Hydrol. Earth Syst. Sci., 14, 365–367, 2010
www.hydrol-earth-syst-sci.net/14/365/2010/

Hydrology and Earth System Sciences

Preface

Advances in land surface hydrological processes – field observations, modeling and data assimilation

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Water resources availability severely constrains the social and economic developments of nations. Increased research on the terrestrial water cycle is essential for identifying the problems caused by water resource shortage and in making informed decisions. However, much is still unknown about the role of land surface hydrological processes in the terrestrial water cycle, especially the feedbacks between surface processes and climate at different spatial and temporal scales. This special issue focuses on the role of land surface hydrological processes on land atmosphere interactions, and attempts to explore the potential for identifying these processes from field experiments, satellite remote sensing and processes numerical modeling.

This issue covers three themes: 1) Recent field experiments and preliminary results. 2) Assessment of land surface hydrological processes through ground measurements, remote sensing and numerical modeling, with emphasis on algorithm and validation, and applications of remote sensing data to numerical modeling. 3) Response of key variables of land surface hydrological processes to local and global climate change. The emphasis of the contributions is on new measurement techniques, new data sets and new ideas of addressing spatial and temporal scale problems.

Ad. 1) The contributions in this part focused on recent field experiments and summarize their preliminary results. Su et al. (2009) reported in detail the EAGLE 2006 – Multi-purpose, multi-angle and multi-sensor in-situ and airborne campaigns over grassland and forest. An overview of thermal remote sensing from Airborne Hyperspectral Scanner data in the framework of the SPARC and SEN2FLEX projects was given by Sobrino et al. (2009). Wen et al. (2009) gave an overview of the LOess Plateau mesa region land surface process field EXperiment series (LOPEXs), while Ma et al. (2009) reported recent advances on the study of atmosphere-land interaction observations on the Tibetan Plateau. Finally Zeng et al. (2009) studied the diurnal pattern of the drying front in desert and its application for determining the effective infiltration in a desert experiment carried out in the Badain Jaran Desert in western Inner Mongolia in China. These contributions added some recent field experiments to the existing ones and extended our understanding of these processes at different scales.

Ad. 2) The selections of this part have the emphases on assessment of hydrological processes from ground measurements, satellite remote sensing and numerical modeling, particular attention is given to inversion algorithm development and validation.

These contributions include retrievals of state variables, parameters and fluxes of the atmosphere, land and water surfaces. Lim and Lee (2009) performed a comparative analysis of two wind velocity retrieval techniques by using a single Doppler radar; Richter and Timmermans (2009) presented a physically based retrieval of crop characteristics for improved water use estimates; Salama et al. (2009) demonstrated the retrieval of inherent optical properties and associated inversion-uncertainties in the Dutch Lakes; Timmermans et al. (2009a) developed a method for the retrieval of canopy component temperatures through Bayesian inversion of directional thermal measurements; van der Kwast et al. (2009) performed an evaluation of the Surface Energy

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Published by Copernicus Publications on behalf of the European Geosciences Union.

Balance System (SEBS) applied to ASTER imagery with flux-measurements at the SPARC 2004 site (Barrax, Spain) and quantified the likely uncertainties for various parameterisations of the roughness height; Jia et al. (2009a) presented regional estimation of daily to annual regional evaporation with MODIS data in the Yellow River Delta wetland; Liu et al. (2009) presented a method to derive actual daily evaporation estimated from MERIS and AATSR data over the Chinese Loess Plateau; while Gao et al. (2009) analysed seasonal and diurnal variations in moisture, heat and CO_2 fluxes over a typical steppe prairie in Inner Mongolia, China; finally Timmermans et al. (2009b) presented an analysis dealing with footprint issues in measurements of sensible heat fluxes using scintillometry over heterogeneous landscapes.

Ad. 3) This part intends to analyse the response of the key variables of land surface hydrological processes to the local and global climate change, with applications of satellite remote sensing data in numerical modeling of hydrological process as the focus. Van der Velde et al. (2009) performed a detailed analysis of the performance of the Noah LSM over a Tibetan plateau site and proposed improved thermodynamic soil and vegetation parameterizations to improve the simulation of soil temperature states and surface fluxes, similarly Yang et al. (2009) proposed some practical improvement on the land surface modeling in the Tibetan Plateau using three different land surface models; Alkhaier et al. (2009) provided a qualitative description of shallow groundwater effect on surface temperature of bare soil suggesting the possibility of inferring shallow ground water tables using thermal remote sensing data; Li et al. (2009) assessed the impacts of snow distribution over the Namco lake area of the Tibetan Plateau; Jia et al. (2009b) presented a distributed model of land surface water and energy budgets and applied it successfully to the inland Heihe river basin of China, suggesting the feasibility of improvements using detailed spatial information from remote sensing data; Van der Tol et al. (2009) developed a Bayesian approach to estimate sensible and latent heat over vegetated land surface and demonstrated the benefit when different information was combined to reduce uncertainties in land surface modeling.

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We thank the HESS Editorial Board for their guidance and assistance during the production of this special issue. Without the generous supports of expert colleagues for providing excellent reviews to the submitted manuscripts, it would not have been possible to accomplish this issue. We would like to thank the following colleagues for their contributions: M. Ashraf, F. Bosveld, E. Boss, J.-C. Calvet, A. Chanzy, Y. Dai, G. Flerchinger, G. de Rooij, H. G. Huang, Y. He, M. Hafeez, H. Ishikawa, E. K. Jauad, L. Jia, H. Jones, T. Kinouchi, X. Li, S. M. Liu, S. Liu, W. Q. Ma, Y. Ma, Y. Oku, N. Oppelt, V. Pauwels, R. Rinehart, A. Royer, H. Saito, F. Shen, W. Timmermans, O. Tsukamoto, H. Uyeda, M. van Helvoirt, B. van den Hurk, C. van der Tol, R. van der Velde, W. Verhoef, A. Verhoef, Z. Vekerdy, J. Wen, D. Yang, K. Yang, and X. Zhan.

Editors: Z. Su, J. Wen, and W. Wagner

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