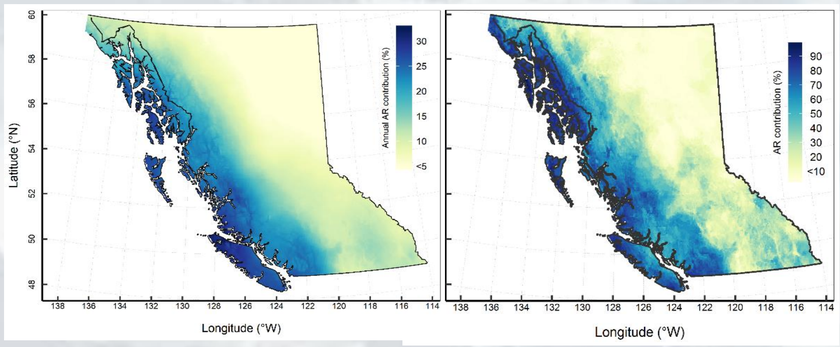
Mountain Water Futures

Managing Uncertain Water Futures in Canada's Mountain West

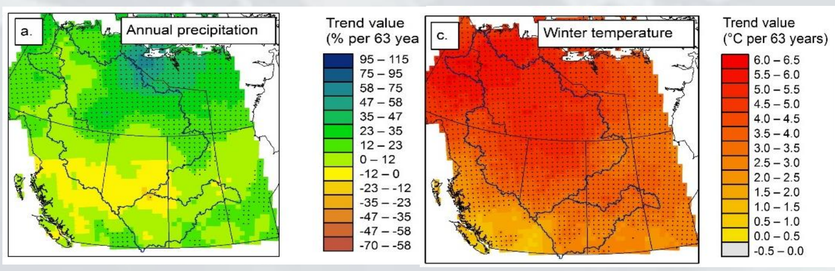
Rapid climate and hydrological changes detrimentally impact Canada's western mountains, and user communities struggle to understand and adapt to this new reality. The project goal, which arises from the needs of government, hydropower generation, parks, agriculture, industry, and recreation is to improve our ability to predict future hydrological regimes, and plan appropriate adaptations in Canada's western mountains. Therefore, the objectives of Mountain Water Futures are:

- **Improve our ability to predict future hydrological regimes, and plan appropriate adaptations in Canada's western mountains**
- **Provide users and stakeholders across a range of sectors with better information, tools and techniques to manage uncertain water futures**

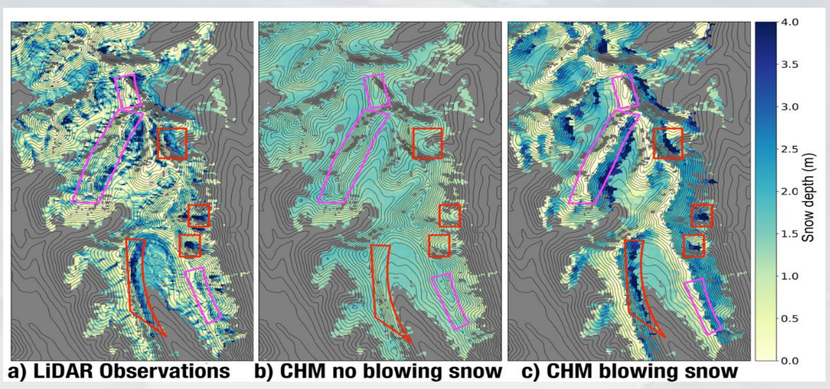
Improving Disaster Warning



Understanding the role of atmospheric rivers in extreme precipitation events can help predict the timing, intensity, and severity of extreme events, with the goal of reducing potential impacts.

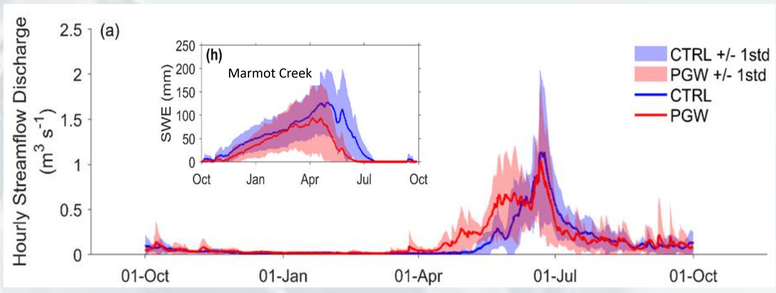


Temperature and precipitation changes, particularly in the winter can have direct impacts on the timing and magnitude of snow accumulation, rain-on-snow events, and spring melt will have direct impacts on flooding, fire, and avalanche risk.

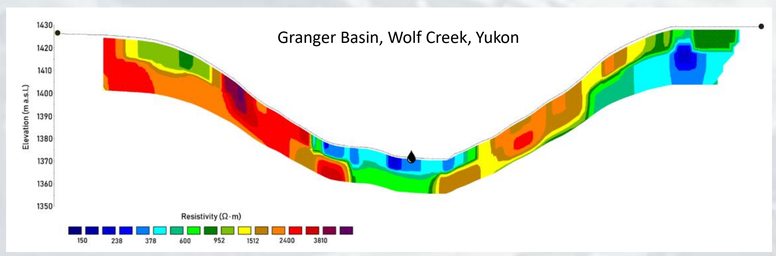


Improved process representation in models aid our ability assess water resources in a changing climate.

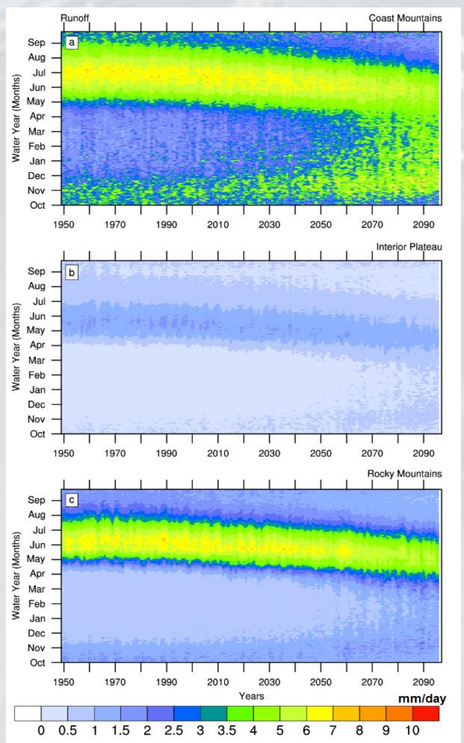
Predicting Water Futures



Future changes are being diagnosed using WRF in a pseudo-global warming approach across a range of watersheds.

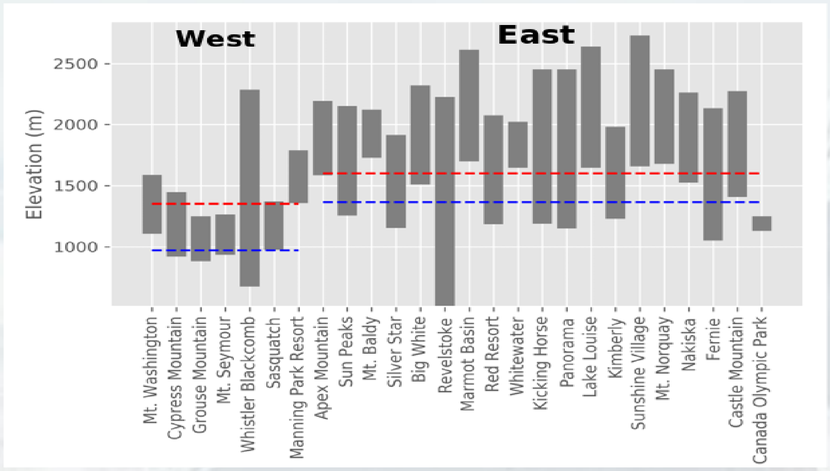


Permafrost disposition and degradation in the mountains is difficult to quantify. We are using geophysics and thermal models to predict future changes to the status of frozen ground.

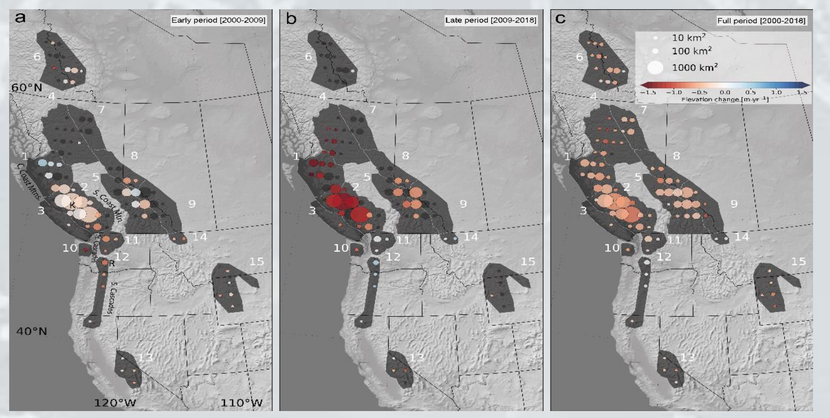


Modeling daily mean runoff to predict cold season runoff events. Runoff increases by 55% in the Coast Mountains by the 2080s (relative to the 1990s), as major runoff events are projected to increase in the cold season.

Adapting and Managing Risk

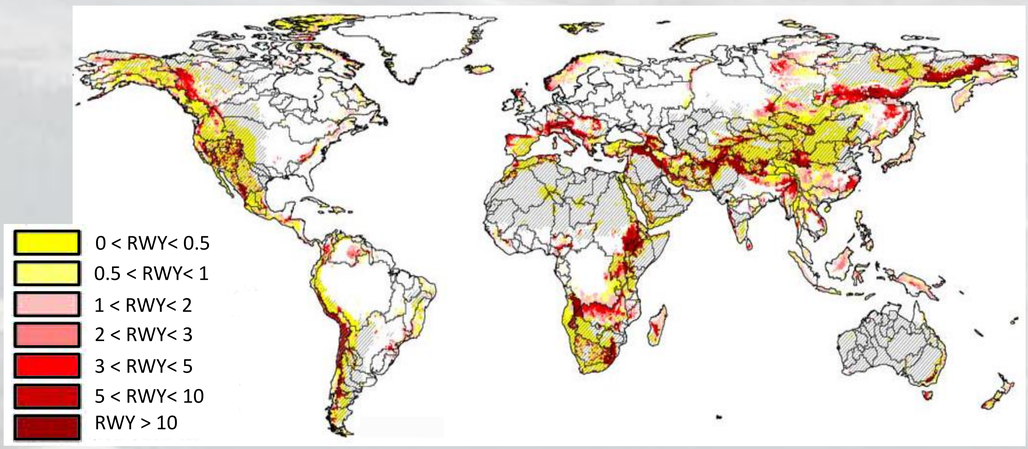


Helping industry prepare for uncertain water futures; elevation ranges (MSL) from ski resort bases to their mountain summits (gray bars) and average heights of transition regions during the 2010 Olympics (blue dashed) and under projected (red dashed) climate simulations.



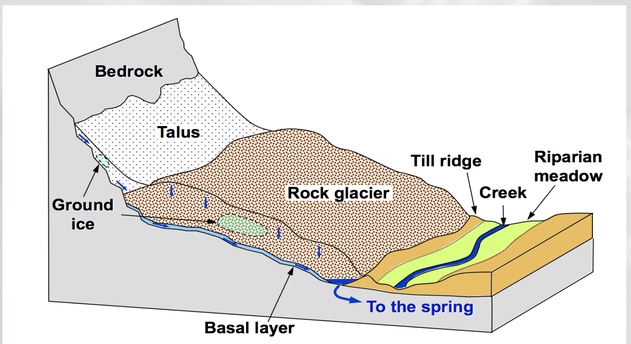
30,000 multi-sensor spaceborne stereo satellite images were used to extract trends in elevation through time for over 99% of North American glaciers excluding those in Alaska and ice that straddles the Alaska-Canada border. Mass change for the region averaged 6.49 +/- 2.32 Gt/yr over the last 18 years. Rates of mass loss over the last decade increased fourfold relative to first decade of the 21st century. This information is critical for future water management and risk planning.

Mountain Water Futures Contributions to United Nations Sustainable Development Goals



6.1: ~40% of world's population relies on mountain rivers for access to fresh water. Future security of alpine water sources is critical for ensuring safe drinking water for all (Viviroli et al. 2007, *Water Resour. Res.*, 43, W07447)

6.4: Integrating atmospheric, hydrological, and ecological processes in modeling to predict future hydrological regimes. Understanding controls on alpine river discharge will be critical for ensuring sustainable usage and reducing water scarcity



6.6: By studying hydrological processes across a range of altitudes, ecological settings, and latitudes we can further our knowledge of key components of alpine hydrological regimes to protect and preserve.

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