Sunday, May 28th

KEYNOTE SPEAKERS

TIME: 1730 TO 1900 ROOM: ESB 1013

Keynote 1: The complexity of urban hydrology – capturing drivers and processes in human-modified landscapes

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Mankind is altering the natural landscape and hence hydrological processes with increasing speed and magnitude, with urban areas reflecting one of the most prominent alteration. In the past, cities were developed to drain rainwater efficiently without considering long-term alteration on the water balance. The result were severe changes in water quality, quantity and even climate. In order to mitigate these influences, approaches for stormwater management, green infrastructure and low impact development now target a reduction of the mostly negative impacts on hydrology and climate. These structures and approaches brought more “natural” hydrological processes back into urban areas, but they also complicate estimates of the overall water balance, runoff prediction and flooding potential and associated contamination by pollutants. In particular, the various partly sealed surfaces, green roofs and urban trees, the small scale lateral redistribution of water form sealed or partly sealed area to soils or specific bio-retention systems, and the small-scale variability of meteorological drivers and fluxes are major challenges in the development of adequate model representations of these landscapes. Data from several long-term observatories of urban catchments in Germany obtained with fix and mobile sensor networks allow a number of analyses of these competing influences, including for example approaches of paired catchment hydrology. Based on insights from experimental data a new model framework (Urban-RoGeR) for the simulation and prediction of the highly spatial and temporally variable drivers and fluxes of urban hydrology has been developed that adapts approaches from catchment and soil hydrology of natural landscapes to urban situations. The talk will demonstrate the challenges of urban hydrology with several examples and show the potential for more process based modelling to predict urban water balance as well as short-term flash flood events.

Bio: A hydrologist by training, Markus Weiler has worked in fields ranging from hydrology, soil science, isotope geochemistry, solute transport to plant physiology using field experiments, statistical approaches and conceptual and numerical modelling. After graduating in Hydrology from the University of Freiburg, Germany, he obtained his PhD in 2001 from the ETH Zürich, Switzerland working on preferential flow processes in soils. After a 2 year post-doc at Oregon State University, USA, he was appointed Assistant Professor and Chair of Forest Hydrology at the University of British Columbia in Vancouver, Canada. Since 2008, Markus Weiler is Professor in Hydrology and was director of the Centre of Water Research at the University of Freiburg, Germany. Markus Weiler established a modern stable water isotope laboratory and set-up several hydrological observatories in urban, agricultural and forested catchments. He also founded the MSc programme in Hydrology offered at the University of Freiburg.

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Keynote 2: Measuring and attributing greenhouse gas emissions in complex urban landscapes

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More than 50% of the global population and 80% of Canadians live in cities. Cities are 'hot spots' for greenhouse gas (GHG) emissions and also key areas for reduction efforts. Although economic fossil fuel inventories at coarse scales can provide accurate national and provincial emissions estimates that can be downscaled — there is growing interest to constrain and quantify GHG emissions at urban and intra-urban scales. Measurements of GHG emissions in the urban atmosphere have the potential to (i) validate fine-scale emission inventories and models, (ii) determine realistic emission factors, (iii) identify and quantify poorly-known sources (e.g. gas leaks), and (iv) account for the effects of urban land-cover change — all at the scale of decision making and planning. Developing and improving techniques for directly measuring GHG emissions into (and uptake from) the urban atmosphere, however, requires us to combine atmospheric data, various models, and surface databases.

This keynote presentation will focus on measurement approaches we developed at UBC, and tested in the city of Vancouver, Canada, with the aim to highlight the potential of atmospheric measurements to quantify and attribute GHG emissions in cities at various scales. We start with exploring whether boundary layer budgeting approaches, using sensors on balloons, can be used to quantify and temporally resolve anthropogenic carbon dioxide emissions from the entire urban region and compare results against municipal inventories. We then show how we can exploit data from direct eddy covariance flux measurements on towers in cities to determine fleet-scale emission factors. Next, we will ask the question whether stable isotope ratios in emitted greenhouse gases add additional information on fuel sources?. Finally, we will explore the potential of mobile sensor-networks to spatially map and quantify CO_2 emissions at block and street level using low-cost sensors on car-sharing vehicles. In summary, the application of established and the development of new techniques to map, quantify and attribute emissions in complex configurations poses challenges but also great opportunities to contribute to urban system science. We conclude that similar methods should be used to characterize emissions in otherwise complex and transient landscapes — from GHG exchange in wetlands in the Canadian Arctic, attacked or disturbed forests, to patchy agricultural landscapes.

Bio: Andreas Christen is Associate Professor in the Department of Geography and in the Atmospheric Science Program at the University of British Columbia in Vancouver. He obtained a PhD in Meteorology (2005) from the University of Basel (Switzerland), worked as post-doc at the Technical University of Berlin (Germany), and was visiting professor at the École Polytechnique Fédérale de Lausanne (Switzerland, 2012-13).

Andreas works on methods to quantify and model interactions of energy, water, and trace-gases between complex and three-dimensional land surfaces and the atmosphere – studying flow and turbulence studies and biogeochemical cycling. His group develops tools to attribute trace-gas and energy exchange in complex land configurations, including microscale dispersion modelling, high frequency thermal imaging, stable isotope approaches, and urban mobile sensing. Andreas is an Editorial Board Member of *Boundary-Layer Meteorology* and *Theoretical and Applied Climatology*, and a co-author of the urban climatology textbook *Urban Climates* (Cambridge University Press, 2017).

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