



Societal & Economic Research & Applications (SERA)

Brian Mills *SERA* Chair
Adaptation and Impacts Research Division



*c/o Faculty of Environmental Studies
University of Waterloo
Waterloo, Ontario N2L 3G1
+1 519 888 4567 ext.35496
Brian.Mills@ec.gc.ca*



*23 September 2008
THORPEX workshop and working group meetings
World Meteorological Organization headquarters
Geneva, Switzerland*

SERA Milestones

Nov 2002

First meeting of The Observing System Research and Predictability Experiment (THORPEX – A Global Atmospheric Research Programme) International Core Steering Committee (ICSC) with acknowledgement of importance of societal and economic applications

Sep 2008

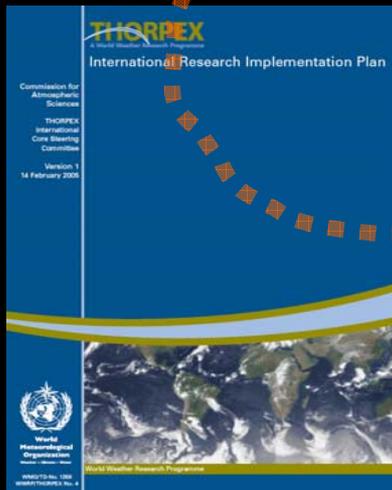
SERA Milestones

Nov 2002

ThorpeX International Research Implementation Plan published with formal establishment of SERA as one of 4 core sub-programme working groups within the ThorpeX structure.

Feb 2005

- *Defining high-impact weather forecasts and assessing their values*
- *Evaluating the costs and benefits of improved forecast systems*
- *New user-specific weather products and user procedures, for developed and developing countries*
- *Equitable use of Global Interactive Forecasting System (GIFS)*



Sep 2008

SERA Milestones

Nov 2002

Dr. Jeffrey Lazo appointed first Co-chair of the Thorpex Societal and Economic Applications Working Group (SEA-WG).

Initial WG membership: Dr. Frederic Atger (Météo France), Mr. Gerald Flemming (Met Eirann), Mr. C.Y. Lam (Hong Kong Observatory), Mr. Brian Mills (Environment Canada), Mr. Xie Pu (Beijing Met Bureau), Dr. Peter Webster (Georgia Tech)

Sep 2005

Sep 2008

SERA Milestones

Nov 2002

Feb 2006

WMO Commission for Atmospheric Sciences (CAS) (CAS XIV meeting, February 2007) establishes an Open Programme Area Group (OPAG) on World Weather Research Programme (WWRP)

SERA officially becomes a World Weather Research Programme working group (WWRP-SERA-WG)

Sep 2008

SERA Milestones

Nov 2002

Mar 2006

Second meeting of the THORPEX SERA WG as part of THORPEX workshop and parallel meetings of all WGs (Reading, UK). "Research" added to applications mandate.

Sep 2008

SERA Milestones

Nov 2002

*North American THORPEX Societal and Economic Research and Applications (NAT SERA) Workshop
(Boulder, CO, USA)*



Aug 2006



SOCIETAL AND ECONOMIC RESEARCH AND APPLICATIONS FOR WEATHER FORECASTS
Priorities for the North American THORPEX Program

BY REBECCA E. MORSS, JEFFREY K. LAZO, BARBARA G. BROWN, HAROLD E. BROOKS, PHILIP T. GANDERTON, AND BRIAN N. MILLS

Sep 2008

SERA Milestones

Nov 2002

*Second International THORPEX Science Symposium
(Landshut, Germany) with 3 sessions devoted to SERA
activities*

Dec 2006

Sep 2008

SERA Milestones

Nov 2002

Secure and Sustainable Living: Social and Economic Benefits of Weather, Climate and Water Services international conference held in Madrid.

Mar 2007

WMO Forum on Social and Economic Applications of Meteorological and Hydrological Services formed to assist with implementation of the Madrid Action Plan. Some cross-membership with WWRP-SERA-WG
<http://www.wmo.int/pages/madrid07/>

Sep 2008



ELEMENTS FOR LIFE

A Publication for the
International Conference on Secure and Sustainable Living, Madrid, March 2007



SERA Milestones

Nov 2002

WWRP Joint Scientific Committee (JSC) First Session meeting held. Initial outline of Strategic Plan with SERA elements proposed

Apr 2007

Sep 2008

SERA Milestones

Nov 2002

Dr. Jeffrey Lazo completes 3-year term as THORPEX SERA-WG Co-chair. Brian Mills appointed new Co-chair of the WWRP-SERA-WG

June 2008

Sep 2008

WWRP Strategic Plan: A Path Forward for SERA

The Working Group on Societal and Economic Applications (WG-SEA) has the following terms of reference:

- (a) To advance the science of the social and economic application of weather-related information and services;***
- (b) To promote and aid the implementation of social science research within OPAG-WWRP, OPAG-EPAC and throughout WMO, as may be required;***
- (c) To review and assist in the development and promotion of societal and economic-related demonstration projects.***

Annex II, CAS XIV final meeting report

(http://www.wmo.ch/pages/prog/arep/cas/index_en.html)

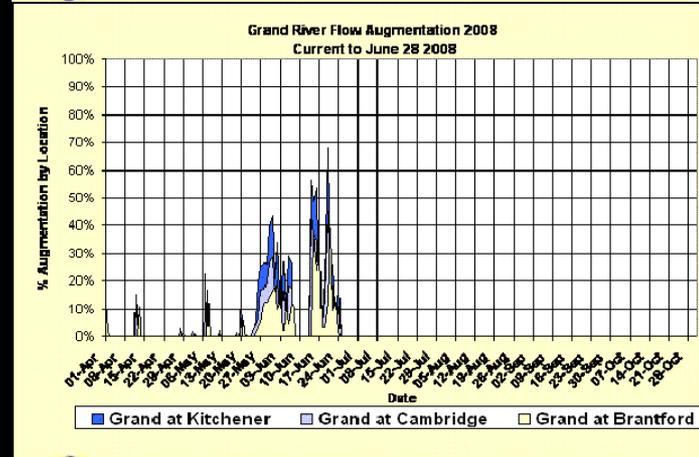
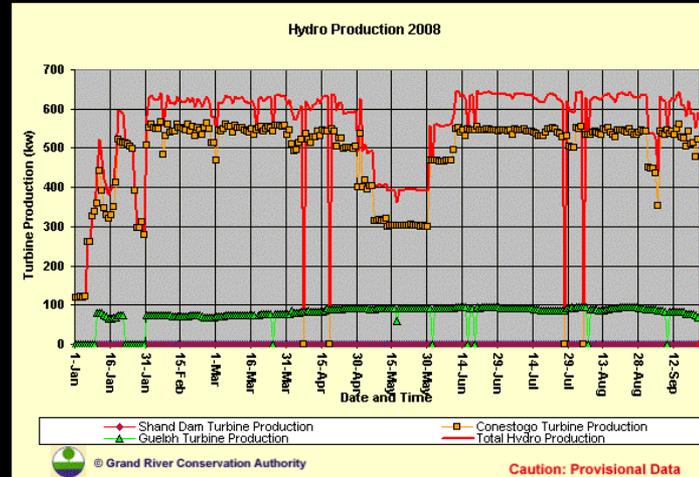
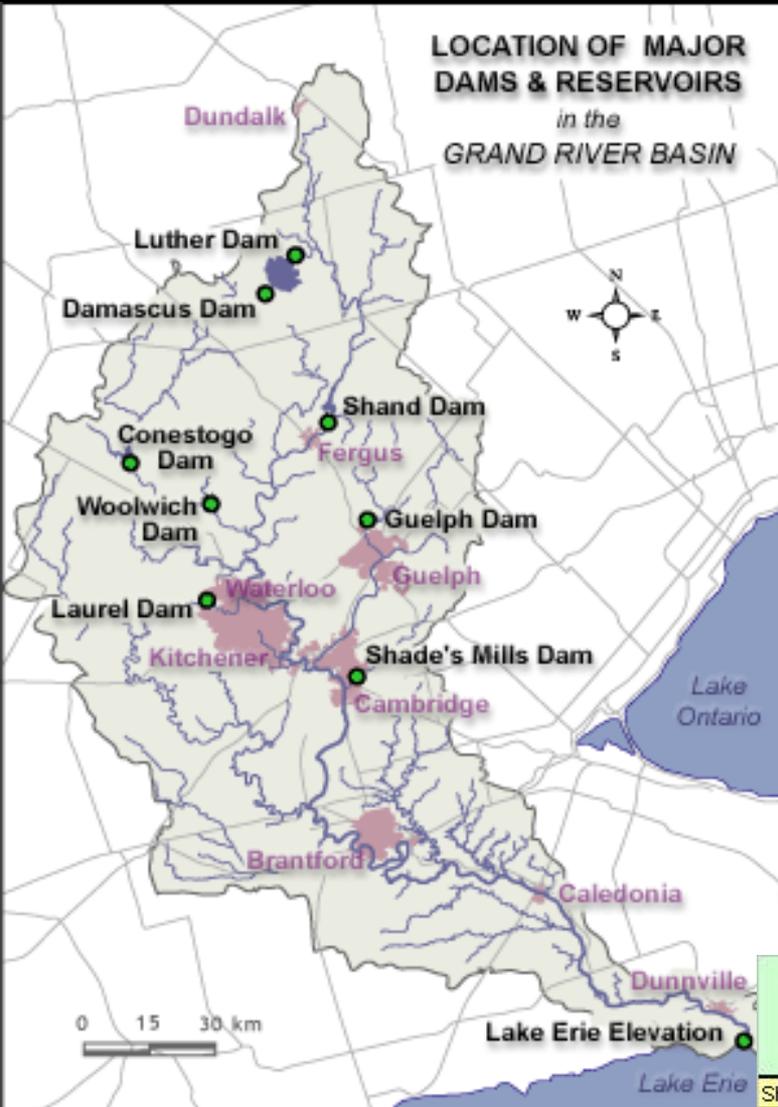
WWRP Strategic Plan: A Path Forward for SERA

Mission of the Working Group on Societal and Economic Research and Applications...is to advance the science of the social and economic application of weather related information and services and review and assist in the development and promotion of societal and economic related demonstration projects.

Weather and Society page of WWRP

(http://www.wmo.ch/pages/prog/arep/wwrp/new/weather_society.html)

WWRP Strategic Plan: A Path Forward for SERA



Reservoir	Time	Elevation (m)	Storage (1000's m ³)	U/S Gauge Inflow (m ³ /s)	Back Routed Inflow (m ³ /s)	Discharge (m ³ /s)	Avaiable Storage To Full Dam (1000's m ³)	Runoff Storage To Full Dam (mm)
Shand Dam	09/23/08 1:00	420.232	30,517	3.5	3.8	9.2	32,241	40
Conestogo Dam	09/23/08 1:00	387.235	24,795	2.6	2.6	6.1	34,651	60
Guelph Dam	09/23/08 1:00	346.554	12,467	0.9	2.0	9.8	10,008	44
Luther Dam	09/23/08 1:00	481.423	17,592		-3.48	1.48	10,483	164
Woolwich Dam	09/23/08 1:00	361.871	1,554	0.11	0.24	0.69	3,943	65
Laurel Cr. Dam	09/23/08 1:00	342.333	938	0.10	0.09	0.09	756	25
Shades Mills Dam	09/23/08 1:00	286.687	1,093	0.68	0.48	0.90	821	8

WWRP Strategic Plan: A Path Forward for SERA

INFORMATION TYPES	Time=0															
	ARCHIVING						MONITORING		PREDICTION							
ACTIONS	Design to new standard						Fire suppression		Open emergency shelters				Coastal protection/resettlement			
Costs/benefits	Costs-avoided losses						Costs-avoided losses		Costs-avoided losses				Costs-avoided losses			
IMPACTS																
Economic	Historic damage/insured losses						Property affected		Vale of life/healthcare burden				Property value at risk			
Social	Injuries/fatalities						People affected		Extra visits/hospital ER visitation				Displaced population			
Bio-physical/environmental	50-year snowload						Forest fires		Heat stress				Coastal flooding			
STATE OF THE ATMOSPHERE																
General NMHA function	Extreme snowfall						CG lightning flashes		Humidex advisory				Sea-level rise			
TIMESCALE	Centuries	Years	Months	Weeks	Days	Hours	Minutes	Hours	Days	Weeks	Months	Years	Centuries			

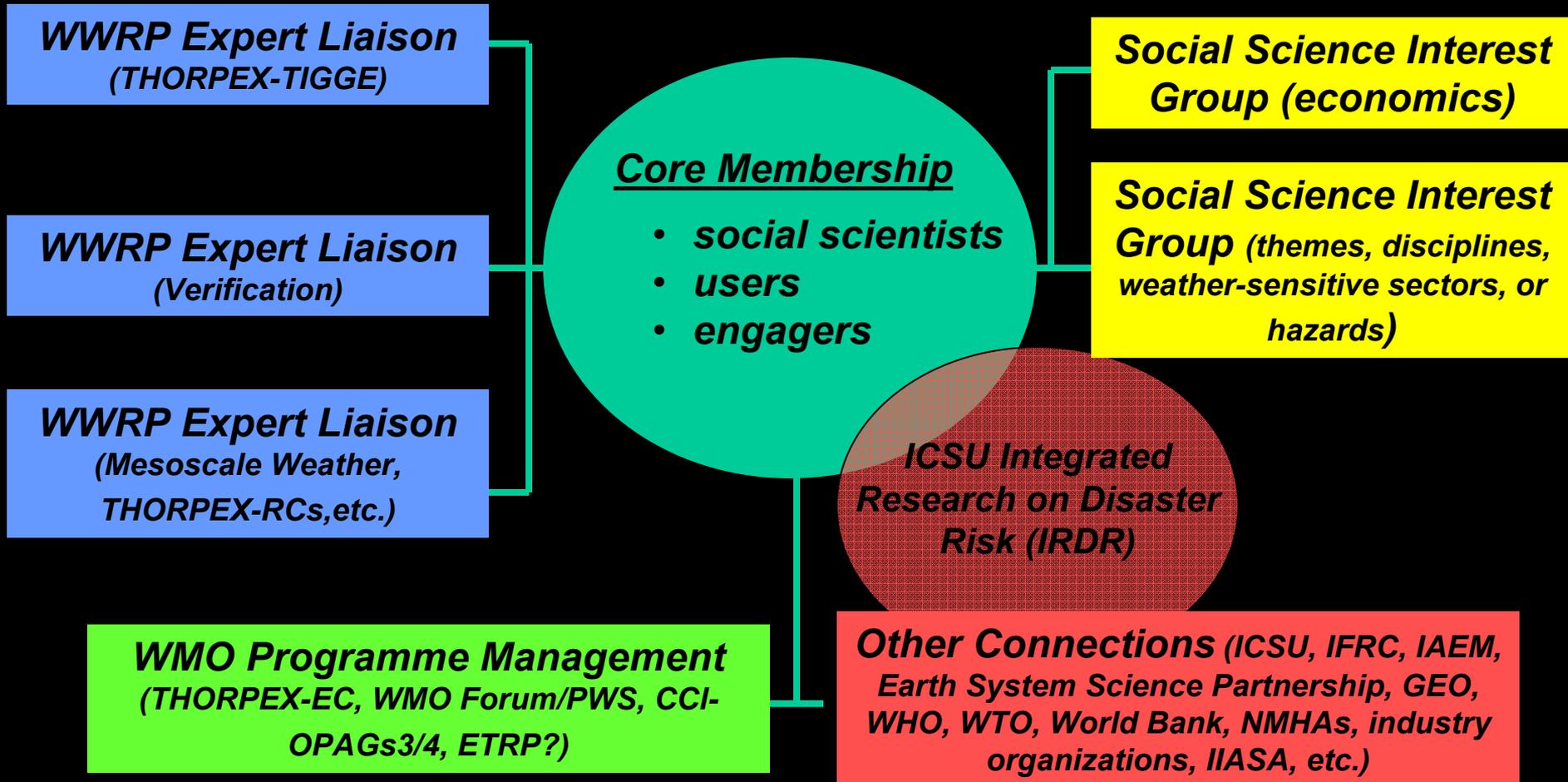


User-relevance & Value

Weather

WWRP Strategic Plan: A Path Forward for SERA

WG Structure



Core Members

6-10 members possessing 1-3 types of expertise:

- 1. Social, economic or decision scientists (i.e., from anthropology, applied health, communications, economics, geography, management sciences, sociology, psychology, or similar disciplines) or other researchers with experience applying social science methods and techniques to weather-related issues***
- 2. Representatives of private, public or non-government sector organization that engages users in the development, application, and beneficial use of weather and related information, products and services***
- 3. Representatives of a user or community of users that benefits directly or indirectly from weather and related information, products and services***

WWRP Strategic Plan: A Path Forward for SERA

Priority Social Science Research Topics

- *Understanding the use of weather information in decision making*
- *Estimation of the economic (societal) value of weather information*
- *Development of user-relevant verification methods*
- *Communication of weather forecast uncertainty*
- *Development of decision support systems and tools*

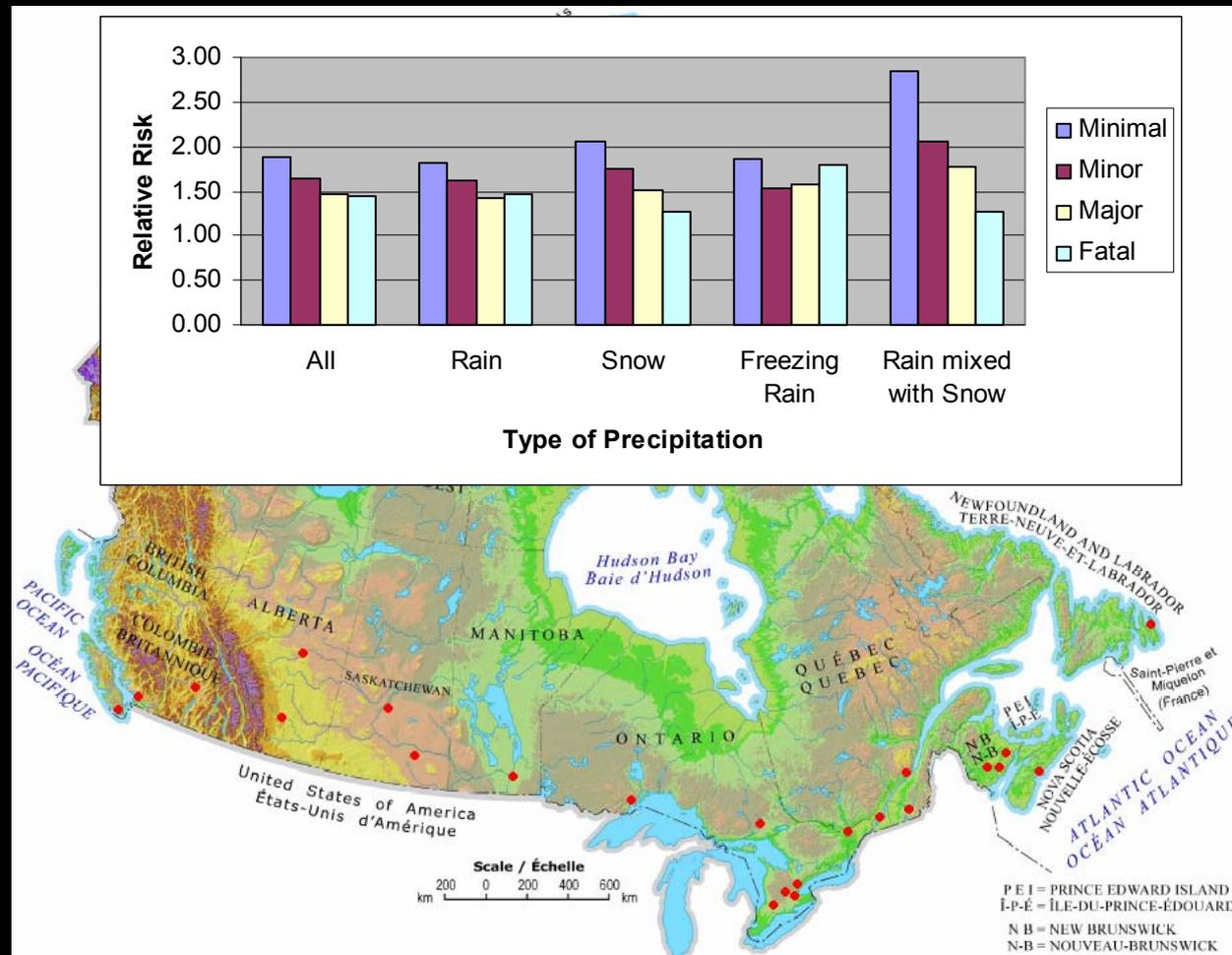
WWRP Strategic Plan: A Path Forward for SERA

Priority issues and sectors:

- *Mortality, morbidity, and significant loss of property*
- *Critical infrastructure and resources required to support communities and livelihoods (water, energy, food, transportation)*

WWRP Strategic Plan: A Path Forward for SERA

High Impact Weather is often not severe or extreme....



Andrey et al. 2005; Andrey, (under review)

Relative Collision & Injury Risk - Ottawa (1996-98)

	n*	RELATIVE RISK	
		Collision	Injury
All Events	240	1.74	1.60
No watch, advisory or warning in effect within past 24 hours	207	1.80	1.68
Watch, advisory or warning in effect within past 24 hours	33	1.40	1.18

*event-control pairs

Source: Mills and Andrey (in preparation)

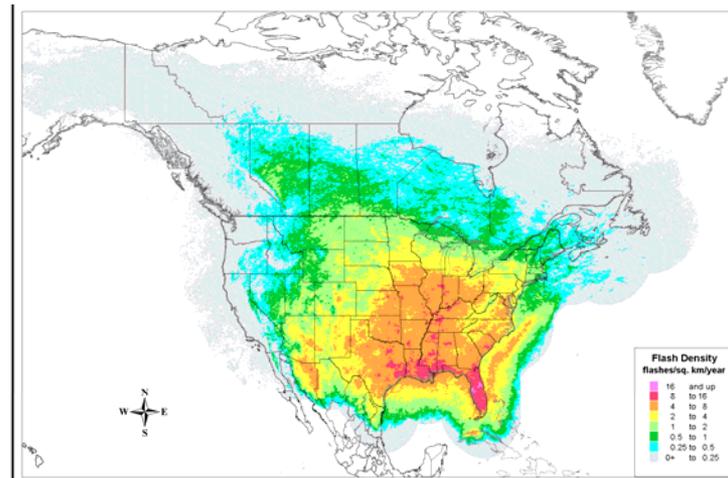


WWRP Strategic Plan: A Path Forward for SERA

High Impact Weather is often not severe or extreme....

Sector	Key impact/cost	Estimated Annual Costs/Losses ¹	
		Low	High
Health	Lightning-related injuries and fatalities	\$3,648,793	\$79,291,126
Property	Lightning-ignited municipal fires	\$14,858,541	\$16,414,436
	Insured losses and deductibles	\$7,906,521	\$23,540,272
Forestry	Forest fire suppression and pre-suppression	\$306,981,081	\$437,611,328
Electricity	Sustained and momentary outage costs to customers	\$266,940,187	\$444,900,311
	Lost revenue	\$16,187	\$16,187
TOTAL		\$600,351,310	\$1,001,773,660

¹ low and high estimates taken from report tables; electricity low and high values determined by subtracting and adding 25% to baseline estimates (Mills et al., 2008b)



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Other desirable qualities:

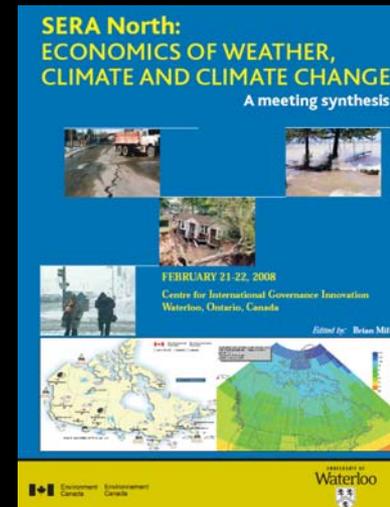
- *Comparisons across regions and socio-economic contexts*
- *Incorporation of THORPEX-TIGGE and WWRP-Verification data/elements*
- *Leverage on-going/planned projects (e.g., MERIT, ICSU-IRDR, NCAR-SIP)*
- *Transferability and capacity building potential*

WWRP Strategic Plan: A Path Forward for SERA

Priority Activities (1-2 years)

- ***Populate the WG structure and establish regular correspondence and meeting schedule***
- ***Canvass WG members, NMHAs, WWRP WGs, and WMO programmes to establish basic inventory of related projects, capacity, contacts and interest in SERA***
- ***Develop/promote a SERAwx web resource for social scientists to access:***
 - ***user-friendly meteorological data***
 - ***links to socio-economic data***
 - ***meta-data concerning SERA research, applications, methods, and workshops/training opportunities***
 - ***inventory/database of individual high impact weather events, high impact forecasts (success/failure) and impact climatologies***

<http://www.fes.uwaterloo.ca/research/aird/sera/index.html>



WWRP Strategic Plan: A Path Forward for SERA


NOAA's National Weather Service
Storm Prediction Center

Site Map
News
Organization
Search for:

Local forecast by
"City, St" or "ZIP"
City, St

Overview
[SPC Products](#)
[All SPC Forecasts](#)
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Climatological or Past Storm Information

New: [WSR-88D radar coverage area severe weather climatologies.](#)

New: [Gridded national severe weather climatologies.](#)

New: [SPC preliminary severe weather summary.](#)

Killer Tornadoes by Year

1997	1998	1999	2000	2001
2002	2003	2004	2005	2006
2007				

Fatality locations (1985-2003) This information allows you to see where fatalities from tornadoes have occurred since 1985. The locations refer to physical location and not geographic location.

Archived Data

The table below provides links to comma separated value (.csv) files for tornado, hail, and damaging wind data as compiled in *Storm Data*. Tornado reports exist back to 1950 while hail and damaging wind reports date from 1955. These files can be imported into any spreadsheet capable of handling .csv format.

This document  describes the format of the .csv files.

TORNADO	HAIL	DAMAGING WIND
2005-2007_torn.csv (0.25 mb)	2005-2007_hail.csv (4 mb)	2005-2007_wind.csv (4 mb)
2000-2004_torn.csv (0.7 mb)	2000-2004_hail.csv (6 mb)	2000-2004_wind.csv (6 mb)
90-99_torn.csv (1 mb)	90-99_hail.csv (6 mb)	90-99_wind.csv (8 mb)

<http://www.spc.noaa.gov/climo/historical.html>

WWRP Strategic Plan: A Path Forward for SERA

Public Safety Canada / Sécurité publique Canada

Canada

Français About us Contact Us Policy Help Publications Search Programs Canada Site Newsroom

Keeping Canadians Safe

Home ► Publications ► Canadian Disaster Database

Canadian Disaster Database

The Canadian Disaster Database contains historical information on disasters which have directly affected Canadians, at home and abroad, over the past century. References to all types of Canadian disasters, including those triggered by natural hazards, technological hazards or conflict (not including war) can be found here. The database describes where and when a disaster occurred, who was affected, and provides a rough estimate of the direct costs.

You can search the disaster database by using criteria such as the type of disaster, and/or the location or time period of occurrence. Please select one or more disaster type, one or more province and one or more time period from the lists below. You are given several options in a drop down box at the bottom of the form that will help you organize the results in an easy-to-search manner. Your search will be displayed on the screen and can be downloaded as a plain text or tab-delimited file to your computer.

All Disaster Types

Biological

- Epidemic
- Infestation

Geological

- Earthquake
- Landslide
- Tsunami

Meteorological and Hydrological

Data	Period	Source	Region	Completeness
Vital statistics - cause-of-death by gender	1921-2002	Statistics Canada	National and provincial (except 1950-64)	- based on ICD codes (E907) and place of residence - non-Canadians excluded
National Trauma Registry - admissions to acute care hospitals	1999-2003*	Canadian Institute for Health Information (CIHI)	National	- based on ICD-9 code (E907) and ICD-10 code (X33 victim of lightning) - data collected only for acute care hospitals
National Ambulatory Care Registry System - emergency room visits	2002-2003*	Canadian Institute for Health Information (CIHI)	Ontario	- based on ICD-10 code (X33 victim of lightning)
Injuries caused by fires ignited by lightning	1986-2001	Council of Canadian Fire Marshals and Fire Commissioners (CCFMFC)	National and provincial	- based on standard code of fires by source of ignition (CCFMFC 2002) - includes fires where response was from a government fire department - does not include forest fires that do not affect structures

*based on FY (April 1-March 31)

Mills et al., 2008

Article Title: Lightning strikes Nfld. family three times

Source: Edmonton Journal

Date of Article: Thursday, December 01, 2005

Date of Strike: [] Time of Strike: []

Location Information

Location - Province: Newfoundland

Location - City/Region: St. John's

Death(s)

Death1 - Age: [0] Death1 - Sex: [] Death1 - Activit: []

Death2 - Age: [0] Death2 - Sex: [] Death2 - Activit: []

Injuries

1: Type: [] Number: [0] Ages: [] # of Male: [0] # of Female: [0] Activit: []

2: Type: [] Number: [0] Ages: [] # of Male: [0] # of Female: [0] Activit: []

3: Type: [] Number: [0] Ages: [] # of Male: [0] # of Female: [0] Activit: []

Property Damage

Property Damag: [] Cause of Damage: Lightning

House(s) Damaged (#): [5] House(s) Destroyed (#): [0] Damage Cost (\$): \$3,000.00

Power Disrupted (peopl): [] Power Disrupted (households): []

People Evacuate: [] Forest Fire Costs (\$): \$0.00 Forest Fire Period (year?): []

Article Title: Pasture fire spreading: Had grown to 4,000 hectares by Thursday

Source: Daily Herald (Prince Albert)

Date of Article: Friday, June 20, 2003

Date of Strike: [] Time of Strike: []

Location Information

Location - Province: Saskatchewan

Location - City/Region: Prince Albert

Death(s)

Death1 - Age: [0] Death1 - Sex: [] Death1 - Activit: []

Death2 - Age: [0] Death2 - Sex: [] Death2 - Activit: []

Injuries

<http://www.ps-sp.gc.ca/res/em/cdd/index-en.asp>

VI. Natural disasters - major multiple-payment occurrences

IBC, 2006

Date and place	Event	PROPERTY			AUTOMOBILE			TOTAL		
		# of claims	Loss (\$000)	Average paid (\$)	# of claims	Loss (\$000)	Average paid (\$)	# of claims	Loss (\$000)	Adjusted for inflation 2005 \$000
1992 July 31 Calgary	Hailstorm	4,285	12,098	2,823	6,324	9,980	1,578	10,609	22,078	28,305
1992 July 31 Toronto	Flooding	993	4,596	4,628	341	302	885	1,334	4,898	6,279
1992 Aug. 28 Alberta	Hailstorm	1,060	3,594	3,390	905	1,669	1,844	1,965	5,263	6,747
1992 Aug. 28 Elmira, Aurora, Ontario	Flooding	1,137	4,292	3,776	92	56	609	1,229	4,348	5,574
1992 Sept. 1 Alberta	Hailstorm	1,457	4,611	3,165	1,628	2,810	1,726	3,085	7,421	9,514
1992 Oct. 6-7 Avalon, NL	Wind	3,549	7,487	2,109	641	729	1,137	4,190	8,216	10,533
1992 Nov. 12-13 southern Ontario	Wind	18,259	35,209	1,928	1,048	1,228	1,172	19,307	36,437	46,714
1992 Nov. 12-13 Québec	Wind	5,624	10,106	1,797	1,412	1,950	1,381	7,036	12,056	15,456
1993 March 13-14 Quebec	Storm	6,280	11,814	1,881	3,440	6,633	1,928	9,720	18,447	23,351
1993 July 25-Aug. 14 Winnipeg	Flooding	21,264	184,837	8,692	----	not available	----	----	184,837	233,971
1993 July 29-30 Alberta	Hailstorm	759	7,078	9,322	673	1,038	1,542	1,432	8,116	10,273
1993 July 29 Saskatchewan	Flooding	2,741	5,383	1,964	----	not available	----	----	5,383	6,814
1993 July 29-30 Quebec	Flooding	1,366	7,624	5,581	----	not available	----	----	7,624	9,651
1994 Jan. 16-17 southern Ontario	Flooding	3,289	11,759	3,576	1,042	1,386	1,330	4,331	13,145	16,431
1994 Jan. 28 southern Ontario	Storms	1,781	5,470	3,072	579	780	1,346	2,360	6,250	7,813
1994 May 18 southern Manitoba	Storms	2,141	8,260	3,859	----	not available	----	----	8,260	10,325
1994 May 22 Saskatchewan	Storms	5,048	8,666	1,717	----	not available	----	----	8,666	10,833
1994 June 18 southern Alberta	Hailstorm	1,653	4,284	2,592	2,032	3,979	1,958	3,685	8,263	10,329
1994 Aug. 4 Salmon Arm, BC	Storm	2,026	10,225	5,048	----	not available	----	----	10,225	12,781
1994 Aug. 4 Aylmer, Quebec	Tornado	484	6,730	13,904	81	181	2,235	565	6,911	8,639
1994 Aug. 27 southern Manitoba	Hailstorm	1,908	4,845	2,540	1,559	3,267	2,096	3,467	8,112	10,140
1994 Aug. 28 southern Ontario	Storms	1,236	6,772	5,479	366	448	1,223	1,602	7,219	9,024
1995 June 6-9 Calgary	Flooding	1,596	20,292	12,714	298	472	1,584	1,894	20,764	25,322
1995 July 4 Edmonton	Hailstorm	1,785	14,083	7,890	424	615	1,450	2,209	14,698	17,924
1995 July 10 southern Alberta	Hailstorm	3,093	17,997	5,819	3,634	8,392	2,309	6,727	26,389	32,182
1995 July 13-15 southern Ontario	Storms	12,762	36,448	2,856	11,074	16,991	1,534	23,836	53,439	65,170
1995 July 17 Calgary	Hailstorm	9,843	32,887	3,341	8,996	19,417	2,158	18,839	52,304	63,785
1995 July 30 southern Manitoba	Storm	1,582	4,971	3,142	1,645	3,497	2,126	3,227	8,468	10,327
1995 Aug. 26 Regina	Storm	3,309	12,294	3,715	----	not available	----	----	12,294	14,993
1995 Oct. 5-6 Hamilton, Ontario	Storm	5,141	15,916	3,096	262	409	1,560	5,403	16,325	19,909
1996 July 16 Winnipeg	Flood/hailstorm	21,027	94,250	4,482	24,444	52,575	2,151	45,471	146,825	176,898
1996 July 16-18 Calgary	Hailstorm	15,845	91,981	5,805	10,778	27,110	2,515	26,623	119,091	143,483
1996 July 24-25 Calgary	Hailstorm	15,742	71,400	4,536	6,005	13,822	2,302	21,747	85,222	102,677
1996 July 19-20 Saguenay, Quebec	Flooding	5,289	203,579*	[*]	1,172	3,580	3,054	6,461	207,159	249,589
1996 July 23 Outaouais, Quebec	Wind/hailstorm	330	1,257	3,809	192	314	1,639	522	1,571	1,893
1996 Aug. 8 Ottawa	Flooding	2,341	19,705	8,417	246	552	2,243	2,587	20,257	24,406
1996 Aug. 8 Outaouais, Estrie, Quebec	Flooding	1,459	7,729	5,297	65	153	2,353	3,207	7,882	9,496
1996 Nov. 9 Montreal and Quebec City	Flooding	9,813	75,684	7,713	131	356	2,721	9,944	76,040	91,614
1997 Feb. 27 Niagara Peninsula, Ontario	Wind	13,080	22,130	1,692	1,194	1,646	1,378	14,274	23,776	28,305
1997 April 6-7 Sudbury, Ontario	Flooding	2,553	20,426	8,000	65	132	2,042	2,618	20,558	24,474
1997 July 14-15 Chambly, Quebec	Flooding	3,118	29,865	9,579	----	not available	----	----	29,865	35,554

WWRP Strategic Plan: A Path Forward for SERA

 Centre for Research on the Epidemiology of Disasters				
<p>Latest</p> <p>CREC</p> <p>Assessing Public Health in Emergency Situations - International CREC Summer Course 2008</p> <p>REDAT</p> <p>August 2006: The Regional Disaster Information Management System provides resources on disaster management and prevention in South and Southeast Asia.</p> <p>EM-DAT</p> <p>September 2007: CREC CRUNCH 10 Newsletter: Disaster Data: A Balanced Perspective.</p> <p>June 2007: HOYOIS P., SCHEUREN J-M., BELOW R., GUHA-SAPIR D. (2007). Annual Disaster Statistical Review: Numbers and Trends 2006. CREC, Brussels, Belgium.</p>	<p>The Centre</p> <p>CREC</p> <p>CREC promotes research, training, and information dissemination on disasters, with a special focus on public health, epidemiology, structural and socio-economic aspects. It aims to enhance the effectiveness of developing countries' disaster management capabilities as well as fostering policy-oriented research.</p> <p>Our goals</p> <ul style="list-style-type: none"> To promote research and provide information to the international community that ensures sufficient 	  	<p>Disasters of the Week</p> <p>Week 44: 29 October - 04 November 2007</p> <p>Natural Disasters</p> <ul style="list-style-type: none"> Mexico, floods in Chiapas and Tabasco Viet Nam, floods Dominican Republic and Haiti, tropical storm "Noel" India, floods in Andhra Pradesh and Tamil Nadu <p>More Disasters of the Week >></p>	
<p>CREC</p> <p>More information on the Centre for Research on the Epidemiology of Disasters.</p>	<p>EM-DAT</p> <p>The International Disaster Database: provides methodologically-compiled data on global disaster occurrence and impact.</p>	<p>MICRODIS</p> <p>MICRODIS is a project with the overall goal to strengthen preparedness, mitigation and prevention strategies.</p>	<p>CE-DAT</p> <p>The Complex Emergency Database: standardized and comprehensive data on the human impact of conflict.</p>	<p>EM-BIB</p> <p>The Bibliographic Database: our collection of publications on disasters, and their impacts.</p>

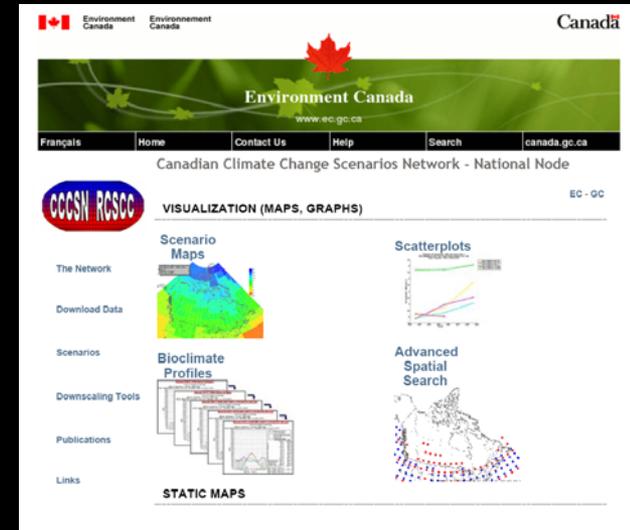
<http://www.cred.be/>

WWRP Strategic Plan: A Path Forward for SERA

Priority Activities (1-3 years)

- ***Define and complete joint SERA projects with THORPEX-TIGGE***
 - ***SERA-friendly TIGGE dataset***
 - ***regional and sector-based case applications***

<http://www.cccsn.ca/>



- ***Define and complete joint SERA projects with WWRP-Verification WG***
 - ***regional and sector-based case applications***
 - ***nowcasting, meso-, and sub-seasonal scales of prediction/decision-making***

WWRP Strategic Plan: A Path Forward for SERA

Priority Activities (2-5 years)

- ***WMO global assessment of the societal and economic benefits (and costs) of weather information***
 - ***synthesis and critical review of existing research by sector and region***
 - ***meta-analysis/expert-based global estimate***
 - ***methods and best practices required to yield a rigorous estimate***
 - ***practical guidance/training for NMHAs, researchers, and social science students***

Key international fora:

2010 Davos International Disaster Reduction Conference

2012 Madrid +5 conference