural rivers for which the knowledge of fluvial processes and hydraulics is of great importance. The best known examples in Germany of such rivers are the Rhine and the Elbe. Thus, the principal challenges confronting hydraulic engineers today - with specific regard to ecology, morphology, infrastructure construction, operation and maintenance - are as follows:

- Trend towards larger vessels in the shipbuilding sector (individual vessels, push-tow units),
- Optimisation of river training and sediment management,
- Unfavourable age pyramid of waterway infrastructure with a high percentage of older structures,
- Ecological requirements, e.g. as described in the European Water Framework Directive,
- Development of adaptation strategies to minimise the expected impact of climate change.

Most of these challenges are closely related to fluvial hydraulic processes and can only be tackled successfully using the latest advances in the areas of theoretical, experimental and computational hydraulics. The ideal platform for exchange between scientists and engineers with respect to fluvial hydraulics and river-related disciplines are the River Flow Conferences which are organized biannually since 2002. River Flow 2010 is the fifth in a now highly successful series of this kind of conference and was organized under the auspices of the Fluvial Hydraulics Committee of the International Association for Hydro-Environment Engineering and Research (IAHR). The ensuing conferences have witnessed an increase in participation of members of our community of river engineers and researchers, a clear indication of the relevance of such a forum.

The Local Organizing Committee of River Flow 2010 has received 487 abstracts, of which 284 were considered to be aligned with the conference topics. Subsequently, 235 papers were submitted by engineers and researchers of 32 countries from all 5 inhabited continents. The International Scientific Com-

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<sup>1</sup> Garbrecht, G.; 1987: „Hydrologic and hydraulic concepts in antiquity“. In: Hydraulics and Hydraulic Research: A Historical Review. Editor: Garbrecht, G.: A.A. Balkema / Rotterdam / Boston, pp. 1 - 22

mittee has, finally, selected 223 to be included in this proceedings book. Of these, 74 % were considered for oral presentation and 26 % were selected for the poster sessions. The accepted contributions essentially cover river hydrodynamics, river morphodynamics and sediment transport, and interdisciplinary approaches for river management.

A distinctive feature of River Flow conferences has been the existence of Master Classes the day preceding the formal opening of the Conference. They are intended for PhD or MSc students or young researchers working on fluvial hydraulics or related disciplines. They represent a unique opportunity for students to address senior scientists, meet peers working on similar topics and identify possible collaborations for the continuation of their work. The response to this initiative exceeded the best initial expectations: 7 master Classes were conducted organised by 14 masters, enrolling 58 students from 14 countries. This is an indication of the vitality of fluvial hydraulics and a contribution for the continuity of the IAHR.

*Prof. Dr. Andreas Dittrich*

Conference Chairman

*Prof. Dr.-Ing. Christoph Heinzelmann*

Director of BAW

## Acknowledgements

A conference can only be as good as their contributors. We are therefore grateful to all researchers and practitioners working in river-related disciplines who chose to participate in River Flow 2010. The high quality of the contributions was verified by the in-depth reviewing process of the manuscripts by the International Scientific Committee. We are indebted to its members for their excellent work, rare in conferences, despite the limited time available. A major concern of the River Flow conferences is the involvement of young researchers, and thus special thanks go to the students that applied to the Master Classes, and especially to the Masters who attracted so many students.

A conference, involving so many students at reduced fees, is only financially sustainable with some level of sponsorship. We acknowledge the support of TU Braunschweig, EWE AG, Bundesanstalt für Wasserbau, and Deutsche Forschungsgemeinschaft. Thanks to the support of these institutions it was possible to partly cover the expenses of a large number of Masters and of the Proceedings.

The preparation of River Flow 2010 benefited, at several stages, from the experiences of the organizers of previous editions. For that matter, we are indebted to the organizers of the foregoing conferences for sharing their experiences with us. The image of the conference was essentially a product of collective work within the LOC. A word of appreciation to Ute Buchholz and Heidrun Rasch for their contribution in preparing the presentation that introduced River Flow 2010 on September 2008, in Çeşme.

The involvement of IAHR was fundamental for the sponsorship and announcement of the conference. At last, the preparation of the manuscripts often required the guidance of the publisher, Bundesanstalt für Wasserbau. Our recognition goes to Peter Weinmann and Sabine Johnson from Bundesanstalt für Wasserbau, Dr. Silke Müller-Hagedorn and Birgit Jüttner from arxio GmbH and remaining staff involved, and Oliver Kern who helped design the CD.

*The Scientific Secretariat of River Flow 2010*