# The effects of climate change and land use on basin hydrology: a review of major forcings affecting water balance

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## Abstract

There is clear evidence that the earth's climate is changing. The average temperature is rising at an alarming rate, and the occurrence of extreme weather events seems to be increasing. Although rising temperatures have been correlated to increasing atmospheric $CO_2$ levels, evidence exists in the paleo-records for natural warming and cooling cycles related to other external drivers (e.g., celestial forcings and global feedback mechanisms). The role of short-term (ENSO) and decadal-scale (PDO) climate tele-connections and the related effects to major storm tracks is gaining attention as the effects of these natural phenomena on the water balance of major catchments can be significant.

The southern portion of Western Canada represents some of the driest country in Canada. The reason for this relates to geographic position and the resulting effects on precipitation. A contributing factor to the scarcity of water is that most of is drained from the area by major rivers. As such, the need to store water is greater than in other parts of the country. High potential evapotranspiration rates play a significant role in water availability, implicating land use practices as a possible contributing factor to deficit soil moisture conditions. Together, climate change and land use practices work to amplify the effects on the water resources of major basins, both for surface water and groundwater. As a result, water-short areas of Canada are highly vulnerable to droughts and the associated environmental, economic and societal repercussions.

The effects of climate change on the hydrological cycle are of utmost concern to water resource managers, especially in areas prone to moisture deficits. Understanding the role of land use on a local and regional scale is also key to achieving the goal of water resource sustainability. Going forward, adaptive management strategies will form an important means to maintaining the viability of climate sensitive areas of Canada and the rest of the world.

*Key words: climate, hydrology, groundwater, adaptation*

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Jon's areas of specialization include physical hydrology and hydrogeology, environmental forensics, isotope geochemistry, and groundwater resource evaluation. Much of this experience has gained in the various Oilsands regions of Alberta and southern basins. Over the last few years he has been involved in assessing the effects of climate change and land cover changes on basin-scale hydrology, and has been working to develop effective management strategies for water resource sustainability.