

Mine Affected Lands Climate Change Modelling and Adaptation

Nunavut Mining Symposium
May 9-12, 2022



Introductions



25 Years Advancing Mine Closure Solutions

Our multidisciplinary team specializes in providing **integrated mine planning, closure and relinquishment solutions** at all mining stages.

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Land Acknowledgement – Calgary

The land on which the Okane Calgary office is located is Moh'kins'tsis.

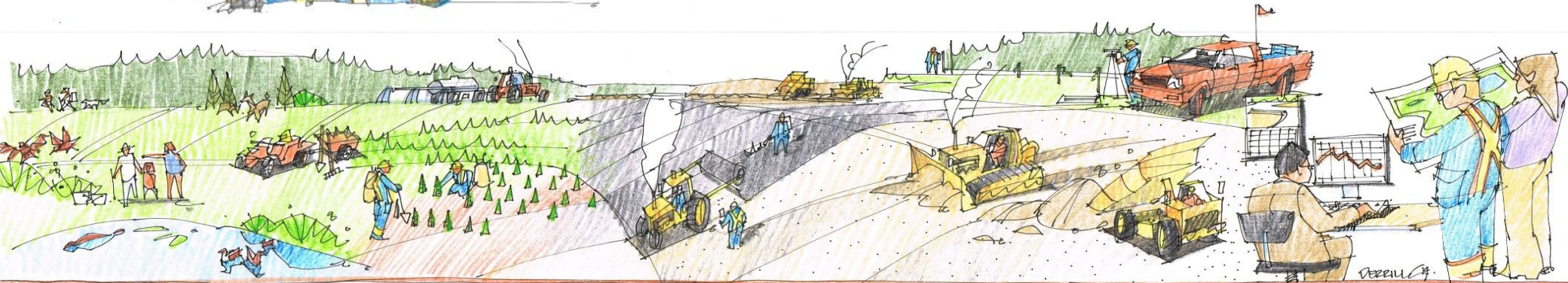


Presentation Outline

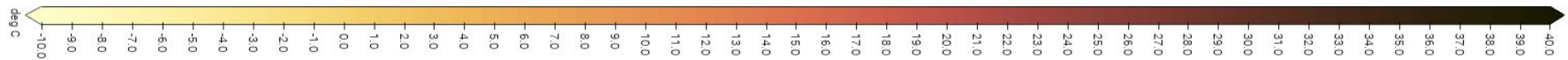
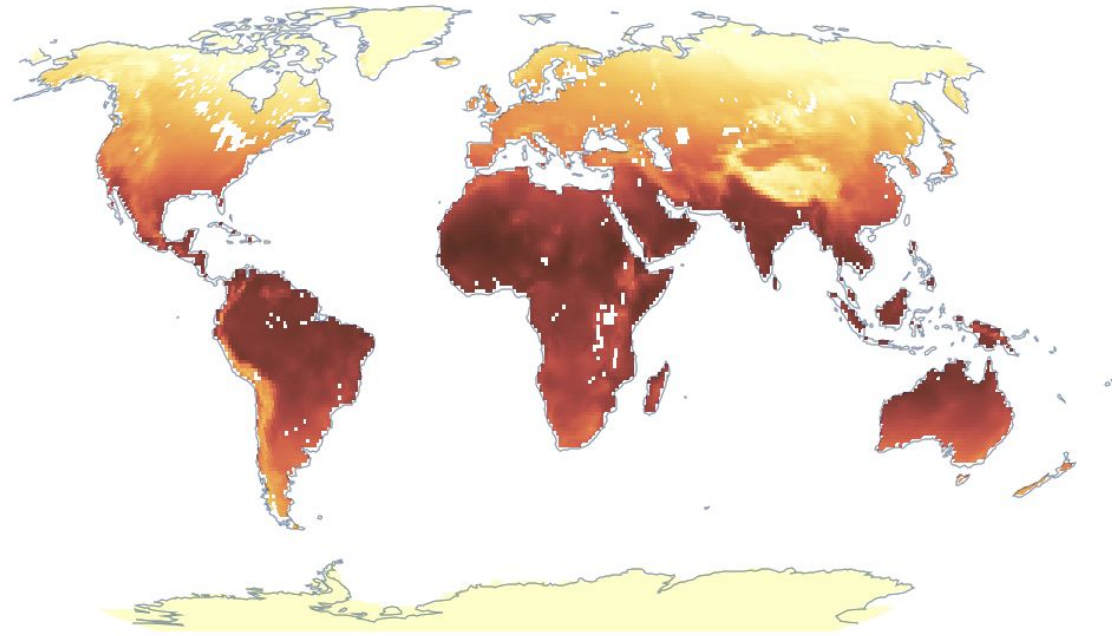
- Mine Affected Lands and Climate Change Impacts
- Overview of Climate Change and Current Climate
- Discussion of Shared Socioeconomic Pathways (SSPs)
- Impacts to Arctic Sites
 - Illustrative Examples
- Summary

Mining Operations

Mining has the potential to impact the land, but over a relatively short timeframe



Annual Observed Temperatures



Mean temperature (T) - (deg C)
1961-2015 (Observations)
Berkeley Earth - Annual

□ Significant
▨ Non significant

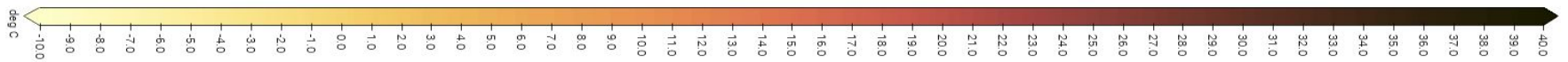
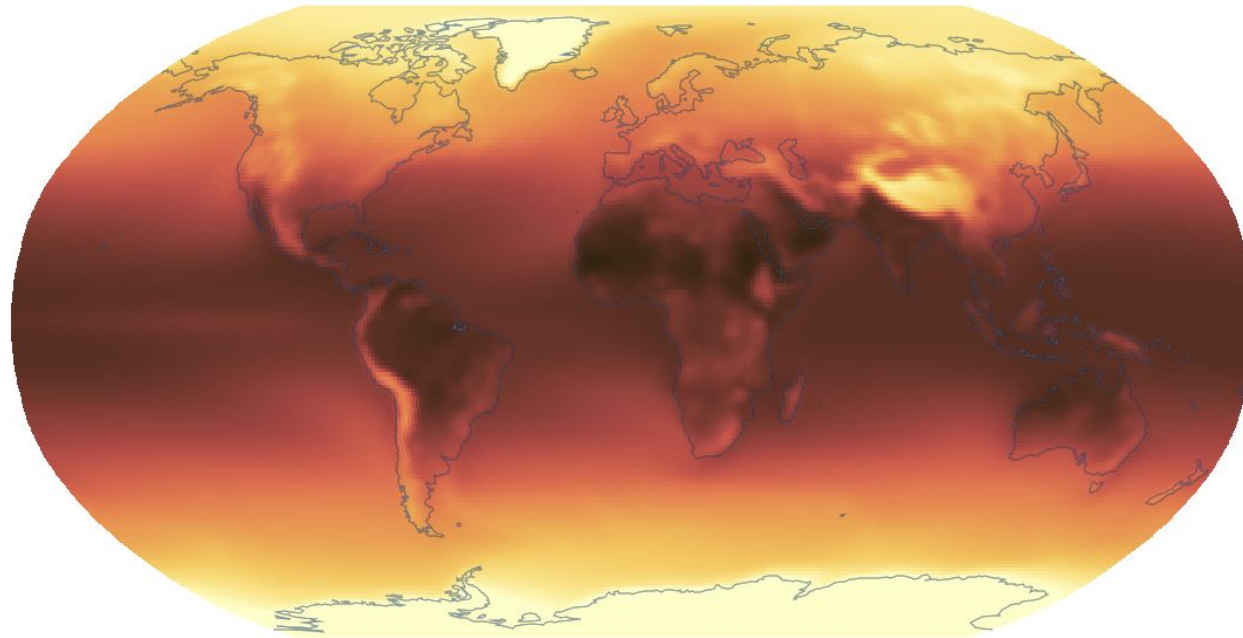


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(Gutiérrez et al., 2021)

Projected Annual Temperatures



Mean temperature (T) - (deg C)
Long Term (2081-2100) (SSP5-8.5) (rel. to 1850-1900)
CMIP6 - Annual (34 models)

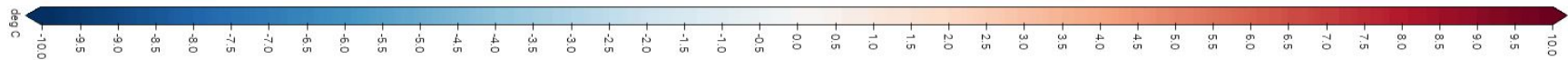
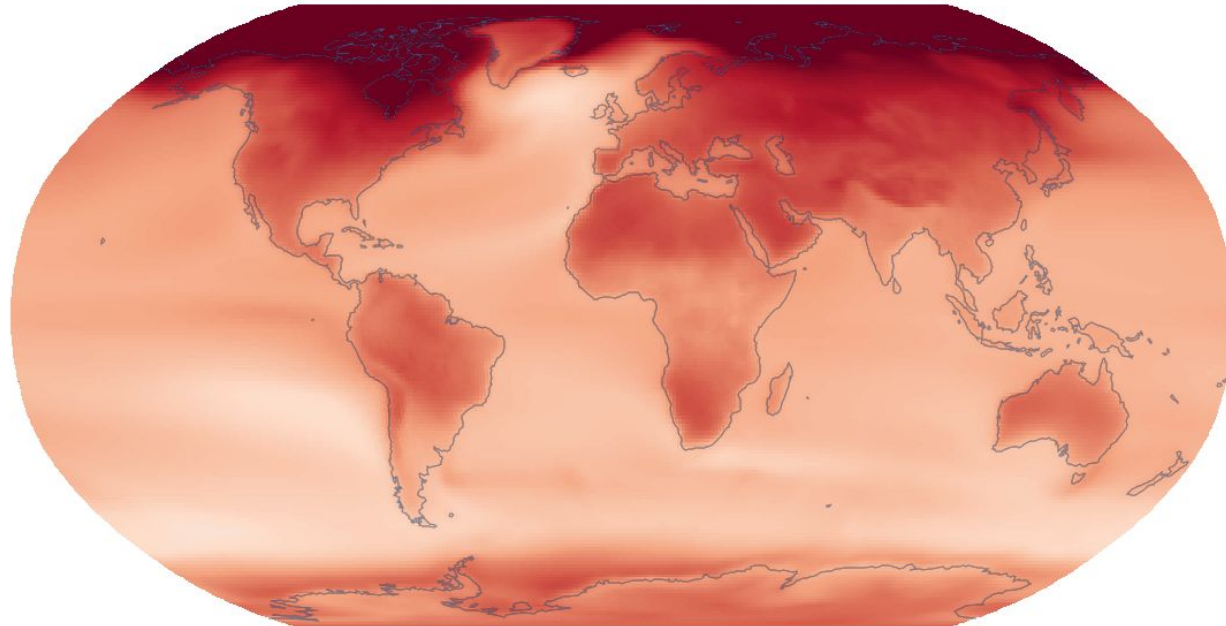
High agreement
 Low agreement



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(Gutiérrez et al., 2021)

Projected Relative Change in Temperature



Mean temperature (T) - Change (deg C)
Long Term (2081-2100) (SSP5-8.5) (rel. to 1961-1990)
CMIP6 - Annual (34 models)



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(Gutiérrez et al., 2021)

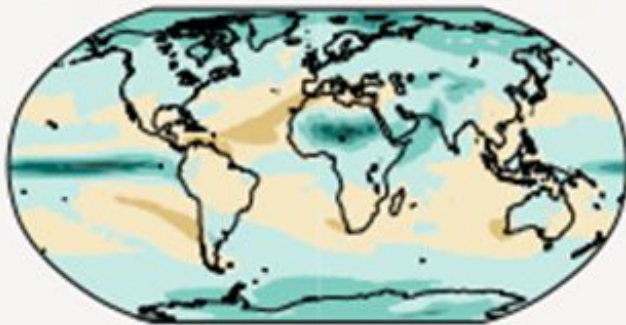
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Global Precipitation Change

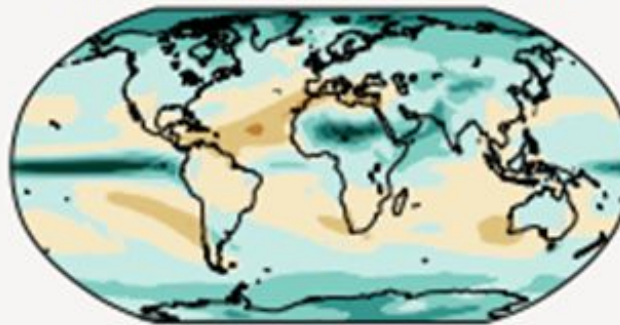
c) Annual mean precipitation change (%) relative to 1850-1900

Precipitation is projected to increase over high latitudes, the equatorial Pacific and parts of the monsoon regions, but decrease over parts of the subtropics and in limited areas of the tropics.

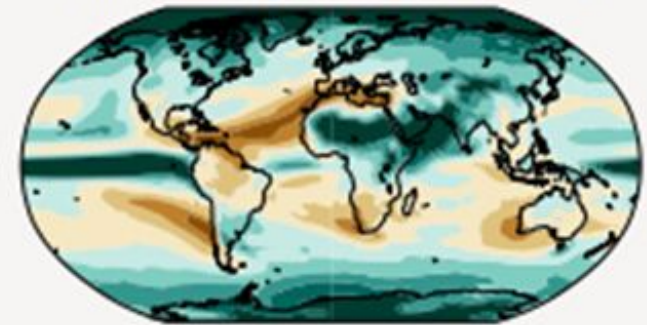
Simulated change at 1.5 °C global warming



Simulated change at 2 °C global warming



Simulated change at 4 °C global warming



Relatively small absolute changes may appear as large % changes in regions with dry baseline conditions



(Figure SPM.5, IPCC, 2021)

Current Climate

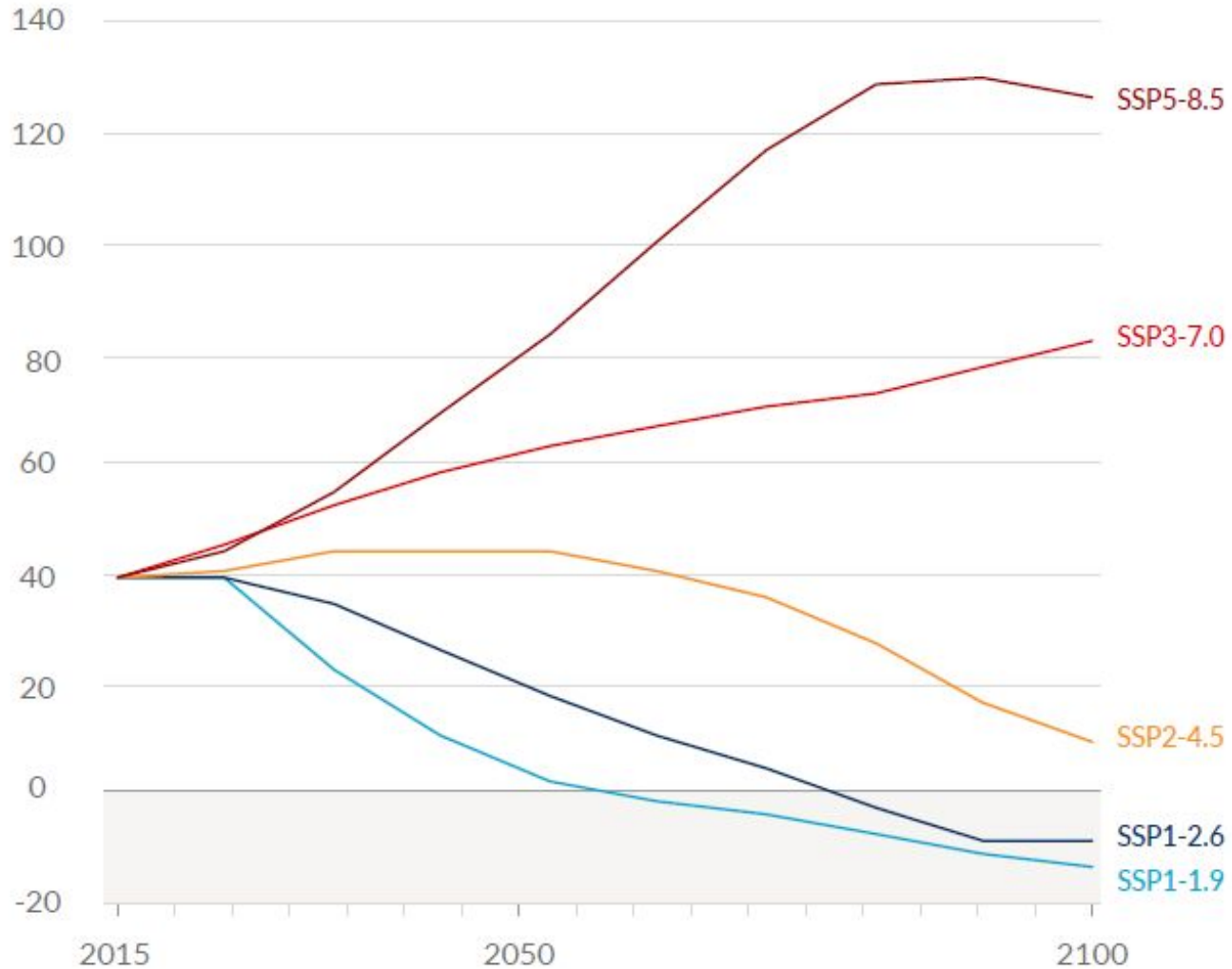
- Global surface temperature increase from 1850-1900 to 2010-2019 of 0.8°C to 1.3°C.
 - Best estimate = 1.07°C.
 - Warming from GHGs = 1.0°C to 2.0°C.
 - Other human drivers (aerosols) contributed to cooling of 0.0°C to 0.8°C.
 - Natural drivers = -0.1°C to 0.1°C.
 - Internal variability = -0.2°C to 0.2°C.
- Precipitation over land increased since 1950.

Shared Socioeconomic Pathways

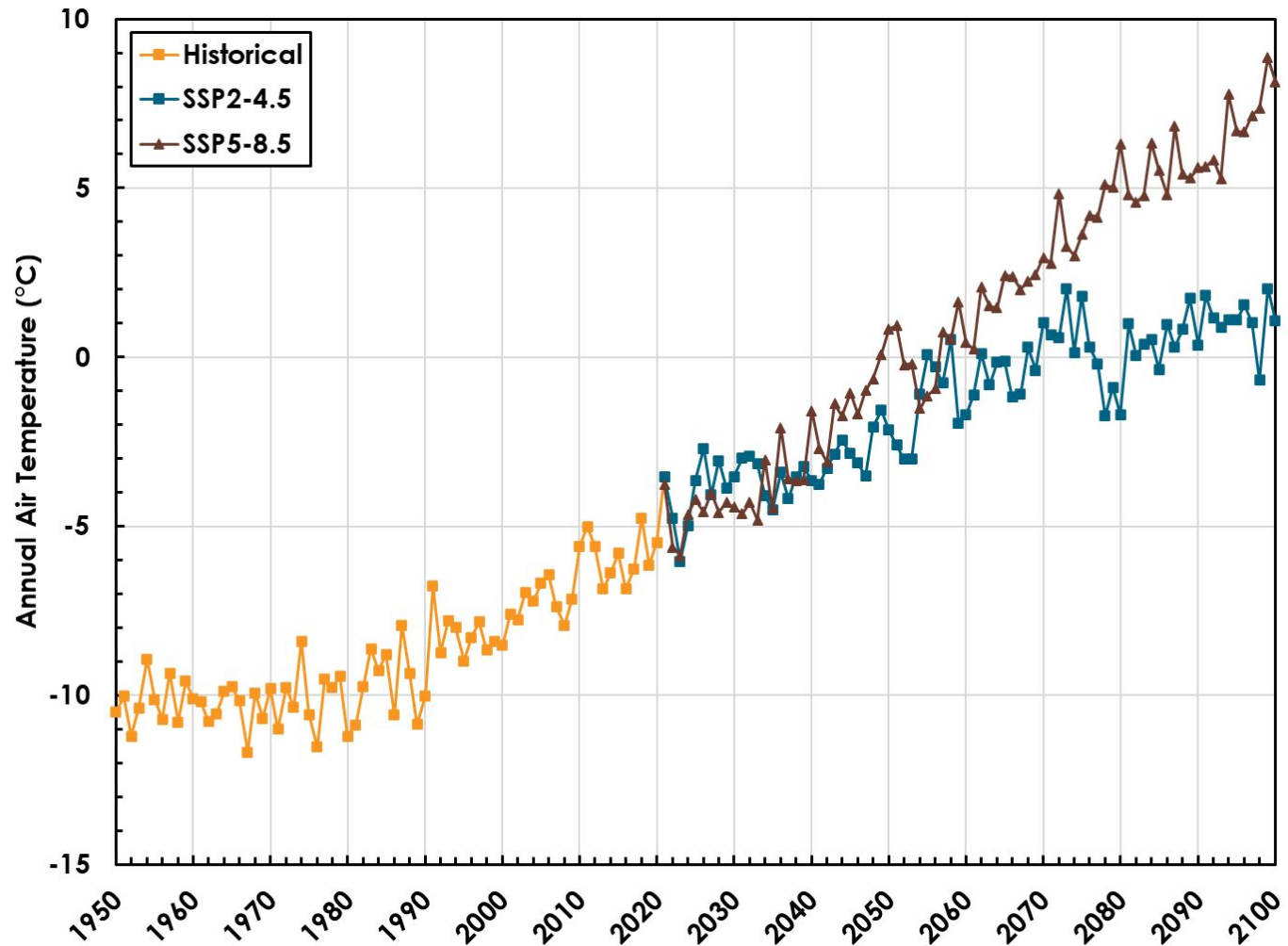
- Five SSPs
 - Range of plausible trends in the evolution of society over the 21st century.
 - Do not account for any new climate policies.
 - Represent '**sustainability**' (SSP1), '**middle of the road**' (SSP2), '**regional rivalry**' (SSP3), '**inequality**' (SSP4) and '**fossil fuel intensive**' development (SSP5).

Core SSPs

Carbon dioxide (GtCO₂/yr)



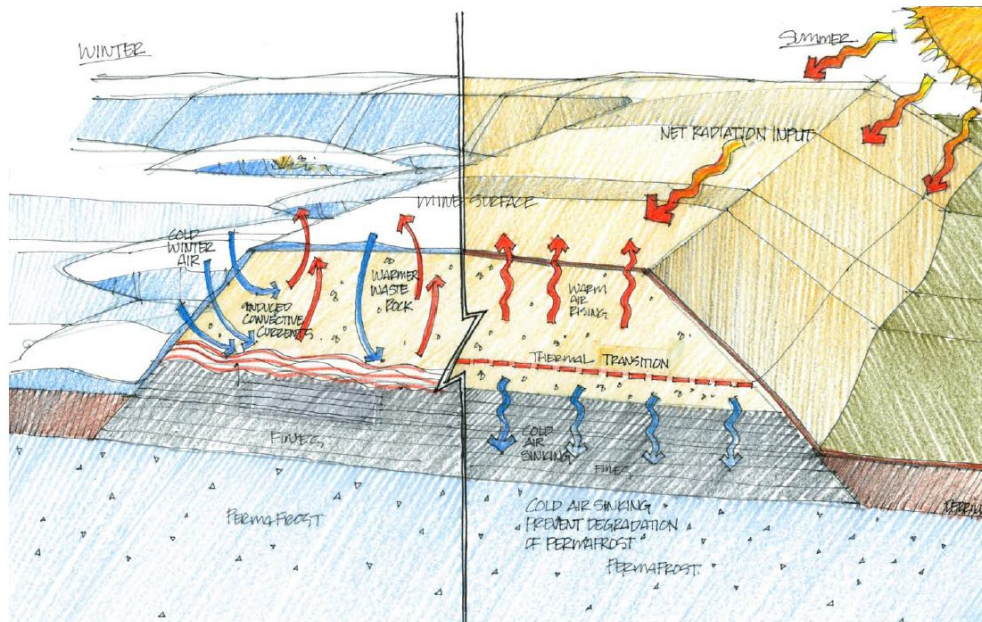
Climate and Climate Change



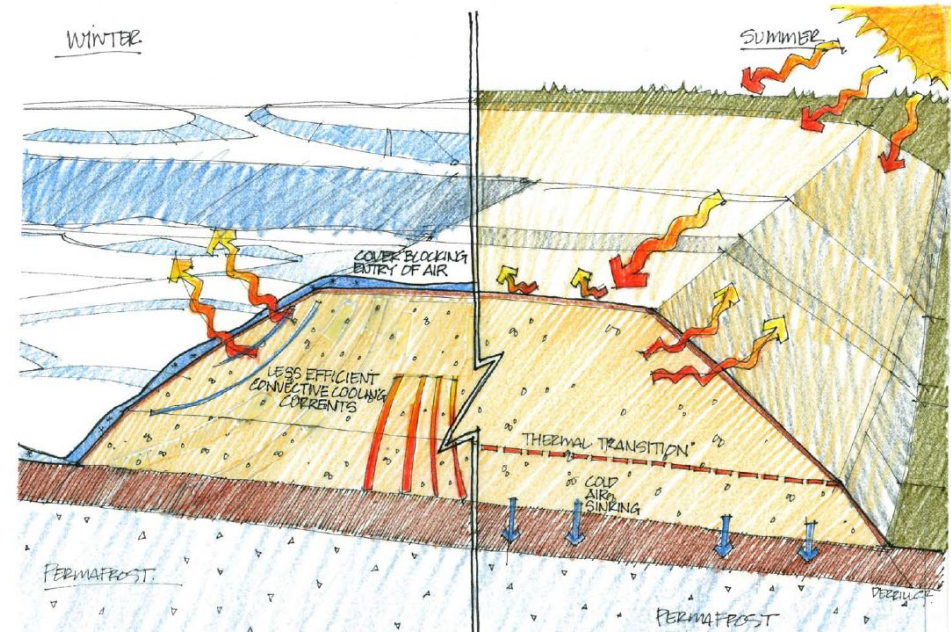
(Data from ECCC and PCIC, 2022)

Thermal Cover Systems

No Cover

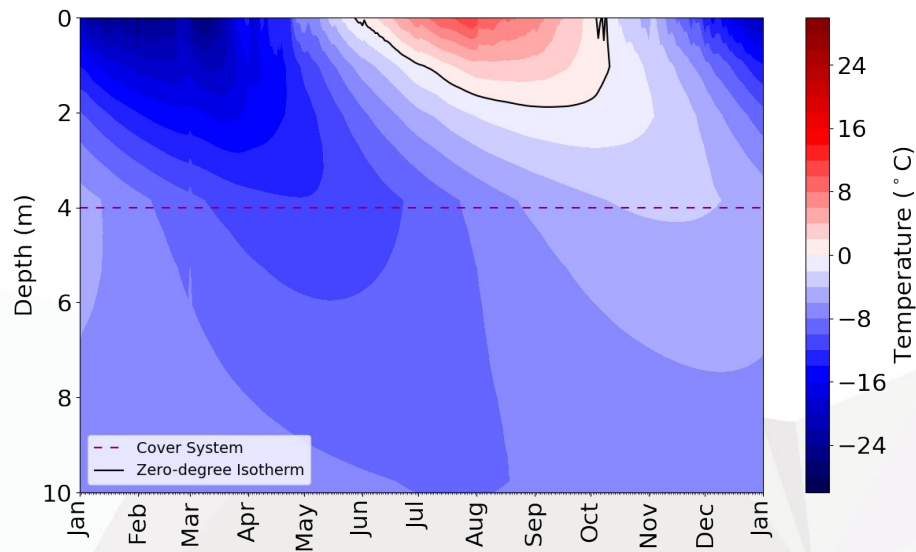
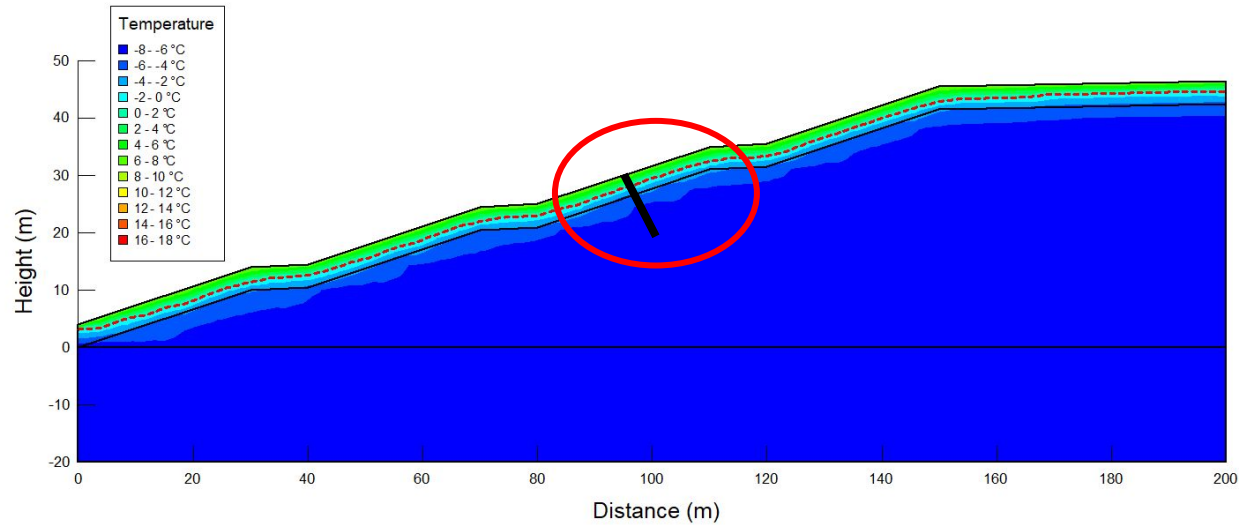


Cover

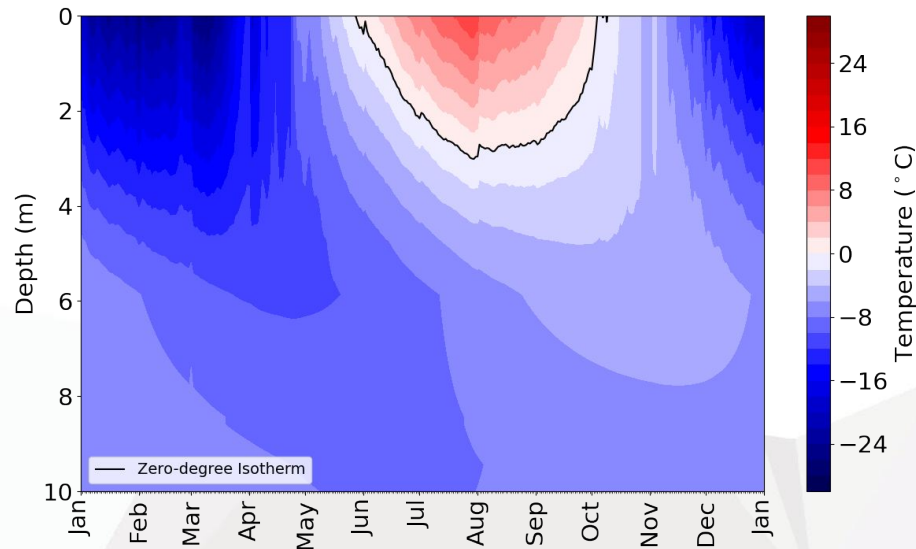
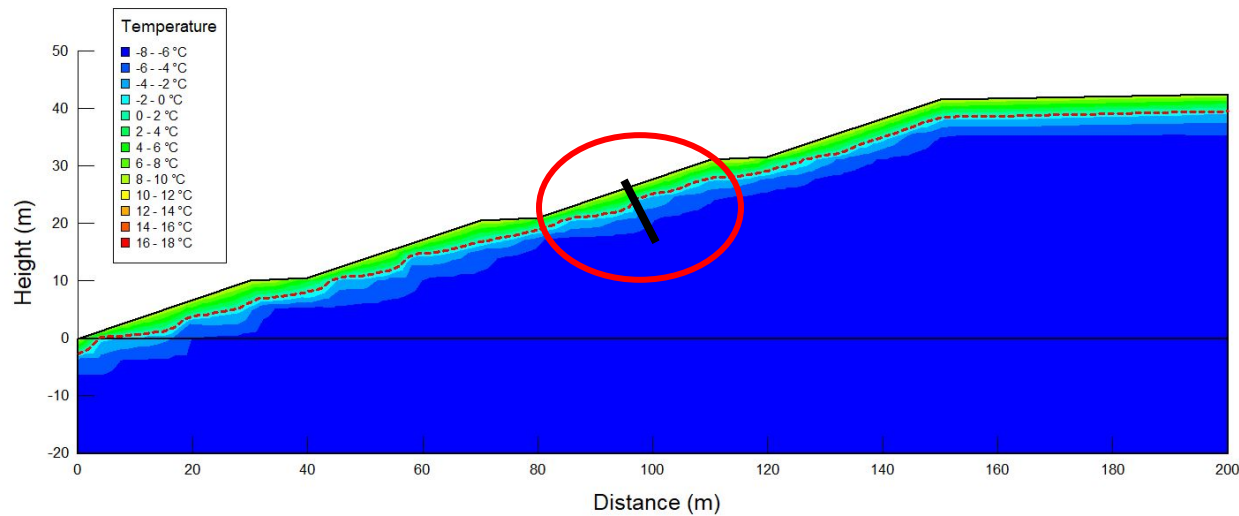


(MEND, 2012)

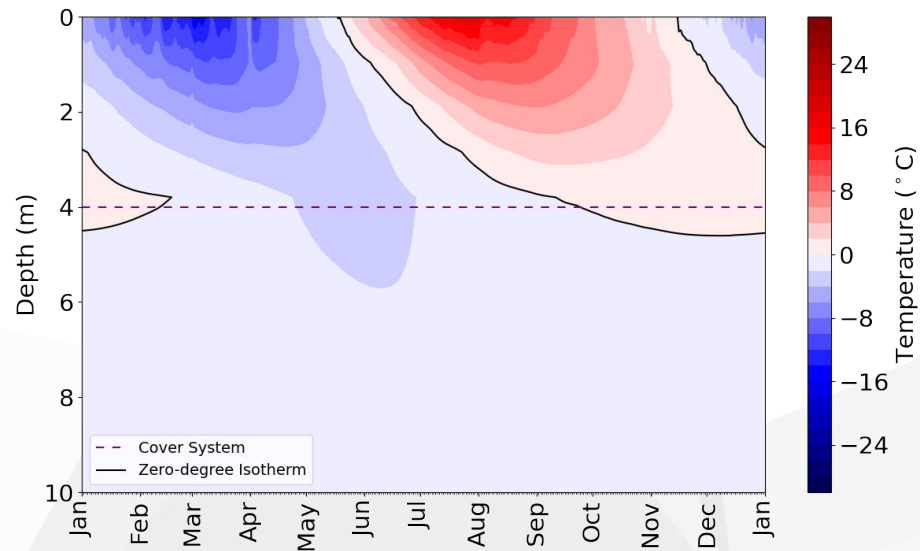
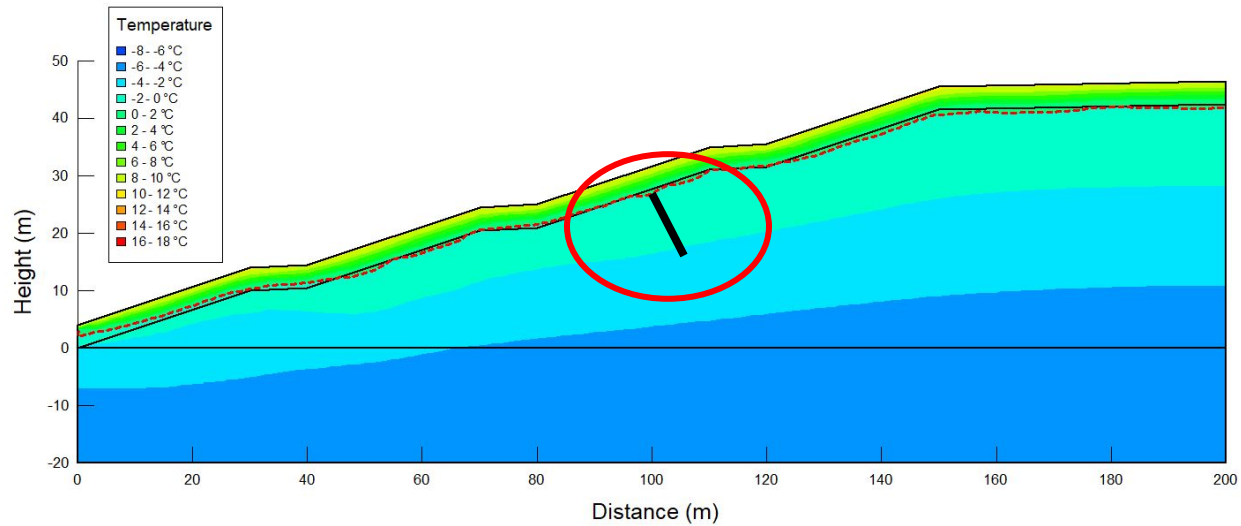
Arctic MRS Model Historical Climate



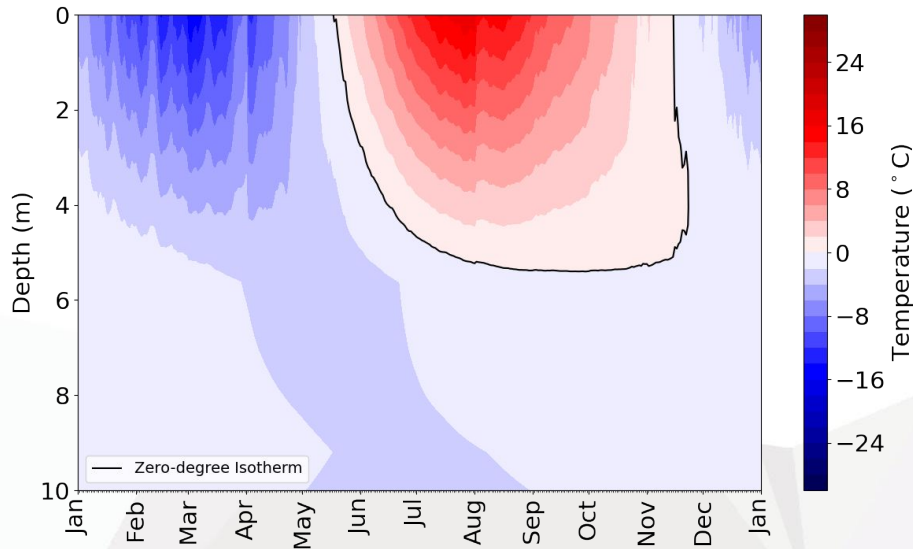
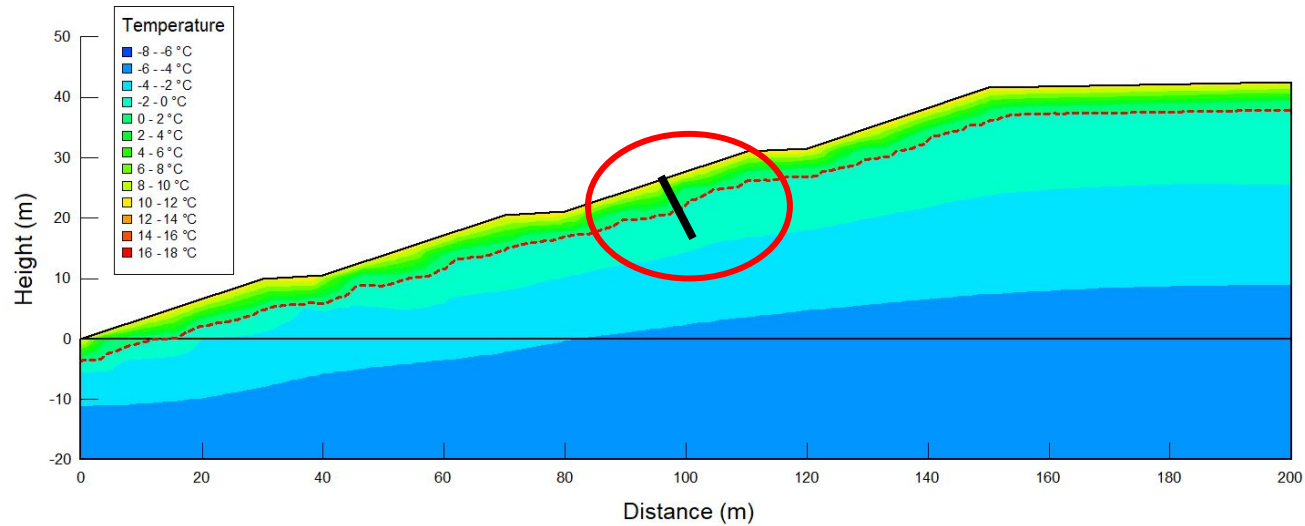
Arctic MRS Model Historical Climate – No Cover System



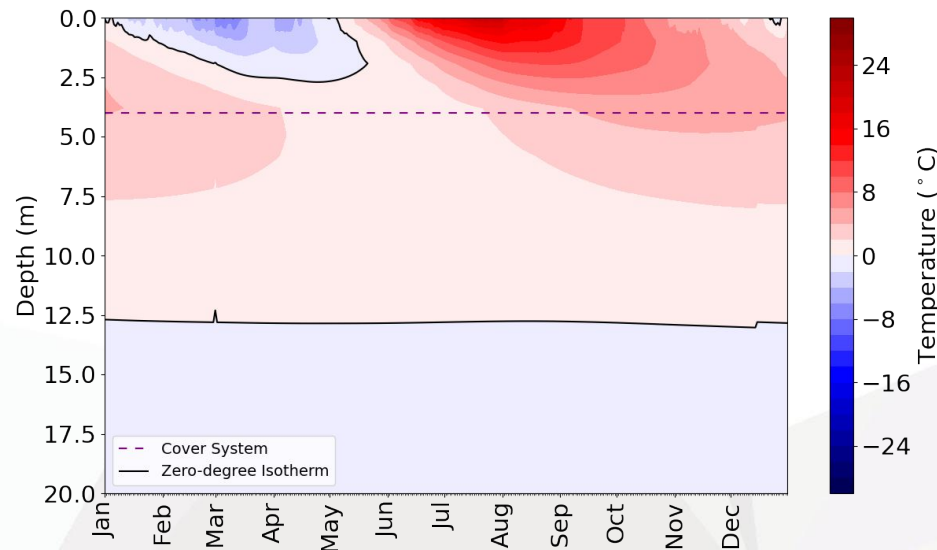
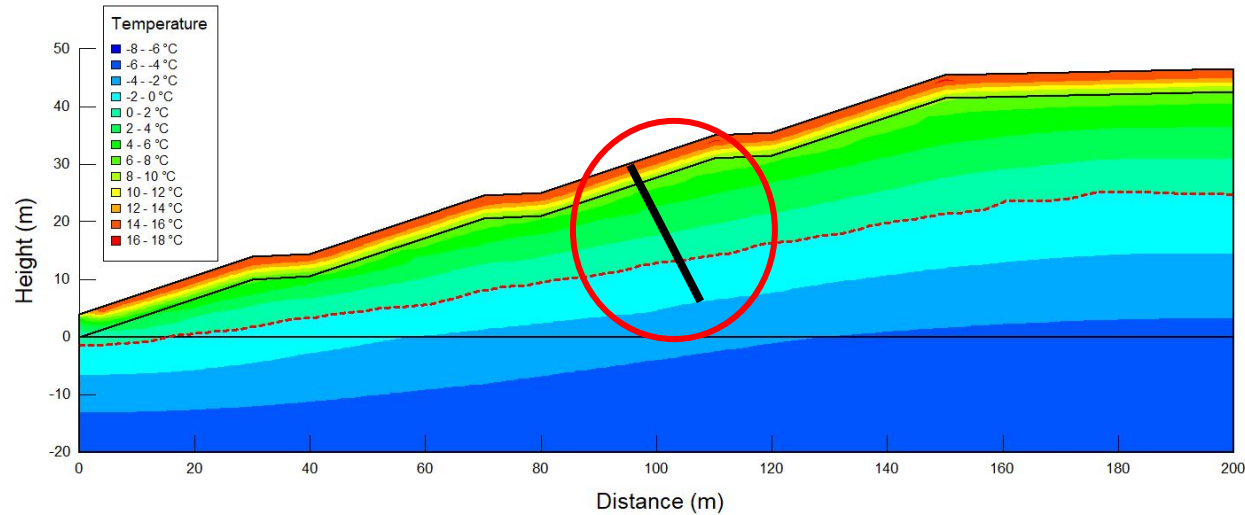
Arctic MRS Model SSP2-4.5 Climate



Arctic MRS Model SSP2-4.5 Climate – No Cover System



Arctic MRS Model SSP5-8.5 Climate



Summary

- Arctic is projected to continue to warm at ~2x the global rate.
- Important to consider how climate will change with time and the influence that may have on the returning land use.
- Climate change should be assessed during creation of closure plans, especially when thermal cover systems are being considered.

Thank You!

Feel free to reach out to info@okc-sk.com with any follow up questions



References

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