



# Evaluation of Flood Forecasting and Warning Systems in Canada

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**Montréal**

**22<sup>nd</sup> Canadian Hydrotechnical Conference**

**22<sup>e</sup> Conférence canadienne sur l'hydrotechnique**



Water for Sustainable Development: Coping with Climate and Environmental Changes  
L'eau pour le développement durable : adaptation aux changements du climat et de l'environnement

Being a flood forecaster  
requires thick skin !



# Flooded with miscalculations

## Forecasters admit error in volume of spring runoff

By: Larry Kusch

Posted: 04/18/2015 3:00 AM | Comments: 38

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*Cliff Trinder stands in front of the control gate at the Shellmouth reservoir in November 2010. He says the province's flood forecasting is 'abominable.'* [Photo Store](#)

The province has admitted it miscalculated the volume of spring runoff from eastern Saskatchewan this

# Alberta must do a 'much better job of forecasting' after failing to sound flood alarm early

MATT MCCLURE, CALGARY HERALD | 06.27.2013



Forecasters had known for days that heavy rainfall was expected west of Calgary but, by the time flood warnings were issued, communities downstream were already underwater or were mere hours from being submerged.

Ted Rhodes / Calgary Herald



Alberta's river forecasters knew two days in advance that heavy rains would likely hit the foothills of the Rockies, but didn't

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# No more excuses, Minister Ashton

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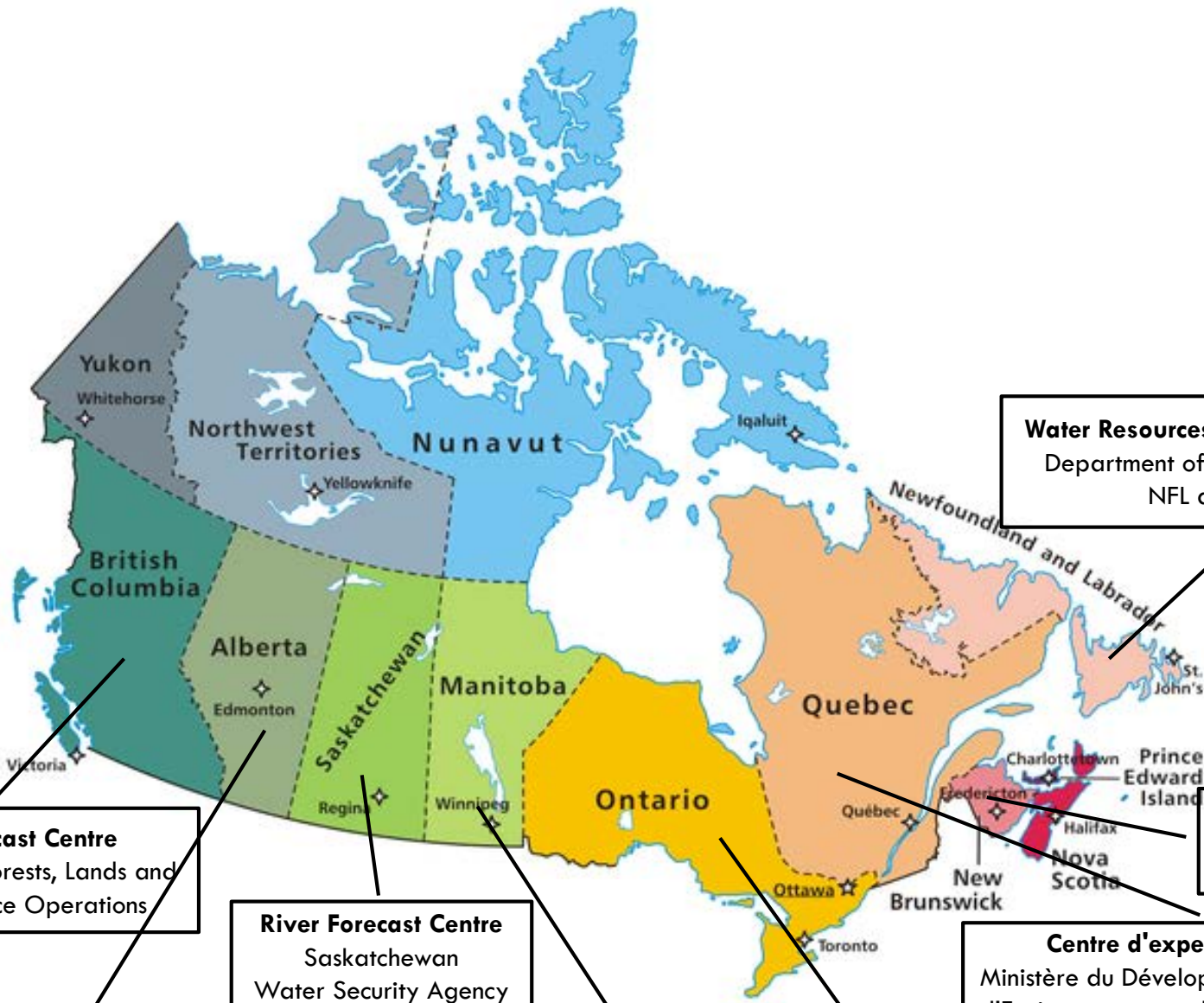
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THE historic flood of 2011 was unlike anything seen or recorded in Manitoba previously. Emergency Measures Minister Steve Ashton insists natural conditions overwhelmed provincial government resources, that no amount of forecasting could have prepared for what came down the Assiniboine River. In fact, a report released Friday found the province's forecasting centre was badly hobbled and produced some poor predictions. That was most evident at Lake Manitoba and Souris.



**Water Resources Management Division**  
 Department of Env. and Conservation  
 NFL and Labrador

**River Forecast Centre**  
 BC Ministry of Forests, Lands and  
 Natural Resource Operations

**River Forecast Centre**  
 Saskatchewan  
 Water Security Agency

**River Forecasting**  
 Alberta Environment and  
 Sustainable Resource Development

**Hydrologic Forecast Centre**  
 Manitoba Infrastructure and  
 Transportation

**Surface Water Monitoring Centre**  
 Ontario Ministry of Natural  
 Resources

**Centre d'expertise hydrique**  
 Ministère du Développement durable, de  
 l'Environnement et de la Lutte contre les  
 changements climatiques

**River Watch**  
 Government of  
 New Brunswick

# Flood forecasting program


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- Data Collection and Monitoring
- Modelling and Forecasting
- Warning Construction and Communication
- Response and Further Dissemination

# Manitoba Flood Forecast Centre

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Government Business Residents Tourism Services Search... GO

Manitoba 

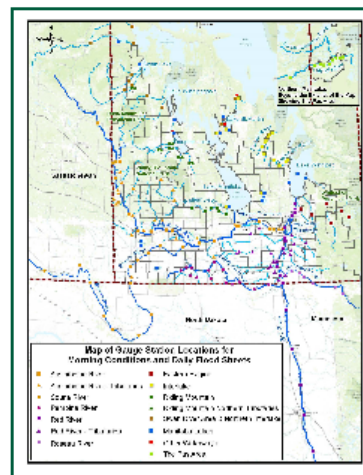
Infrastructure and Transportation  [Printer Friendly](#)

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## Forecasts / Reports

- [Overview](#)
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- [Predicted Daily Levels](#)
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# Manitoba Flood Forecast Centre

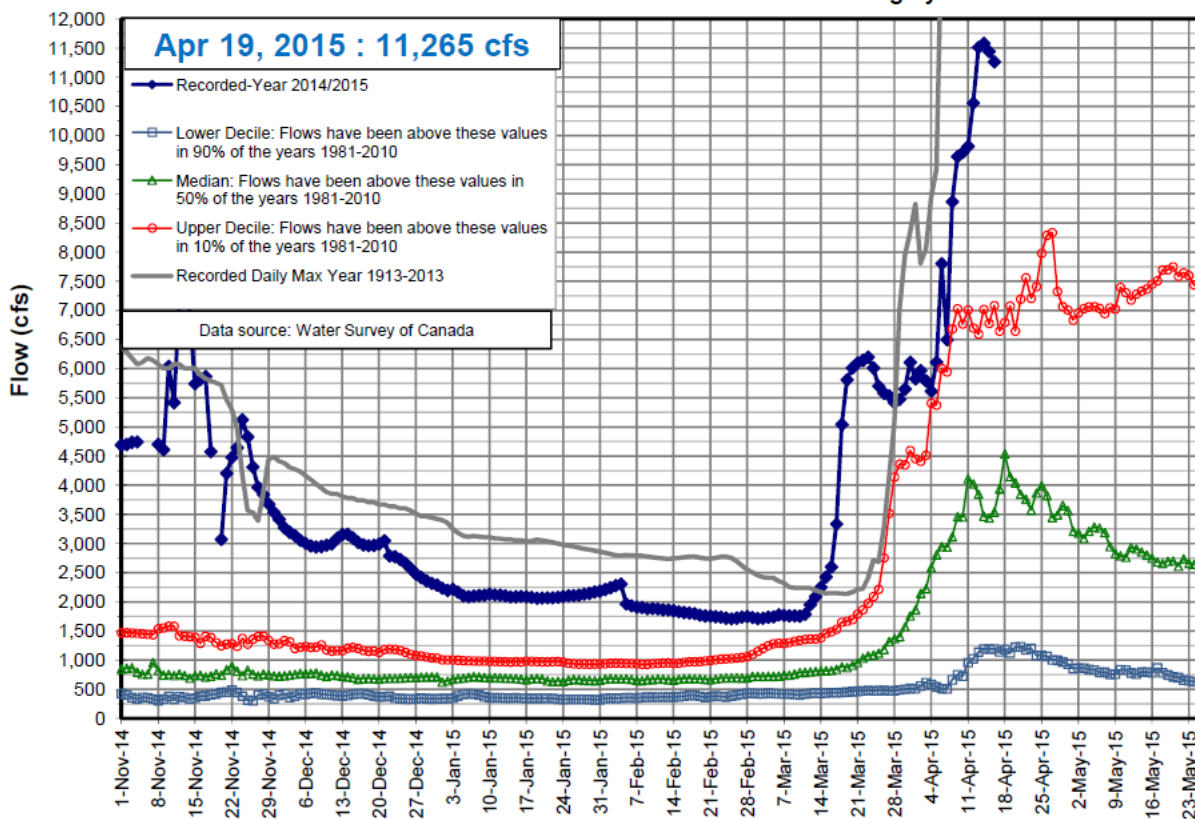
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- Provision of flood condition reports, forecasts and warnings to enable effective coordination of flood response planning.
- Operation of dams and the provision of data and forecasts for the operation of floodways and diversions.
- Preparation of spring flood outlooks during the winter and daily flood reports and specific river forecasts during spring flood events.
- Flash flood watches, warnings and flood advisories due to heavy rainfall are issued when significant impacts are anticipated.

# Manitoba Flood Forecast Centre

## Hydrologic Forecast Centre - Manitoba Infrastructure and Transportation

### Assiniboine River at Headingley



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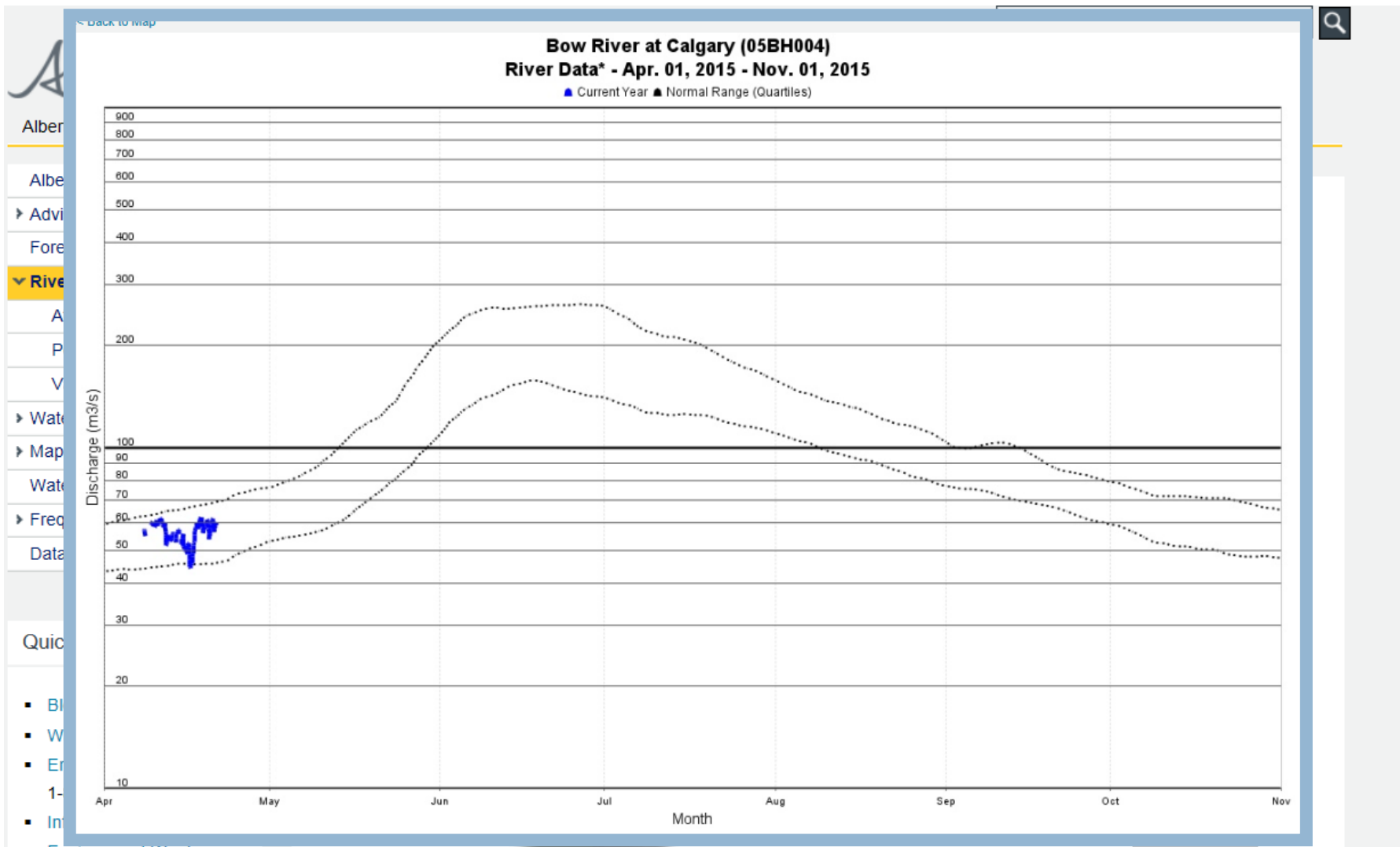
# Alberta River Forecast Centre

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- Provide flood warnings for river flood events due to melting snow or heavy rainfall;
- Produce monthly water supply forecasts from February to August
- Develop reservoir operation procedures for flood and water supply management.

# Alberta River Forecast Centre

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# Saskatchewan Water Security Agency



S A S K A T C H E W A N

Date of Forecast: April 24, 2015

| DATE           | SOUTH SASKATCHEWAN RIVER              |                          |  |                                     | NORTH SASKATCHEWAN RIVER               |                                     |
|----------------|---------------------------------------|--------------------------|--|-------------------------------------|--|-------------------------------------|
|                | Lake Diefenbaker                      |                          |  | Saskatoon                           | Alberta Border                         | Prince Albert                       |
|                | Daily Mean Inflow (m <sup>3</sup> /s) | Daily Mean Elevation (m) | Daily Mean Outflow (m <sup>3</sup> /s) | Daily Mean Flow (m <sup>3</sup> /s) | Daily Mean Flow (m <sup>3</sup> /s)    | Daily Mean Flow (m <sup>3</sup> /s) |
| April 24, 2015 | 130                                   | 553.71                   | 250                                    | 260                                 | 190                                    | 390                                 |
| April 25, 2015 | 130                                   | 553.70                   | 280                                    | 250                                 | 210                                    | 360                                 |
| April 26, 2015 | 130                                   | 553.67                   | 280                                    | 270                                 | 220                                    | 350                                 |
| April 27, 2015 | 130                                   | 553.65                   | 280                                    | 280                                 | 230                                    | 330                                 |
| April 28, 2015 | 130                                   | 553.62                   | 310                                    | 280                                 | 240                                    | 310                                 |
| April 29, 2015 | 130                                   | 553.58                   | 310                                    | 300                                 | 240                                    | 310                                 |
| April 30, 2015 | 140                                   | 553.55                   | 310                                    | 310                                 | 250                                    | 320                                 |
| May 1, 2015    | 140                                   | 553.52                   | 310                                    | 310                                 | 250                                    | 330                                 |
| May 2, 2015    | 140                                   | 553.49                   | 280                                    | 310                                 | 250                                    | 340                                 |
| May 3, 2015    | 150                                   | 553.47                   | 280                                    | 300                                 | 250                                    | 350                                 |
| DATE           | SASKATCHEWAN RIVER                    |                          |  |                                     |  |                                     |
|                | Codette Reservoir                     |                          |  | Tobin Lake                          |  |                                     |
|                | Daily Mean Inflow (m <sup>3</sup> /s) | Daily Mean Elevation (m) | Daily Mean Outflow (m <sup>3</sup> /s) | Daily Mean Elevation (m)            | Daily Mean Outflow (m <sup>3</sup> /s) |                                     |
| April 24, 2015 | 690                                   | 347.58                   | 660                                    | 313.44                              | 570                                    |                                     |
| April 25, 2015 | 660                                   | 347.36                   | 750                                    | 313.49                              | 570                                    |                                     |
| April 26, 2015 | 630                                   | 347.20                   | 700                                    | 313.53                              | 570                                    |                                     |
| April 27, 2015 | 600                                   | 347.18                   | 630                                    | 313.56                              | 570                                    |                                     |
| April 28, 2015 | 590                                   | 347.20                   | 600                                    | 313.56                              | 670                                    |                                     |
| April 29, 2015 | 590                                   | 347.22                   | 600                                    | 313.55                              | 630                                    |                                     |
| April 30, 2015 | 590                                   | 347.24                   | 600                                    | 313.54                              | 630                                    |                                     |
| May 1, 2015    | 610                                   | 347.32                   | 600                                    | 313.53                              | 630                                    |                                     |
| May 2, 2015    | 630                                   | 347.48                   | 590                                    | 313.54                              | 510                                    |                                     |
| May 3, 2015    | 650                                   | 347.69                   | 590                                    | 313.57                              | 480                                    |                                     |

HYD 66

# Centre d'expertise hydrique, Quebec



Station : 030401 - Richelieu - aux rapides Fryers à Carignan \* ( Débit moyen en m<sup>3</sup>/s )



# FloodNet Project 3.1

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## Evaluation of Flood Forecasting and Warning Systems across Canada

### Objectives

- Review the flood forecasting systems currently implemented by Canadian provinces and evaluate their performance in meeting their intended purpose.
- Develop a better understanding and provide recommendations for the type of models and data that are most suitable in a given region.

# Questionnaire

- Q1: Describe the type of floods that you deal with.
- Q2: Provide a general description of your flood forecasting system.
- Q3: How many people are involved in flood forecasting in your organization? Which organizations outside your own do you collaborate with to produce flood forecasts?
- Q4: What are your primary sources of precipitation and discharge information?



# Questionnaire

- Q5: What hydrologic, hydraulic, and/or statistical models and tools do you use to produce discharge forecasts?
- Q6: Are there components of your forecasting procedures that you think could be improved?
- Q7: Please provide suggestions for things that would be valuable to your organization (models, tools, data bases, communication, etc.) and that you would like to see addressed in the research program of FloodNET.



## Canada

- ❑ **Alberta**
- ❑ British Columbia
- ❑ Saskatchewan
- ❑ Manitoba
- ❑ Ontario

## International

- ❑ European Union
- ❑ Netherlands, United Kingdom, France, Germany, Switzerland
- ❑ Australia
- ❑ Colorado
- ❑ Japan

# Alberta

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- Data collection and monitoring
  - ▣ Precipitation data gaps
  - ▣ Failure of remote-sensing stations
- Communication with authorities
  - ▣ No dedicated communication officer
- Timing of warnings
  - ▣ Balance between timely info and false-alarm incidents
- Flash floods
  - ▣ No mandate for flash flood forecasting

# Alberta

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- Forecast group staffing and capacity
  - ▣ Specialized field
  - ▣ Difficult to find and retain flood forecasters
  - ▣ High stress level job

"Generally, an assumption is that approximately half of a forecasting group's staff leave their job after a major flood event."

# British Columbia

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- Data collection and monitoring
  - ▣ Better data management system that integrates data acquisition, management, forecasting, analysis and reporting.
  - ▣ Better spatial resolution of the weather observation and forecast data.
  
- Modelling and forecasting
  - ▣ Develop methodology for ensemble forecasts (model, input data)
  - ▣ Hydrologic models for more watersheds.

# Manitoba

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- Data collection and monitoring
  - ▣ Data network is sparse; CoCoRaHS data considered.
  - ▣ Need for better data management systems.
  - ▣ Accurate forecasts highly dependent on forecasts from neighbouring jurisdictions.
  
- Modelling and forecasting
  - ▣ MANAPI has known limitations (rainfall, depression storage)
  
- Forecast group staffing and capacity
  - ▣ Lack of succession planning. Retention issues.

# Quebec

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- Modelling and forecasting
  - General improvement in overall forecast performance.
  - Uncertainty assessment: meteo ensembles, multiple hydrologic models, ensemble assimilation.

# Identified needs - general

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- Access to more accurate precipitation/snowfall estimation and forecasts
- Up-to-date soil moisture products for use in forecasting.
- Improved modelling tools; modelling of more watersheds
- Tools and approaches for ensemble forecasting.
- Support tools to more effectively communicate results of forecasts, risk, and uncertainty.



# Identified needs - general

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- Tools, models and precipitation and hydrometric data standards that would make it easier to develop, implement and run continuous models.
- “Standards of Practice” in the flood forecast community.