AN NREN CASE STUDY BY risq

BETTER PREDICTING NEAR-FREEZING PRECIPITATION

UNPREDICTABLE WINTER WEATHER

Most of us are quite familiar with winter storms. The image that comes to most people's minds is that of a snowstorm, but a wide variety of different precipitation can occur when temperatures hover near 0°C. These include freezing rain, freezing drizzle, ice pellets, snow pellets, and wet snow.

These precipitation types have a major impact on society. The 1998 ice storm was one of the largest natural disasters in our country's history – displacing 600,000 people, injuring 945, taking 35 lives, and costing an estimated $5.4 billion. Similar storms of mixed precipitation affect Canadians across the country every year whether they are involved in traffic accidents, airline delays, or lengthy power outages.

One of the biggest challenges in dealing with near-freezing precipitation stems from the difficulty it poses to accurate forecasting, since a small change in temperature dramatically affects the type of precipitation and its severity. To better understand these storms and more accurately predict them, researchers at the Université du Québec à Montreal (UQAM) have begun using sophisticated observational techniques and numerical modeling schemes.

BIDIRECTIONAL ATTACK

This research is based on two main approaches. The first is to collect better data. The UQAM team is comparing rain and snow gauge measurements with observed precipitation at meteorological stations on a minute-by-minute basis in collaboration with researchers in Saskatchewan and Colorado. That performance data is being combined with data from new LIDAR sensors that provide accurate 3D data about windspeed and direction during precipitation events. These improvements let researchers better understand the fine scale details that feed into climate modeling systems.

The second approach is to improve climate models. By introducing new insights into the microphysics of droplet formation – particle sizes, formation speed, combination conditions, temperature gradients, and inter-cloud trajectories – the team is able to produce far

WHAT IS THE NREN?

The National Research and Education Network (NREN) is an essential collective of infrastructure, tools and people that bolsters Canadian leadership in research, education, and innovation. CANARIE and its twelve provincial and territorial partners form Canada's NREN. We connect Canada's researchers, educators, and innovators to each other and to data, technology, and colleagues around the world.

better estimates of atmospheric conditions and surface precipitation. These additional microphysics refinements are possible only with higher-resolution models that incorporate data above the planet's surface and extend up through the atmospheric column.

CANADIAN TECHNOLOGY TO THE RESCUE

Needless to say, moving climate models from 2D to 3D, increasing their resolution in time and space, adding more sensor input, and expanding their attributes creates a blizzard of new data – between 200 and 300 TB for one data set. The computational horsepower for these models comes from Compute Canada while the high-speed data network that enables the flow of collaboration among researchers comes from Canada's National Research and Education Network (NREN). RISQ, the Quebec partner in the NREN, connects researchers at UQAM to peers across Canada via NREN partners in the provinces and territories, and then to global peers via CANARIE, the federal partner in the NREN. The NREN connects these Canadian researchers to each other and to their counterparts in the US so that they can exchange enormous data sets, continually improve climate models, and compare results in a way that would be practically impossible with conventionally available networks.

PRAGMATIC PREDICTIONS

Better understanding our near-freezing weather and precipitation patterns has very practical benefits. Knowing exactly when and where ice, snow, and rain will occur allows for quicker and more efficient municipal responses, safer highway traffic, and more timely disaster management. The recent floods in Alberta are just one of the natural emergencies that are dramatically affected by the type and timing of different precipitation types; such events are becoming more common as our climate changes. The UQAM researchers are working with Environment Canada in pilot programs right now, with the eventual goal of bringing the increased precision of their near-freezing microphysics models to everyone. The need for better prediction accuracy affects every Northerly country, and with this advanced meteorological research, Canada is able to lead the way.

For more information, visit:

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