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sigma extra

Canada: wildfire and flood risk profiles change as temperatures increase

The annual average temperature in Canada has increased by 1.7°C since 1948,[1] roughly double the global average but with strong regional and seasonal variations. The increase has been strongest in the Arctic region, and the warming is considerably higher in the winter than in the summer seasons, particularly in British Columbia, Alberta, Yukon, Northwest Territories, and western Nunavut.[2] In addition, warm events are becoming more intense and more frequent, and cold events less intense and less frequent. Warming has changed the country's wildfire and flood risk profiles. In our view, if risk models are updated with latest understandings of current conditions, fire and flood risks will remain insurable by the market.

Wildfire

Alberta sustained 55% of Canada's natural catastrophe insured loss burden of the last 10 years, the main drivers being the flood of 2013 and the fires in 2016. Ontario was next, accounting for 26% of national losses.[3] Wildfire risk has increased and this is expected to continue as temperatures warm.[4] Fire-conducive weather conditions are expected to become more common, with the number of such days potentially increasing by more than 200% in eastern Canada and by more than 50% in the west by the end of the century under an RCP 8.5 scenario.[5,6]

According to Natural Resources Canada, the north western boreal regions saw a steady increase in the annual amount of forest area burned by wildland fires over the second half of the 20th century, with some of this attributed to climate change. In contrast, in Canada's southern boreal forest, the annual amount of area burned seems to have decreased, which may be due to climate change also leading to more rainfall in that region. In 2016, the oil town of Fort McMurray, Alberta, was devastated by the costliest wildfire and natural catastrophe event ever in the country (in term of insured losses) and in 2017, extensive areas of British Columbia burned.

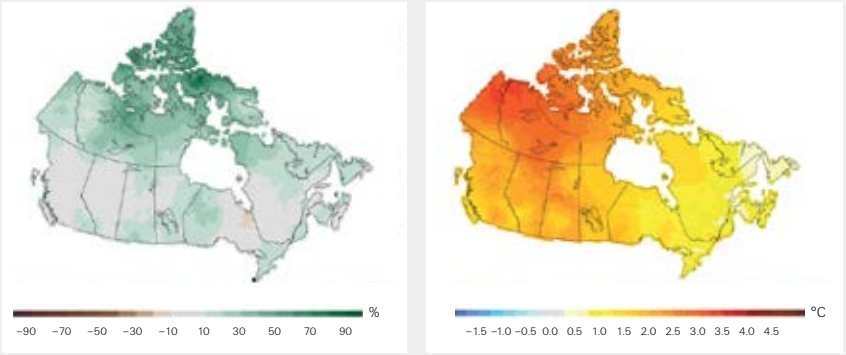
Flooding

On average, annual precipitation in Canada has increased since the beginning of the 20th century. The largest increases have been in the Arctic region (see Figure 1). More frequent extreme precipitation events across the country are projected.[7] However, this change may not manifest in detectable increases in flood risk, particularly in snow-covered and frozen regions. For example, an attribution study of

1 *Canada's Changing Climate Report*, Government of Canada, 2019.
2 Ibid.
3 Ibid.
4 M.C. Kirchmeier-Young et al., "Attribution of the Influence of Human-Induced Climate Change on an Extreme Fire Season", *Earth's Future*, vol 7, 2019.
5 X. Wang, "Projected Changes in Daily Fire Spread Across Canada Over the Next Century", *Environmental Research Letters*, vol 12, 2017.
6 Representative Concentration Pathways (RCP) are time-dependent projections of atmospheric greenhouse gas (GHG) concentrations adopted by the IPCC to represent several scenarios.
7 *Canada's Changing Climate Report*, Government of Canada, 2019, op. cit.

the 2013 Alberta flood, the costliest flood in Canada on sigma records, found that greenhouse gas increases are likely to have increased the occurrence probability of extreme rain events in the region.[8] The present-day probability for the kind of precipitation that would lead to a similar flood event is twice as high than in pre-industrial times. However, the study's authors did not detect a discernible influence of anthropogenic climate change on runoff, suggesting that the impacts of increased precipitation may be offset by reduced snowmelt and/or increased soil permeability (due to thawing of soils previously containing frozen water). On a broader scale, another study showed a decrease in high stream flows in southern Canada but an increase in the north, with temperatures 2°C warmer than in pre-industrial times.[9] Such trends may be sensitive to the time period that is analysed, with a recent analysis of trends in Canadian streamflow data finding significant increasing trends in flood magnitude for recent time periods (last 30-40 years) but more decreasing trends in longer periods of record (60 years).[10]

Figure 1
Observed change in annual precipitation (%) (left) and change in annual mean temperature (degrees Celsius) (right) between 1948 and 2016



Source: *Canada's Changing Climate Report*, Government of Canada, 2019.

[8] B. Teufel et al., "Investigation of the 2013 Alberta Flood from Weather and Climate Perspectives", *Climate Dynamics*, vol 48, 2017.
[9] P. Döll et al, "Risks for the Global Freshwater System at 1.5 and 2C Global Warming", Environmental *Research Letters*, vol 13, 2018.
[10] S. Mostofi Zadeh et al., "Detection of trends in flood magnitude and frequency in Canada", *Journal of Hydrology*, vol 28, 2020.