B A C K G R O U N D E R

What is IP3?

IP3, or Improved Processes and Parameterisation for Prediction in Cold Regions, is a network of researchers that focuses on advancing our understanding and description of land surface hydrometeorological processes in cold regions (northern latitudes and high altitudes) and on improving the parameterization and predictive capacity of Canadian atmospheric and hydrological models at small to medium scales in cold regions.

The IP3 Network is headquartered at the University of Saskatchewan and includes researchers from across Canada. IP3 is a component of the International Polar Year (IPY) and the International Decade for Prediction in Ungauged Basins (PUB). John Pomeroy is Lead Researcher. For more information: www.usask.ca/ip3.

What does IP3 study?

The scientific objectives of IP3 are:

- To improve our understanding of cold regions hydrometeorological *processes* and their interactions with the atmosphere, hydrological system and biophysical properties of the surface;
- To improve the mathematical *parameterization* of cold regions processes for small to medium scales;
- To evaluate and demonstrate improved *prediction* of hydrological and atmospheric fields at regional and smaller scales in the cold regions of Canada under varying land cover and boundary atmospheric conditions.

Why is this important to Canada?

An increasing number of activities are taking place in Canada's cold regions, and the thorough understanding provided by IP3 is essential to ensuring those activities thrive. In general, issues faced in cold regions include water shortage in some areas and at some times of the year; flooding in other areas and at other parts of the year; and a difficulty in predicting how water behaves to produce these conditions, especially under different climate change scenarios.

Natural resources industries: Oil-and-gas and mining operations are pivotal economic activities to many communities located in cold regions. However, cold regions do not behave the same way as the warm regions that industries have traditionally used. It is important to understand and predict the way water moves around in cold regions, therefore ensuring that billion-dollar engineering and infrastructure can withstand the hazards posed by cold regions. IP3 will generate the understanding that will inform industry leaders and governments as to the standards and procedures to use for design of infrastructure such as roads, pipelines and bridges, and provide guidance to local authorities for land use and watershed planning.

*Environmental effects of industries***:** Industries, such as mines, oil-and-gas drilling sites and others, must understand hydrology so as to minimize their impact on the environment while in operation. For example, tailings pond design must take into account potential water inflow to avoid the possibility of a spill of toxic liquids. At the same time, it is important to clean up the toxins and other materials upon closure. IP3 has already generated a hydrology model that helps industry leaders understand the water-borne movement of toxic chemicals in the ground, which allows them to target their efforts in the most efficient way.

*Communities***:** An increasing number of people and communities are dependent on the water of the Rocky Mountains. IP3 will produce knowledge that will allow city planners and watershed managers to plan for and predict the amount of water available to them for drinking, sewage systems and other municipal uses. Knowledge of how water in cold regions acts is also pivotal to the planning of safe and robust roadways and water management systems that can withstand the annual discharge and peak flows of water in mountain and northern communities.

Agriculture: As one of Canada's leading industries, agriculture is dependent upon a predictable and reliable water supply for irrigation and most of this water in western Canada comes from the mountains.

What are "hydrometeorological processes"?
Hydrometeorological processes are those that lead to the development of precipitation (e.g., snow and rain) and determine its distribution and form (e.g., packed snow, run-off water, open water in the form of small lakes, permafrost) on the ground. In simpler terms, these are processes related to surface water and weather systems.

Hydrology is study of water occurrence, distribution, movement and balances in ecosystems.

What are "cold regions"?
"Cold regions" are those regions that are either of northern latitudes – up North – or high altitudes – the high elevations of mountains. Temperature drops and snowfall increases compared to rainfall with both altitude and latitude. It is important to remember that areas in the Rocky Mountains count as cold regions because they are high up in terms of altitude.

IP3 is focusing on Canada's Rocky Mountains and the western Arctic regions.

What are "biophysical properties of the surface"?
These are living and non-living components, such as soil or permafrost, trees, plants and animals, that impact the way water travels and is used on the surface. For example, soil absorbs water while ice-rich permafrost lets it run-off the surface of the ground. Compared to clearcuts, meadows and beetle-killed stands, mountain evergreen forests reduce water run-off as they hold (intercept) snowfall in their canopies where it evaporates back to the atmosphere and they also slow the rate of snowmelt by blocking sunlight and warm winds.

These properties are important because they ensure a proper balance of water intake, absorption and run-off in the watershed. The watershed vegetation, wildlife and aquatic species have evolved to this natural hydrology. When the natural hydrology changes, the water balance changes as well – this can cause flooding or water shortage, and other hazards. This in tern affects the ecosystem in the watershed in what is most often a negative way.

What is "mathematical parameterization"?
Otherwise known as modeling, this is the process of describing the processes at work in nature in mathematical terms. This helps scientists understand how the processes work over a watershed, and allows them to apply different scenarios to those processes, which helps predict how those processes react under different conditions such as a changing climate or mountain pine beetle infestation.

What is the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS)?
The Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) is the main funding body for university-based research on climate, atmospheric and related oceanic work in Canada. It provides research grants through a competitive (peer-reviewed) process. Its current mandate extends to March 2011.

CFCAS is funding IP3 with a $2.5 million investment from 2006-2010.

What is the Wilfrid Laurier University Cold Regions Research Centre?
The Cold Regions Research Centre was established in 1988. The CRRC evolved from a multidisciplinary research and training project on Snow and Ice Hydrology in the Karakorum Himalaya that was based in Wilfrid Laurier's Geography Department. The Centre's initial focus was on arctic and mountain glaciology but since 1990 the scope of research has broadened to also encompass hydrology, geochemistry, resource management, parks planning, anthropology, history and social work in Cold Regions.

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