Hydrology and climate change in northern Ontario

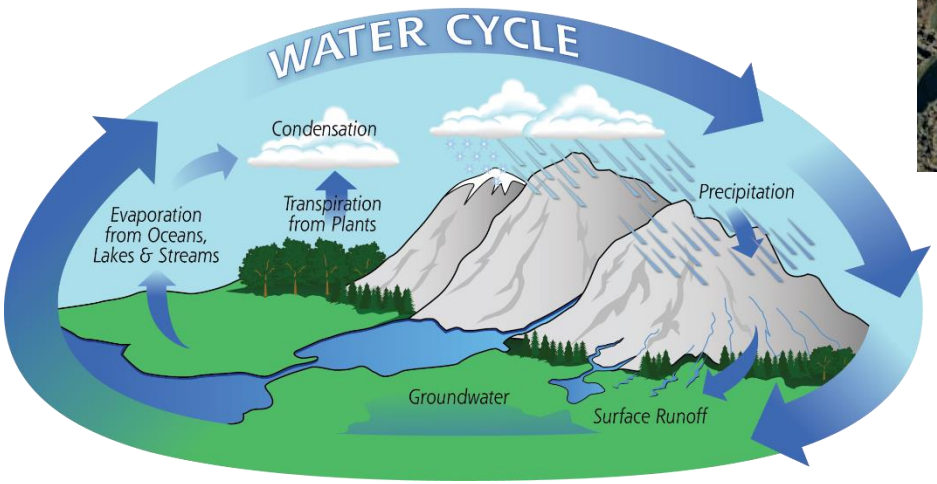
Up North on Climate

Thunder Bay, Ontario · 25 April 2018

Halya Petzold, Regional Hydrologist (MNRF)

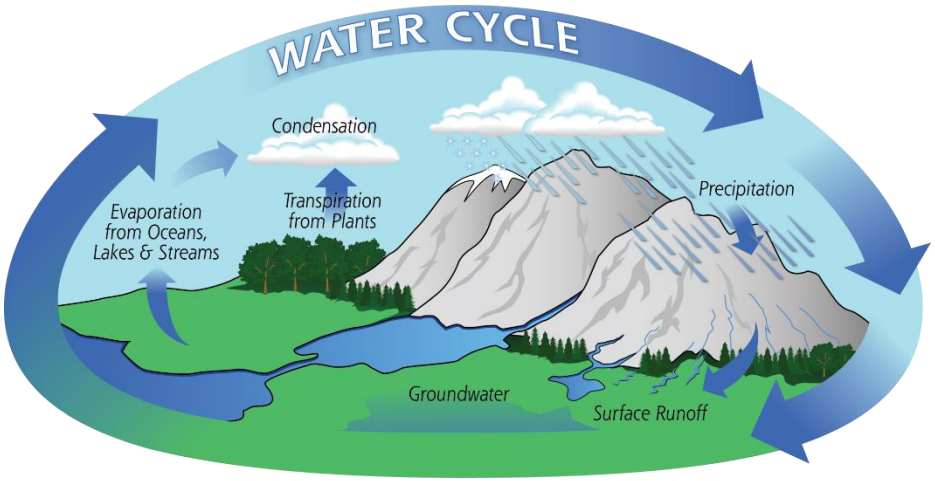
The importance of local observations in detecting hydrologic change in the north

Northern Ontario's unique landscapes:



The importance of local observations in detecting hydrologic change in the north

Some of hydrology's most studied landscapes:



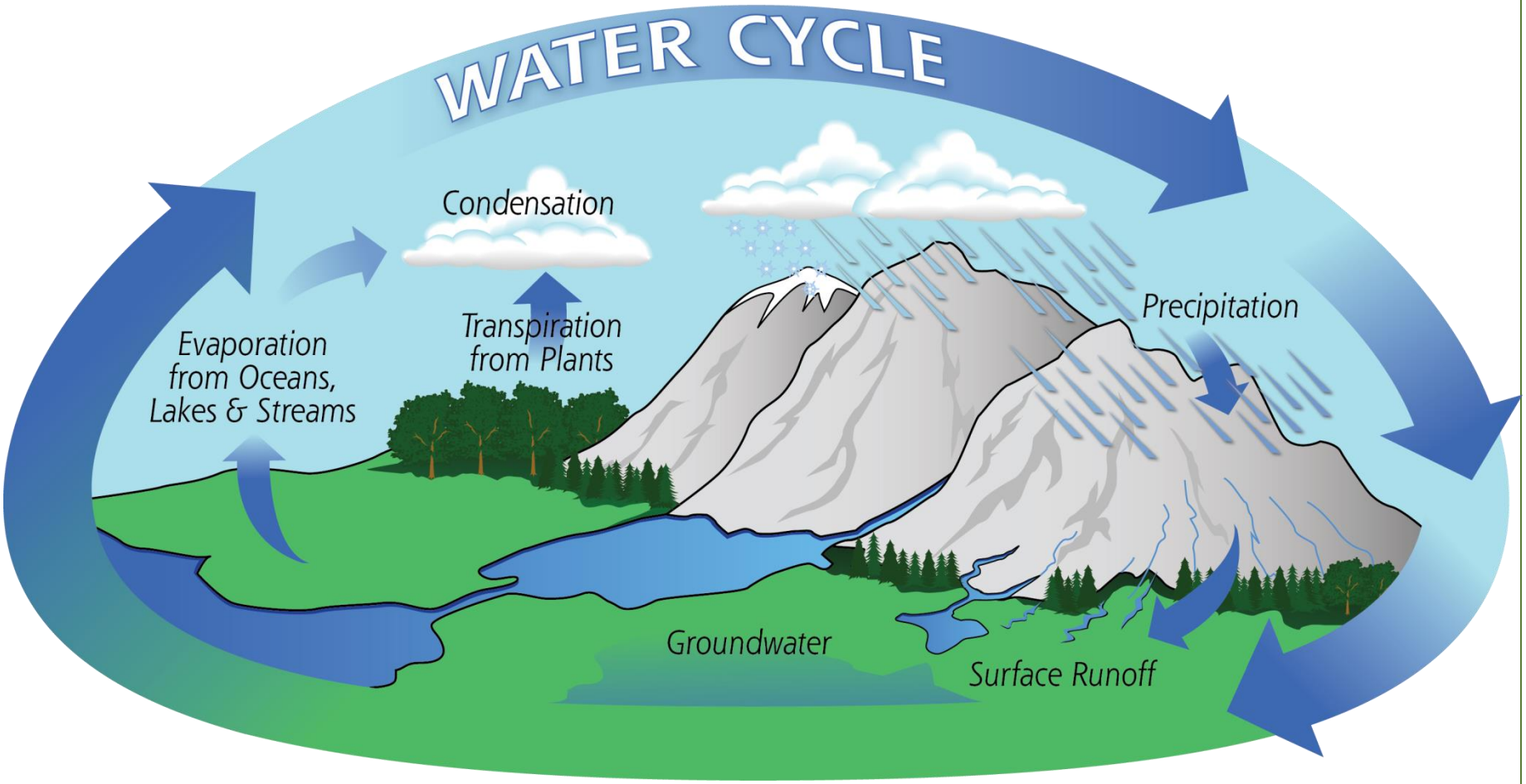
Delaware Rive
http://www.regionalplans
ms-and-issues/planning

US)
gram/our-scientists/dr-

obard-brook-watershed

Sleepers River (Vermont, US)
http://herwinda.cf/post/us-geological-survey-water-resources-education

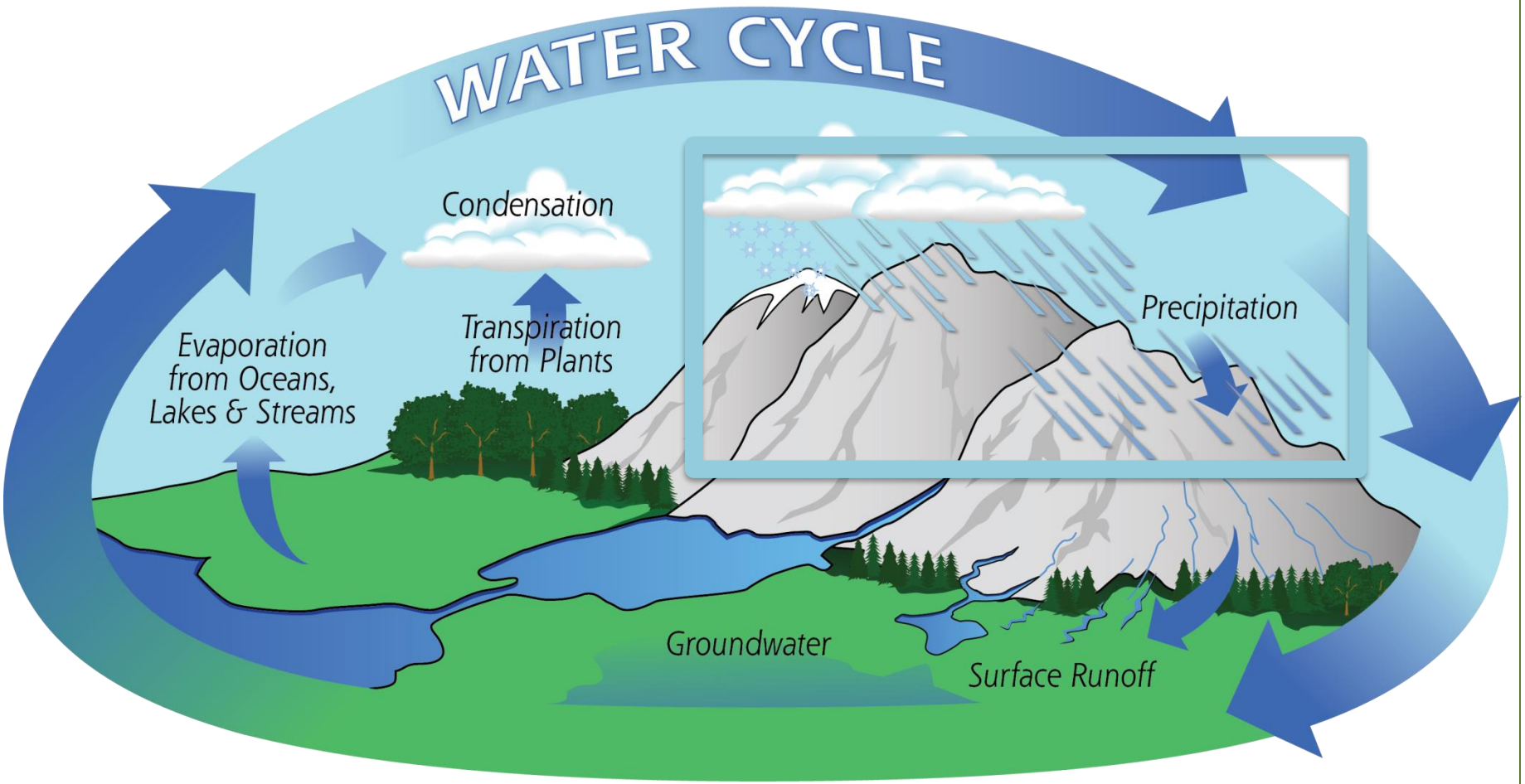
The water balance



Climate change impacts all aspects of the water balance

Runoff = Precipitation – Evaporation **+** ∆Storage

Precipitation



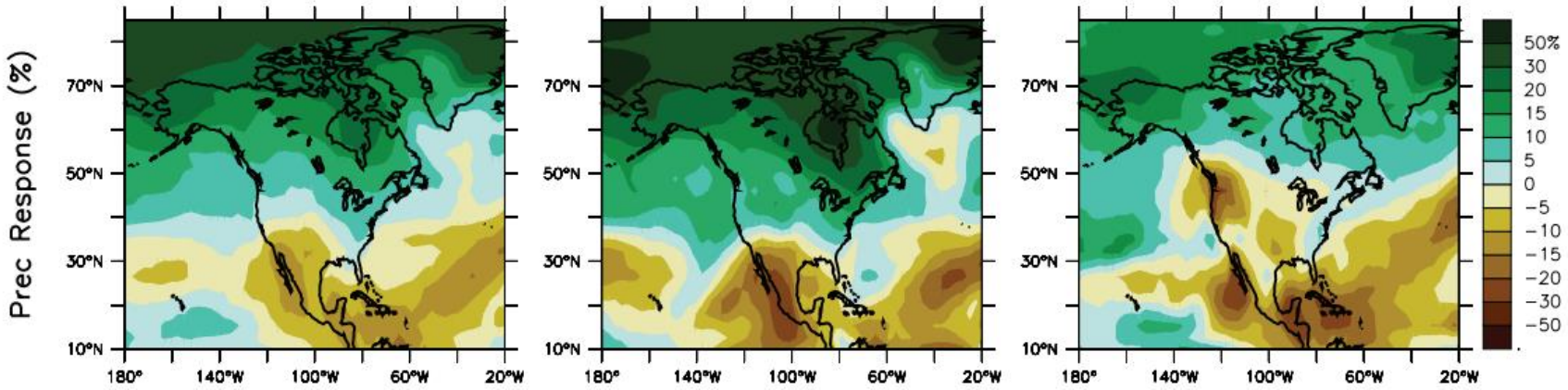
Precipitation

Expectations:

- Increase in number, frequency, and intensity of heavy precipitation events
- Increase in total seasonal precipitation?

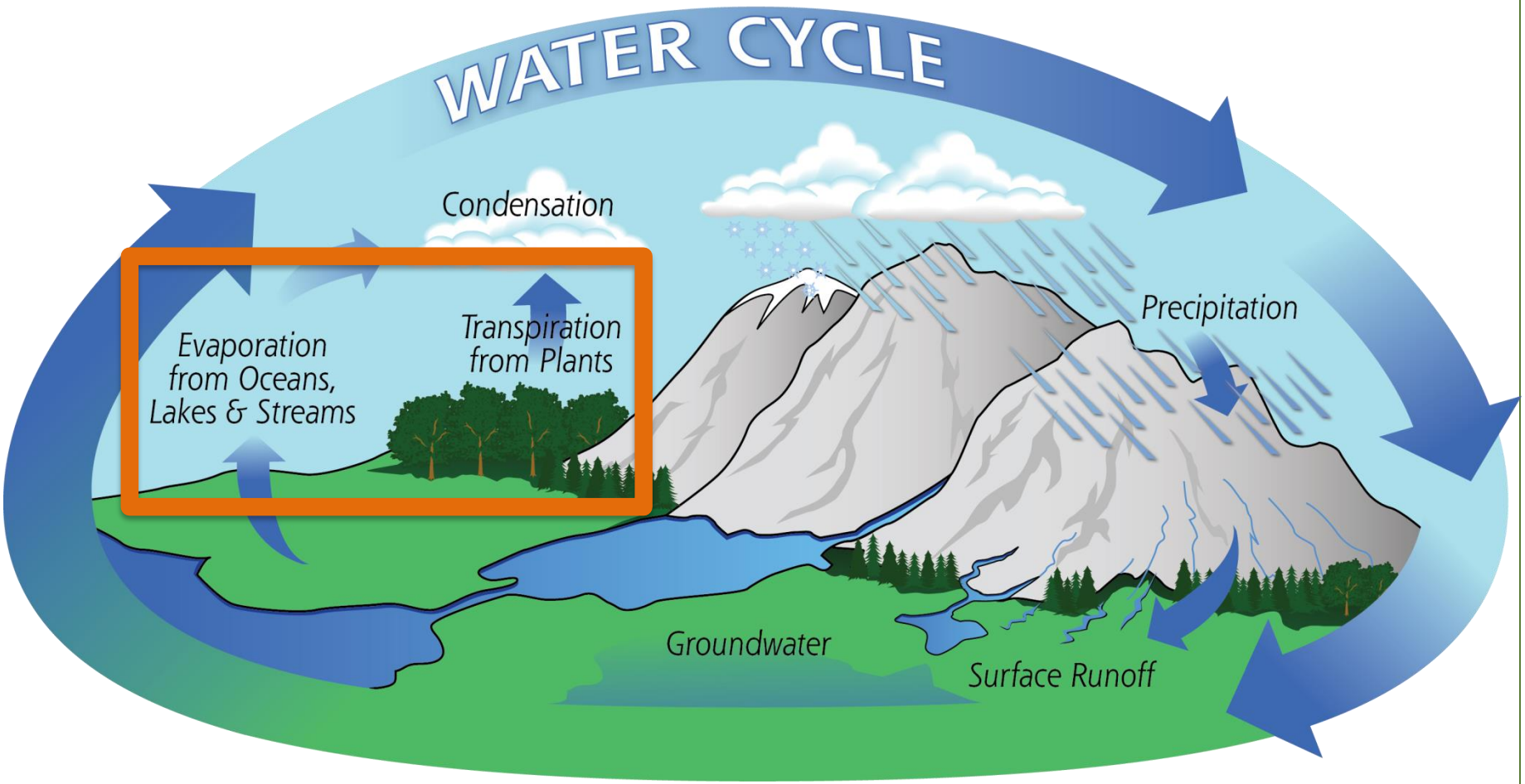
Notes on snow melt:

- Increasing winter temperatures may cause earlier spring snow melt, mid-winter thaws, or winter rain



MNRF, MOE, CVC (2010) Guide for Assessment of Hydrologic Effects of Climate Change in Ontario

Evaporation/Transpiration

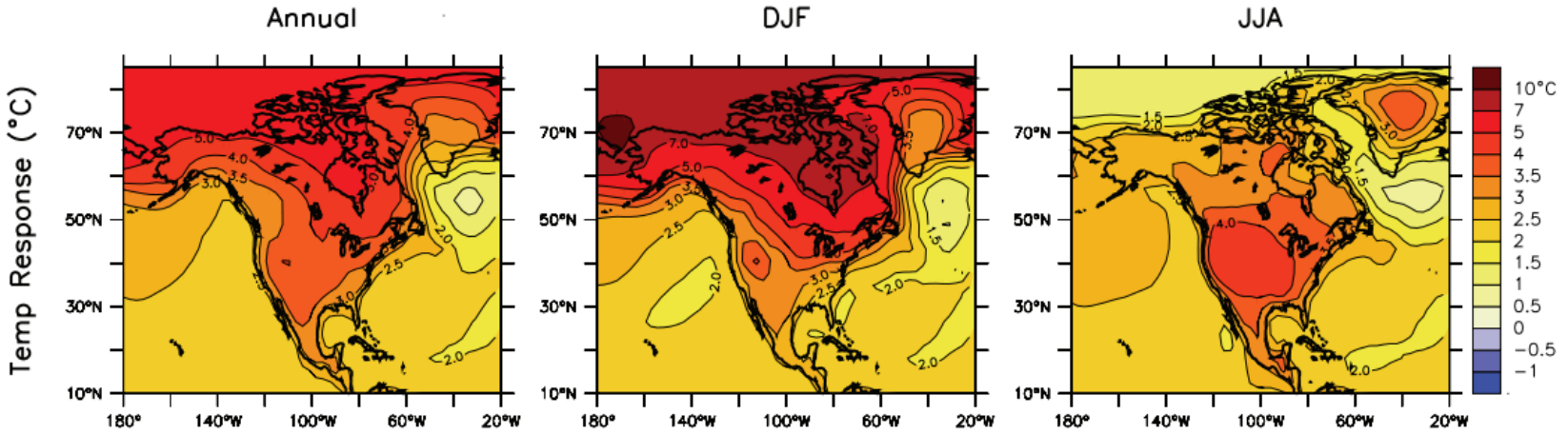


Evaporation/Transpiration

Potential evaporation & transpiration increase with temperature.

Expectations

- Summer average temperatures expected to increase
- Winter average temperature expected to increase faster than summer average temperatures
- Greatest winter temperature increase in Far North



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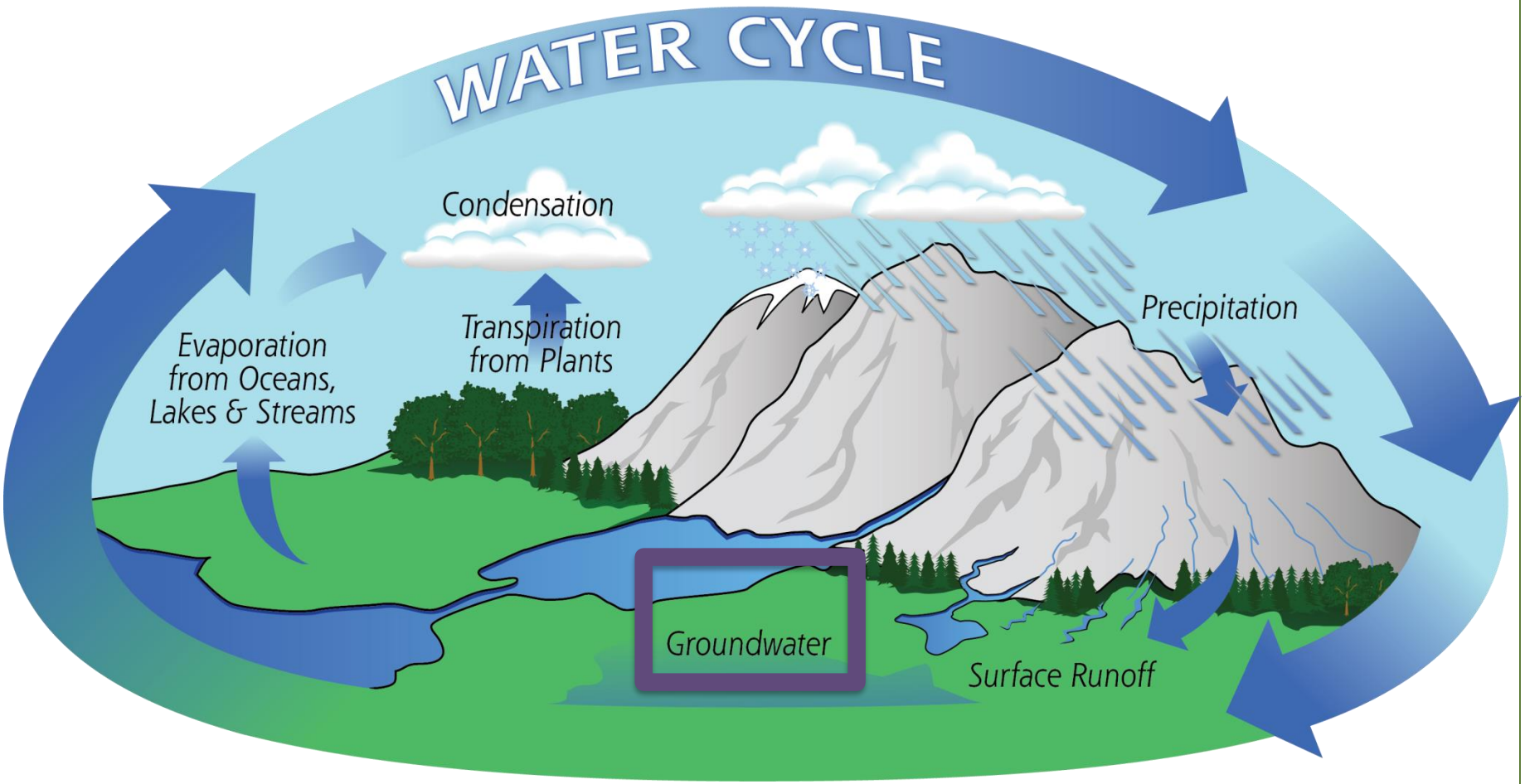
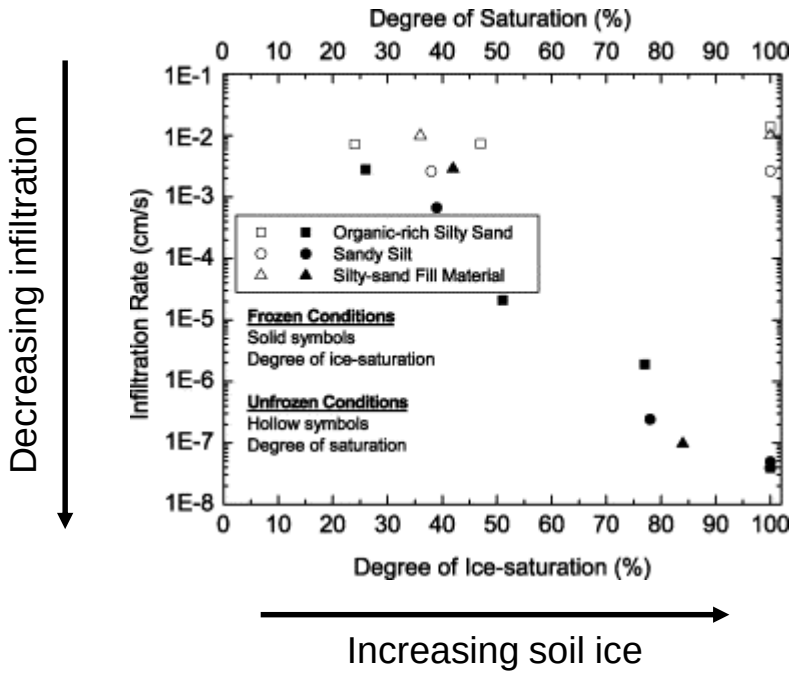
Storage


WATER CYCLE
Condensation
Transpiration from Plants
Evaporation from Oceans, Lakes & Streams
Precipitation
Groundwater
Surface Runoff

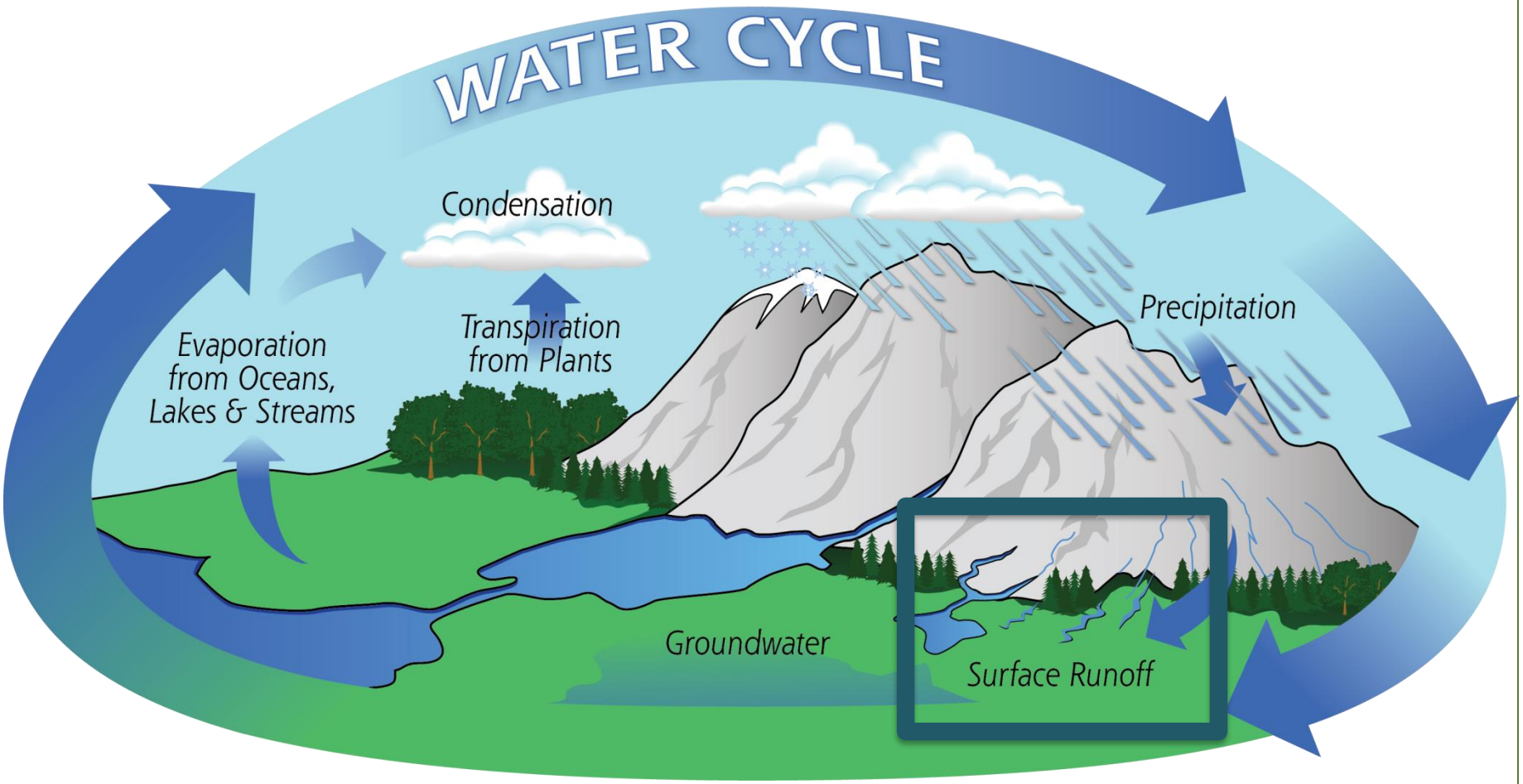
Storage

- Higher temperatures could reduce areas of frozen ground, allowing more infiltration into soils
- Decrease in storage as snow in winter



McCauley et al. (2002) A comparison of hydraulic conductivities, permeabilities and infiltration rates in frozen and unfrozen soils.

Surface runoff



Surface runoff

	Runoff =	Precipitation -	Evaporation	+ ΔStorage
Winter	Increase	?	Increase (sublimation)	Decrease (snow)
Summer	Decrease	?	Increase (Evaporation and transpiration)	Increase? (ground water recharge)

Summary

- Later freeze-up and earlier spring melt
- Spring runoff may decrease due to decrease in end-of-winter snow pack
- More severe rain storms - could increase summer flooding
- Higher evaporation rates may lead to more frequent drought conditions (especially if precipitation does not also increase)

Thanks!

Links:

Guide for Assessment of Hydrologic Impacts of Climate Change (2010)

See how climate change could affect temperature and precipitation in your area (2007)

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