Session A New perspectives in hydrology

Prof. John Selker / A critical role of transgenerational teams in advancing hydrological measurements

While thousands of new micro-sized sensors have been marketed, telemetry has become ubiquitous, and 3-D printing makes short-run production accessible to millions, we must wonder why water resources instrumentation is slow to change, to a large degree static for 20 years. We have had a culture of individuals making new sensor systems for their own work, which have not translated efficiently to the research community or industry. To break this cycle we need to create an efficient approach to design development which includes a collaborative exchange of innovations. Environmental sensing is a challenging field with respect to energy management, sensor selection and maintenance, and data collection and telemetry. At the OPEnS lab (Open-Sensing.org) for 6 years we employ 30 undergraduate engineers in teams that span ecological, electrical, mechanical and computer engineering who develop new sensor systems, and are trained in the challenges of this undertaking. With 8 student-led publications and a patent applied for, we think the OPEnS model demonstrates a way forward for your community, addressing both the short-term and long term needs for new sensor systems for water resources.

Prof. Efrat Morin / Floods in a warming climate: what are the missing puzzle pieces?

As the climate becomes warmer globally, precipitation patterns are changing and, consequently, altering flood regimes. Resolving the expected changes in flood properties requires examining projections of precipitation features most correlated with floods. While the redistribution of mean annual precipitation amounts is generally known (and described by the "dry gets drier, wet gets wetter" phenomenon), the trends in many other essential factors controlling floods are yet to be resolved. For example, flash flood magnitude is known to be very sensitive to space-time rainstorm properties such as areal coverage or storm speed. Still, knowledge of how these properties are affected by global warming is lacking. Maximal rain rates for duration relevant to the watershed's response time are also crucial parameters controlling the

flood discharge. There is some understanding of how extreme rain rates change, but the magnitude and sign depend on the duration. Thus, different watersheds may respond differently to global warming. Changes in the intra-seasonal distribution of precipitation events can also affect flood regimes through their effect on pre-storm soil moisture.

Prof. Petra Doell / Global-scale quantification of drought hazards

Droughts pose significant risks to humans and ecosystems, and their severity is expected to increase in large parts of our planet due to climate change. Global hydrological models (GHMs) compute time series of water flows and storages for all land areas of the globe, which enables the computation of drought hazard indicators for historic periods, near-real time and the future. In particular, GHMs can be used to quantify soil moisture, groundwater and streamflow drought hazards and thus support our understanding of drought risks, which are a function of hazard, exposure and vulnerability. However, there are a myriad of drought hazard indicators, and a systematic approach for guiding the selection of drought hazard indicators for characterizing specific drought risks is lacking. In this presentation, I will present a new classification for streamflow drought hazard indicators, where, for example, the assumed habituation to streamflow variability is taken into account. In addition, I will present global maps of drought hazards and risks based on different indicators.