

Preface

13th Workshop “Large-scale Hydrological Modelling – Hydrological Modelling for the Assessment of Ecosystem Services and Landscape Functions”, 25–27 November 2009, Dresden

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The 13th Workshop “Large-scale Hydrological Modeling” was held during 25–27 November 2009 in Dresden. Launched in 1997, this event provides a platform to present the state-of-the-art on large-scale hydrological modelling within the German-speaking community and to critically discuss current and future research approaches. The workshop was hosted by the Institute for Soil Science and Site Ecology (TU Dresden), member of the Dresden Water Center (DKW). Based on last year’s focus (“Transdisciplinary Concepts and Modelling Strategies for the Assessment of Complex Environmental Systems”), this year’s workshop kept integrated modelling as one of its key topics. The demands caused by global change (especially climate change) require a holistic view upon complex natural and social conditions. Such a holistic approach is both essential for well-founded prediction models as for high spatial/temporal resolution in the models, e.g. in the development of reasonable future scenarios. The particular responsibility of the modeler on decision-making – especially considering the large number of currently-developed decision support tools – were discussed at the meeting as well as possibilities and limits of simplification and aggregation of model results for dissemination (other scientific disciplines, stakeholders, decision makers).

The subject of “Hydrologic Modelling for the Assessment of Ecosystem Services and Landscape Functions” has been a discussion point between of the more than 70 participants coming from Germany and neighbouring countries. In detail,

the workshop was structured in the following four main blocks:

Block 1: Multidisciplinary model approaches as users and questioners for hydrological models.

Block 2: Modelling of water-related ecosystem services and landscape functions for assessment and decision support.

Block 3: Assessment of ecosystem services and landscape functions under varying climatic conditions.

Block 4: Process description in integrated hydrological models.

Each block was preceded by a selected introductory lecture. A total of 28 technical papers and 12 poster contributions deepened the particular subjects and stimulated discussion.

K. H. Feger presented in his address of welcome a brief overview of the various water research topics in Dresden. The Dresden Water Research Center (DKW) founded in 2003 at the TU Dresden, in the meanwhile has developed into a recognised platform for interdisciplinary research, teaching, and practice transfer. This is underlined by a number of research initiatives such as the two BMBF joint projects REGKLAM in the frame of KLIMZUG and IWAS (International Water Research Alliance Saxony). Introducing the conference theme K. H. Feger focused on the concept of ecosystem services (ESS). ESS are understood as benefits, which are provided by nature and used by people. They are differentiated into Provisioning (food, water, timber, fiber, genetic resources), Regulating (regulation of climate, floods, diseases, water quality, waste management), Cultural



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(recreational, aesthetic pleasure and spiritual fulfillment), and Supporting ESS (soil formation, nutrient cycling). A common characteristic of these services is the close link to water pathways in the landscape and, thus, their description is dependent on process-oriented hydrological models. The opening presentation addressed as well the scaling problem. While the management planning of ESS often takes place at regional or landscape level (hydrological meso- to macroscale), the process description and understanding of the system is often limited to smaller scales (e.g. Pedon, plot or site), i.e. the hydrological micro-scale. This gap must be overcome. The scale transition is therefore a key challenge for large-scale modelling. Processes at the field scale must be known in order to abstract the land-use changes on larger scales. The presented examples from the field of decentralized flood protection showed that especially information from soil science is a major challenge for large-scale hydrological modelling. This means namely quantifying the functional description of soils and landscape segments and interfaces in the water and nutrient cycle of ecosystems.

This volume of “Advances in Geosciences” comprises 19 papers referring to the oral presentations and poster contributions.

1 Multidisciplinary approaches as model users and questioners of hydrological models

S. Herrmann, (Institute for Environmental Planning, Leibniz Universität Hannover), in the keynote entitled “Use of multi-disciplinary approaches to integrated planning model – which is the contribution of hydrological models?” focused on the demands set upon hydrological models and the communication of model results from a planning point of view. It became clear that not only the quality of the modelled hydrologic processes decides if the established models are used or not, but often the ability to integrate the model into the planning processes and in the moderation and negotiation process (data requirements, computer time, flexibility for changes) is relevant. This requires an understandable spatial visualisation concept. The following contributions focused on the ESS-concept. As a primary economic concept, characterising, and evaluating the ESS performance (ESS may not be misunderstood as a function). It was also clear that the demands on hydrological models are high, e.g. assessing water footprint of agricultural products under changing climate conditions (K. Drastig et al.). Data availability can limit the spatial and temporal resolution and always requires new concepts of abstraction (M. Gebel et al.). In addition to the bio-physical description of processes, there is the need for integrative approaches to consider the sometimes contradictory demands of the stakeholders. This is due to the fact that the results of planned measures on the landscape level are often complex. The problem

can only be solved through negotiations on an objective basis in order to balance measures (trade-offs). Hence, a compensation system was introduced to promote sustainable land-use bringing together those who receive benefits and actors like farmers who are requested to implement measures (J. Hack et al.).

2 Modelling of ecosystem services and waterborne landscape features on the evaluation and decision support

The session was opened by U. Haberlandt (Institute for Water Management, Hydrology and Agricultural Hydraulic Engineering, Leibniz Universität Hannover) with the keynote “From the hydrological modelling to decision support”. He reported that in the application of different (eco-) hydrological models used for decision support a wide dispersion of results can be found. This concerns not only the mere modelling of water balance, but even more the matter flux modelling (e.g. nitrogen loss). Combining the results of various models with fuzzy-logic methods yielded plausible results (U. Haberlandt et al.). Presented were also topics like the application of integrated hydrological models, land-use changes, irrigation water demand, climate effects (A. Wahren et al., T. aus der Beek et al., H. Bormann et al., M. Wegehenkel et al., S. van der Heijden et al., P. Krause et al.).

3 Assessment of ecosystem services and landscape functions under variable climatic conditions

The opening keynote by K. C. Kersebaum (Leibniz-Centre for Agricultural Landscape Research (ZALF), Müncheberg, Institute of Landscape Systems Analysis) was entitled “Process modelling of soil-plant interactions to assess ecosystem services and risks under variable climatic conditions”. He explained the “CO₂-effect”, which is not implemented in most hydrological models until now. The increase of CO₂ concentration does not only change the climate inputs but it has as well an influence on water fluxes. The vegetation responds directly to changing chemical conditions in the air. Thus the higher CO₂ concentration raises the water use efficiency and reduces water use by plants. The resulting transpiration fluxes can turn impacts on groundwater recharge or yield, from negative to positive, depending on site conditions. This issue was further discussed in other presentations showing results from the assessment of climate impacts on the water balance of Germany (G. V. Grigoryan et al.) and Switzerland (N. Köplin et al.) and on forest growth (J. Suttmöller et al.).

4 Description of processes in integrated hydrological models

In the final session, M. Disse (Institute of Water Engineering, Universität der Bundeswehr München) introduced the new BMBF project initiative “SUMARIO”. In this framework, ecosystem services are assessed by integrated methods in the arid NW of China and translated into land-use strategies. It is a transdisciplinary approach since not only numerous scientific disciplines work together in the project, but also stakeholders. It was shown that the project structures try to merge the activities to map all relevant processes for sustainable management in the Tarim basin oases. SUMARIO will be based on the transfer of a detailed process knowledge gained at the field scale into the regional and national planning level. M. Disse named the hydrological modelling to be the “spine” for a sustainable land-use management. Further lectures in this session dealt with a flexible flux library for integrated catchment modelling (P. Kraft et al.), coupled hydro-morphology and water balance modelling in wetlands (F. Edom et al.), modelling of long-term nutrient retention in surface waters in Saxony (S. Halbfaß et al.), glacier runoff modelling for flood prognosis (J. Schöber et al.), uncertainties in soil parameterisation in rainfall-runoff-models (W. Rieger et al.), and with remote sensing based analysis of flooded area (L. Adam et al.).

The editorial team would like to thank authors and reviewers of the submitted papers resulting from the workshop for their motivation and cooperation. With this volume, we want to summarise the interesting presentations and discussions of the workshop and to keep the workshop community active. We also like to thank the Copernicus Publication Office for giving the opportunity to publish this issue.