

How can Canadians be protected from extreme weather they have never experienced before?

(Approved by CMOS Council November 29, 2022)

Hurricane Fiona, which ravaged Atlantic Canada in late September 2022, is just another reminder of the threats from extreme weather events. Fiona was responsible for the loss of three lives, an enormous number of livelihoods, and has changed the landscape of many parts of Atlantic Canada. While the storm was well predicted at least three days in advance, it is unlikely very many residents of the hardest hit areas in Prince Edward Island, northern and eastern Nova Scotia, and southwestern Newfoundland, imagined the impacts from the hurricane force winds and extremely high seas to be as bad as what they experienced. Fiona shattered the record for the storm with the lowest central pressure in Canadian history and is expected to be the costliest storm ever in Atlantic Canada.

Just four months ago, a deadly derecho (line of intense and fast moving windstorms) crossed southern Ontario into southwestern Quebec. Some meteorologists consider this historic event as one of the most impactful thunderstorm systems in Canadian history. Approximately 12 people lost their lives, and millions were without power for an extended period of time. For the first time, meteorologists from Environment and Climate Change Canada issued an Alert-Ready Message for a Severe Thunderstorm Warning.

In November 2021, extreme rainfall and the flooding from an “Atmospheric River” resulted in the costliest natural disaster in British Columbia’s history, with at least five deaths from the mudslides along several highways. Just five months prior, in June 2021 a “Heat-Dome” was responsible for a wildfire that destroyed the town of Lytton BC, the highest temperature ever recorded in Canada (49.6°C), and the over 600 heat-related deaths made this the worst loss of life from any weather event in Canadian history.

Current Context

Since the guidance provided by sophisticated computer weather models has improved at an unprecedented pace, weather services around the world are focussing less on the routine forecasts but targeting the extreme events that are threatening lives and becoming more frequent in a changing climate. This involves generation of risk-based products and services so that the public and decision-makers understand the range of possibilities associated with a threatening weather event. Increasingly, graphical depictions and annotated output from observation systems like weather radar, are being used to illustrate threat areas more effectively. Substantial outreach is also required to ensure that these services are well-designed and well-understood, and appropriate action is taken to minimize impact and save lives. The recent misunderstanding of the risks associated with Hurricane Ian in Florida resulted in too many residents remaining in their homes and over 100 lives being lost.

Like other Weather Services, the Meteorological Service of Canada (MSC) is embarking and making steady progress on this transformation to ensure Canadians are better protected from extreme weather and climate events. However, the management of essential components, such as the high-performance computing, information technology, climate and weather research, and climate services delivery has been centralized in other Branches within the Government of Canada. Weather services in other countries

with a similar context to the MSC (like the UK and Australia) have chosen an organizational model that includes these key components to enable efficient, innovative and nimble development and provision of new products and services.

Flooding is the source of Canada's most common and costly disasters. Climate change is projected to increase the frequency, severity and variability of all types of flooding (pluvial, fluvial and coastal) in the coming decades. At the same time, Canada's exposure to flooding is growing as a result of increasing housing, infrastructure development, and asset concentration in flood-prone areas. The federal government is working with provinces, territories, and other partners to enable flood resilience. However, there is no plan for a national flood forecast and warning program to alert the public and trigger evacuations.

Private-sector weather services are providing essential decision-support to managers of critical infrastructure, like electric utilities, roads, railways, and shipping. Surveys have confirmed the important role of the media, through which the majority of the public receive their weather warnings. Both private and media meteorologists are using advanced graphics to illustrate threats and to express uncertainty. However, since MSC has limited resources for coordination with the private sector and the media in advance of threatening weather events, there is a risk of mixed messaging to stakeholders and the public.

University research leads to the development of important innovations critical for modern weather services. McGill has been a world leader in weather radar; Dalhousie's oceanographic research led to the development of a storm-surge prediction model; Western University's Northern Tornado and Hail Projects have established extensive partnerships to improve warnings and damage assessments; and the Université du Québec à Montréal is among the world leaders in regional climate modelling. However, there is no longer a national source of academic weather research funding since the Canadian Foundation for Climate and Atmospheric Sciences ended in 2010. Furthermore, there is a limited number of universities providing the pre-requisite courses for meteorologists. The University of Alberta has eliminated their program, and York University is considering reductions. These would have devastating impacts on long-term research and resources to address extreme climatic events in the future.

Recommendations

Since these extreme weather and climate events are increasingly threatening public safety, it is recommended that the federal government exercise leadership to accelerate necessary transformations:

- The management of essential components, such as the high performance computing, information technology, climate and weather research, and climate services delivery should be re-integrated back into the Meteorological Service of Canada (MSC).
- Provide MSC with the capacity to interact with media, private sector, and academic partners; and to expand collaborative outreach programs to educate the Canadian public on actions required to protect themselves and their families. This investment should consider the unique challenges and vulnerabilities of Canada's North.
- Canada needs a national flood forecasting service fully integrated with the mission of the MSC and done in partnership with Provinces and Territories.

- Universities and employers of meteorological personnel (government, media, and private sector) should collaborate on a comprehensive recruitment strategy for new meteorologists, and a continuous learning strategy for existing staff. This collaboration should consider barriers and explore incentives such as scholarships.
- Research granting councils should consider, once again, the creation of a dedicated fund for academic research in extreme weather and climate change, along with incentives to collaborate with government scientists.
- To account for the complex and interdisciplinary nature of emerging threats, investment in education and research programs should include related earth, engineering and social sciences.

In conclusion, the Canadian Meteorological and Oceanographic Society (CMOS) recommends, and will provide support for a more collaborative approach within the “Weather Enterprise”. Clear and consistent messaging related to risks and actions is required to protect Canadians threatened by a rising number of record-breaking weather and climate extremes. This will be enabled by a strong sustainable Meteorological Service of Canada.

CMOS is the national scientific society of individuals dedicated to advancing atmospheric and oceanographic sciences, as well as related environmental disciplines in Canada. The Society’s Mission is to promote meteorology and oceanography in Canada by working collaboratively with the academic, government, media and private sectors. CMOS, through its educational and outreach efforts, seeks to enhance public understanding of weather, climate and environmental issues.

Jim Abraham, CMOS President