

International Network for Alpine Research Catchment Hydrology, INARCH – part of the Global Energy and Water Exchanges Project, World Climate Research Programme



- INARCH was approved as a Cross-cut Project by the GEWEX Hydroclimate Panel at Pasadena, California in December 2014
- INARCH provides mountain snow and ice water security information for UNESCO's International Hydrological Programme
- INARCH's objective is to better understand alpine cold regions hydrological processes, improve their prediction, diagnose their sensitivities to global change and find consistent measurement strategies.
- INARCH held its inaugural workshop at Kananaskis, Alberta in October 2015, which was attended by 30 scientists from Canada, US, China, Nepal, Chile, UK, Spain, France, Germany, Switzerland and Austria.
- INARCH will hold its next scientific activity as Poster Session C33A & Oral Session C43F, "Improved Understanding and Prediction of Mountain Hydrology through Alpine Research Catchments", on 16-17 Dec. 2015 at the American Geophysical Union Fall Meeting in San Francisco, California.
 - <https://agu.confex.com/agu/fm15/meetingapp.cgi/Session/8067>
 - <https://agu.confex.com/agu/fm15/meetingapp.cgi/Session/10888>

INARCH in Alberta, Canada Oct 2015



INARCH Workshop 2015

Observations and Data



- Observations – INARCH recognises the value of existing mountain observation stations and encourages increased numbers and improved quality of stations on high mountains to provide understanding and warning of the impacts of climate on downstream water resources. INARCH recognises the urgent need to reduce measurement uncertainty – it will contribute to WMO’s SPICE and CRYONET and then implement SPICE and future CRYONET findings in correcting observations at INARCH observatories.
- Data – INARCH supports documentation of metadata on observatories and publication of specialised observational data. Our webpage will point where to find specialized data and metadata for sites and include the originator’s assessment of the fitness use of the data. INARCH will organize a mountain data publication special issue.
- *In order to provide warning of the impacts of climate on downstream water resources, INARCH finds an urgent need for enhanced mountain hydrometeorological and cryospheric observations with open availability of data, and reduced measurement uncertainty. INARCH has identified a series of mountain hydrometeorological observatories around the world that address this need, and will promote enhanced mountain observations, and data publication for these observatories.*

INARCH Workshop 2015

Uncertainty and Models



- Uncertainty – INARCH notes that uncertainty derives from measurements, scaling and models, and that model uncertainty includes structural, parameterisation and parameter facets. Uncertainty can be identified and reduced via catchment classification, improved physics, appropriate model complexity, model comparisons. Model comparisons need to be informative, multi-year, multi-climate and multi-site and should be expanded to include forests, slopes, glaciers, the alpine basin scale and include ice, streamflow and subsurface processes.
- Downscaling & Assimilation. Downscaling atmospheric models appropriately is difficult yet crucial in mountains. INARCH will develop a “mountain downscaling toolbox” of various methods that can be applied in mountains. Comparisons of downscaling methods are needed. New satellite, drone-based and ground-based data assimilation methods need to be evaluated.
- Models. INARCH supports the integration of atmospheric, cryospheric and hydrological models in mountains. The headwaters catchment should be recognised as the fundamental modelling unit within which are important horizontal and vertical mass and energy exchanges. Model structure, parameterisation, and parameter identification need multiple year data from a range of sites and environments.
- *INARCH notes that despite the substantial predictive skill shown, there is a need to identify and reduce uncertainty in application of mountain atmospheric, cryospheric and hydrological models. The understanding developed using mountain hydrometeorological observatories can help accomplish this by improving the capability and range of downscaling methods to drive models, improving exchange processes with frozen surfaces, and integrating atmospheric, cryospheric and hydrological components to consider impacts of dynamic climate and transient vegetation and hydrological and cryospheric storage at various scales.*

INARCH Workshop 2015

Climate Change



- Changing Mountain Hydrology – INARCH notes that mountain snow and ice resources are diminishing rapidly in most regions of the Earth due to rising temperature-driven energy and mass exchange processes including several positive feedback mechanisms such as dust and vegetation change. Streamflow and water storage are impacted by the changing cryosphere, but show a broader range of dampened or enhanced responses depending on the catchment topography, cryospheric state, vegetation and climate.
- *INARCH will observe and diagnose mountain climate, cryospheric and hydrological change and explore the changing prospects for mountain water resources through diagnostic modelling experiments using our instrumented catchments from around the world, paying particular attention to the impact of loss of snow and ice on hydrological cycling. This will help quantify and improve the prognostic potential of these models for predicting the water security impacts of global change in mountain regions.*



INARCH Workshop Statement

- *GEWEX's INARCH is launched and has broad participation and support from scientists studying mountain regions around the world.*
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