

ICSIH Annual Report to IAHS Bureau

July-14, 2020; Dr. Tobias Jonas, ICSIH President



1. Introduction

ICSIH, the International Commission on Snow and Ice Hydrology, continues to promote the scientific study of the processes of snow, permafrost and ice dynamics, the interactions between snow, permafrost, ice and ecosystems, and impact of snow, permafrost and ice on runoff generation, rivers and lakes, with an emphasis on the seasons and regions where the solid phase of water and its subsequent runoff are prevalent.

Cold regions are particularly responsive to changing environmental conditions, and small shifts can result in hydrological regimes that have not been observed in the past. Key to improve our understanding of the involved complex and interacting processes is collaboration, both geographically and across disciplines.

ICSIH maintains a network with many organizations acting in the field of cryospheric sciences. ICSIH strives to integrate the communities' effort within IAHS, enabling us to foster exciting research at the interface between cryospheric and hydrological sciences.

Our full mission statement is available under iahs.info/uploads/Commissions/ICSIH/ from our 2016 annual report.

2. Organization

Since the 2019 election, the new ICSIH Bureau is composed of:

- President: Dr. Tobias Jonas, WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland
- President-Elect: Dr. Melody Sandells, Northumbria University, Newcastle, UK
- Vice-President: Dr. Timothy Link, University of Idaho, Moscow, USA
- Vice-President: Dr. McKenzie Skiles, University of Utah, Salt Lake City, USA
- Vice-President: Dr. James McPhee, Universidad de Chile, Santiago, Chile
- Secretary: Dr. Vsevolod Moreido, Russian Academy of Sciences, Moscow, Russia
- ECC representative: Dr. Elzbieta Czyzowska-Wisniewski, University of Arizona, Tucson, USA

3. ICSIH Activities 2019-2020

ICSIH has continued to promote SIH related science. As detailed below, ICSIH has been involved in several scientific meetings, and has particularly settled an agreement to host the third edition of the International Conference on Snow Hydrology in 2022. We are further committed to promote the study of ICSIH topics, are in the process of publishing a third article in our series of short papers, and are motivated to assemble a ICSIH volume within IAHS's *Benchmark Papers in Hydrology* series.

3.1 Involvement in Scientific Meetings (reporting year + future meetings)

a) IUGG General Assembly, July 8-18, 2019, Montreal, Canada

ICSIH was involved in 4 sessions, which received 86 abstracts in total. The full program including the session descriptions is available online at <http://iugg2019montreal.com/h.html>

- H17 – Advances in Snow Hydrology
- H18 – Advances in Remote Observation of Seasonal Snow
- JC04 – Declining Glaciers and Snow Cover and Their Impacts on Downstream Hydrology
- JC08 – Coupling Processes Between the Atmospheric Boundary-Layer and Snow/Ice

b) International Conference on Snow Hydrology #2, January 28-31, 2020, Bolzano, Italy

ICSIH has sponsored the second edition of the International Conference on Snow Hydrology. We have been involved in shaping scope and format of the conference, were represented in the scientific committee (T Jonas), and officially listed as a supporting organization. The meeting has been a very interesting gathering of snow hydrologist, which fortunately happened before the covid-19 outbreak caused many meetings to be cancelled. SnowHydro2 featured about 90 presentations organized in sequential (non-parallel) sessions over the course of 3 days. The meeting program is available from <https://snowhydro.eurac.edu/>. ICSIH will lead the organization of SnowHydro3 in 2022 (see below)

c) IAHS Scientific Assembly, June 28 – July 2, Montpellier, France

ICSIH is involved in 3 session proposals that have been submitted to the IAHS bureau for further consideration. We have particularly considered inter-commission proposals and broad / inclusive rather than specific topics. The ICSIH sessions are listed below

Cold region runoff and groundwater change

Changes in the storage and delivery of water impact society. Cold regions are particularly susceptible to the effects of climate change so it is crucial to understand and plan for likely future hydrological changes in these regions. Changes in the timing and amount of meltwater release from snow and ice have implications for ecosystems and communities that depend on this water supply. Melting of permafrost can further lead to both ecosystem changes and infrastructure instabilities and damage. Due to the importance of this topic, 'How will cold region runoff and groundwater change in a warmer climate?' was selected as one of the key 23 unsolved problems in hydrology (UPH). This session will bring together experts in cold regions hydrology, climate change, biogeosciences, remote sensing, and groundwater research to address this UPH.

Organized by: ICSIH, ICGW, ICCLAS, ICWRS, ICRS

Convenors: Mel Sandells (ICSIH), Felipe De Barros (ICGW), Fuqiang Tian (ICCLAS), Gökçen Uysal (ICWRS), María J. Polo (ICRS)

Advances in snow and ice hydrology

Storage and release of water from seasonal snowcovers and glaciers constitute critical components of the hydrological cycle in many parts of the world. Quantifying, understanding, and predicting the processes that control distribution and ablation dynamics of snow and ice provide ample research challenges, especially in complex mountainous terrain. Snowcover and glacier dynamics are influenced by surrounding topography, vegetation and other land surface characteristics that control accumulation and redistribution processes, as well as local micrometeorological conditions that control energetics and ablation. Accurate modelling of snow and ice melt dynamics requires methods to simulate a large range of physical processes that act and interact at a range of spatial and temporal scales. Advances in these areas are needed and relevant to develop improved tools for water managers concerned with floods, droughts, water supply, hydropower generation, and climate change impacts. This session will bring together experimental and modeling experts to address recent research in snow and ice hydrology.

Organized by: ICSIH

Convenors: ICSIH bureau

Snow-melt driven erosion and sediment pathways in Polar regions

Snow and ice melting in Polar regions are associated with dramatic changes in the hydrological regime and significantly enhance erosional processes. It is apparently the most important driver of the hydrological cycle of Polar rivers which dominates the fluxes of dissolved and particulate substances from land to the Arctic Ocean. The session aims to present studies which are devoted to mass transport phenomena in polar regions that are associated with snow and ice melt such as continental erosion, sediment transport and water quality issues within the freshet period. The session will further address organic matter delivery into rivers due to permafrost thaw.

Organized by: ICCE, ICSIH

Convenors: Sergey Chalov (ICCE), Vsevolod Moreido (ICSIH)

d) Cryosphere 2021, Sept 27 – Oct 1, Reykjavík, Iceland

ICSIH helped develop format and content of a session on snow and ice hydrology. The session will comprise three sets of paired speakers, with one scientific presentation and one policy and/or societal implications presentation in each pair. Two pairs were identified and approached either directly or indirectly prior to rescheduling of this conference to 2021. The third pair of speakers will come from the open call for abstracts. The session description is:

Snow and Ice as a Water Resource

Snow, a defining characteristic of high latitude and high-altitude regions covering land and ice surfaces, is a cross-cutting component of the cryosphere that influences surface water and energy fluxes, atmospheric dynamics and weather, biogeochemical fluxes, and ecosystem dynamics at local to global scale. On average, snow covers 46 million km² of Earth's surface each year and is thus the largest single component of the cryosphere in terms of area. Fall- and winter-snow cover in the Northern Hemisphere has increased moderately since 1967, whereas a declining trend is observed in spring and summer. Modelling studies suggest that snow cover will decrease in area during this century, decreasing the planetary albedo and, hence, amplifying the initial warming. Ongoing improvement of our knowledge of snow processes and the temporal and spatial changes of snow-cover variables and solid precipitation is essential to meet current and future operational and policy needs, including weather and climate prediction, hydrological forecasting and climate-change detection.

Organized by: ICSIH, Global Water Futures, UNESCO-IHP

e) International Conference on Snow Hydrology #3, February, 2022, Grenoble, France

An idea at the time of SnowHydro #1, a plan when shaping SnowHydro #2, and now set in stone: ICSIH will organize SnowHydro #3. With a similar format as the previous 2 meetings, the conference is scheduled for Early February 2022 and will likely take place in Grenoble, date and place to be confirmed very soon.

3.2 Publications

a) UPH publication:

ICSIH has supported the UPH initiative from the beginning and was actively involved in the process of identifying open research problems. PE Mel Sandells and VP Tim Link are co-authors on the first UPH paper, published Jul 2019 (available at <https://www.tandfonline.com/loi/thsj20>)

b) ICSIH articles:

As reported previously. ICSIH has started a series of short methodological and/or opinion papers to be published online. These papers are aimed at people who only occasionally deal with snow and ice hydrology, intended to outline basic concepts, provide insights on current methods, and point at interesting open-source tools. Published in Aug 2019 (and available from our webpage), Tim Link and Daniel Marks (both ICSIH) provided an opinion paper on “Understanding strengths and limitations of temperature-index snowmelt models”.

Our latest paper is by Dr. Richard Essery (IACS) on “Understanding physically based snowmelt models”. In his article Dr. Essery illustrates the model concept, presents some instructive modelling examples, and provides a guide to “do it yourself”, including links to open source model code and exemplary driving data. His paper is in ICSIH review and will be published on the ICSIH webpage shortly.

3.3 Other activities

a) Benchmark Papers in Hydrology on Snow and Ice Hydrology

ICSIH has decided that it would like to work towards a Volume on snow and ice hydrology within IAHS’s *Benchmark Papers in Hydrology* series. However, to be in line with our mission statement, and to facilitate reaching out to students who are unlikely to buy an expensive and heavy hardcopy, ICSIH require that papers in the volume are also available online / electronically. Obviously, this would require acquisition of respective copyrights. We have contacted IAHS several times and sent examples of papers that are likely to be found in such a volume to allow investigating copy right issues. This initiative was started last winter but due to Covid-19 and other factors we are still awaiting feedback from IAHS. We are willing to edit / assemble such a volume, but would need IAHS to deal with the logistics, legal, and financial aspects of the undertaking.

ICSIH Bureau, July 2020