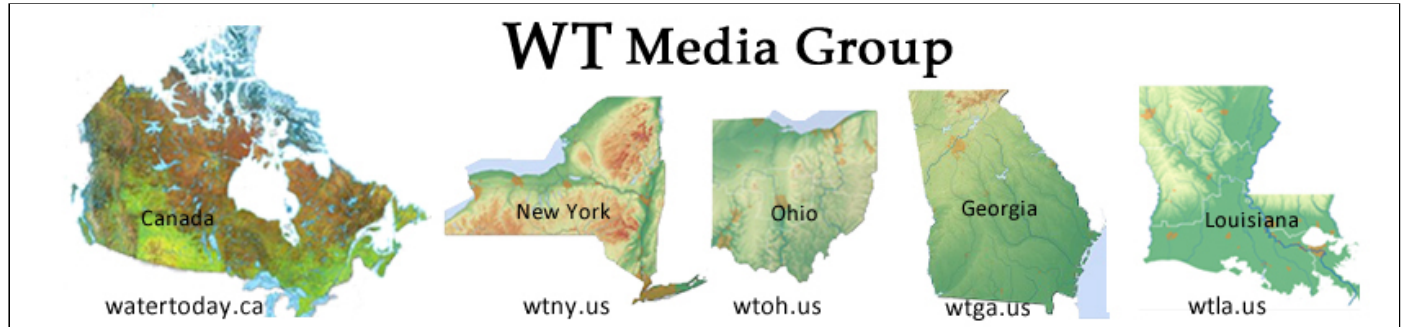


## Features

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Flooding



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## Flood Mapping - Why we need a unified view of flood risk

Interview with Slobodan P. Simonovic, Professor Emeritus, Department of Civil and Environmental Engineering, Western University

By WT Staff

Slobodan P. Simonovic, Ph.D., P.Eng; Fellow CSCE, ASCE and IWRA, D.WRE; Fellow, Royal Society of Canada; Fellow, Canadian Academy of Engineering; Foreign Member, Serbian Academy of Sciences and Arts; Professor Emeritus, Department of Civil and Environmental Engineering; Director of Engineering Studies, Institute for Catastrophic Loss Reduction; The University of Western Ontario, London, Ontario, Canada

**WT: Tell me a bit about why we need a flooding map such as the one you are working on.**

**Professor Simonovic:** Floodplain maps are one of the essential tools for managing floods, either in the period when the flooding is not occurring, to plan for implementation of infrastructure, to assess the proper level of risk, decide what and how to increase resilience in order to reduce the risk, or during the flood event, finding the best response to the situation, mobilizing the necessary resources to properly respond.

In both planning as well as in response, we do need this tool to tell us what the areas are that may be exposed to flood risk, what is the level of flood risk, meaning the extent of inundation, the water depth, and water velocity sometimes.

That is why this kind of activity is considered by many governments as primary in the process of managing floods.

A long time ago, unfortunately, Canada's national (flood mapping) program was cancelled with a change in government and never completed.

Two years ago the current government announced 65 million dollars over the next three years for national flood maps.

The kind of flood events we are facing in Canada are becoming pretty serious and the ability of the government to respond is putting a lot of strain on the budgets and on people in different areas.

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**WT: When I look at your map right now, and I look at 100 years out, it doesn't look like there is a whole lot more water there, yet in the written statements, and in the press releases around this map, indeed there are huge increases. Is this something people would refer to if buying or building a house in a flood plain? Has this got an official use?**

**Simonovic:** Yes and no. The type of maps we produced are generated in order to assess the potential value of the publicly available data and investigate the impacts of climate change on future floods over a large region, as Canada covers almost ten million square kilometres.

Having a unified methodology to look at the whole country did not and does not yet exist. I think our work was the first along that line.

On the question of how to use (our map), "can you use this information in making decisions where to live, where to buy a property?" This is a bit of a different question.

This is usually regulated. In Canada the provinces are responsible to introduce regulations, these regulations should identify areas where you should not build, and where you should not live.

Some provinces/territories have a dual system, identifying areas where some development is possible with special permission from those who take care of flooding. The maps can be informative in that sense. The unfortunate situation is that different provinces are using different standards.

For example, Ontario has a dual standard. In London we have the Thames River, what we usually consider the flood plain is the area that can be inundated with the probability of 1/100 every year - the so-called 100-year return period. No development is allowed in the floodplain. The area of the so-called 250-year return period, known as flood fringe, is the secondary criteria, where some development is possible with special permissions from the municipalities as well as the conservation authorities that carry the primary responsibility for flood management in Ontario.

**WT: Do you think your map will be adopted by each province? I realize this has been done for the federal government, specifically the Department of Natural Resources. Do you think this map**

## **will be used across the country by provinces and territories to develop legislation?**

**Simonovic:** I cannot answer this question. I know that many are already using our maps but being a researcher at the University and using the research grants to develop these maps, we don't have input into what is happening after the research is published and made available to the general public.

I have a feeling, based on the questions I am getting from time to time, that many are looking into these maps. I am not sure if they are being used for regulatory purposes.

One of the very important inputs that these maps are providing is the identification of critical regions in Canada that are exposed to a higher level of flood risk.

By identifying these regions, we can then implement a much more detailed methodology, very traditional, combining the hydrologic and hydraulic modelling to find out what is the level of risk for a small region

We generated maps using the spatial scale of a one-by-one kilometre in a grid form.

When you look at the whole country (10 million square kilometres), the methodology is obviously providing a coarse type of information.

**WT: That's a big wow, one-by-one km, that's quite something.**

**Simonovic:** Yes this is large-scale data-intensive work, but even one-by-one km is not always sufficient (spatial resolution detail) to make serious decisions about flood risk to life and property at a particular location.

**WT: I read you will drill down into specific regions, getting down to almost neighbourhood by neighbourhood. Is that a fair statement?**

**Simonovic:** Yes, you can see your home on our map. You can find out where your home is located or what is the potential risk that you are exposed to now and how will this risk change with changing climatic conditions. We did consider climate change and developed maps for various future climate conditions, you can see what the future could bring. However, the particular location of your home is within one cell, and an assumption within this cell of one-by-one km is that all conditions are uniform (within): the water depth, and the water velocity.

For making more detailed decisions, such as where to put a dike, for protection infrastructure you need more detailed spatial resolution.

I am working with NRCan and Public Safety. Public Safety would like to have this information on a 30m x 30 m cell, so you see the kind of detail they are looking for. I see our maps representing the first step, the first important piece of information that can then point us to areas where much more detailed analysis and work can be done, as well as use the information from our map to possibly implement the regulations.

**WT: In the research, I did for the interview, I read there were one hundred and fifty thousand reference documents, can you tell me about the team that did this map?**

**If I walked into a room with 150,000 reference documents, I don't know what I would do, where do you even begin?**

**Simonovic:** It is a little bit misquoted, the meaning of the number of documents. The number of documents is basically referring to a process that Intergovernmental Panel on Climate Change (IPCC) is implementing. This organization is reviewing the literature, and based on the literature, publishing its reports. The most recent one is the sixth report, which includes a lot of information on flooding in a changing climate. So when I was talking and this number was mentioned, it was referring to the input that goes into the IPCC work. We use that work and the models suggested by IPCC for analyzing the impact of climate change on flood risk in Canada. Does that explain a little better?

**WT: Yes, very much better. How many people work on this project with you?**

**Simonovic:** I had two post-docs involved, one doctoral student and some undergraduate students, but not all the time. The project was supported by the Canadian funding agency Natural Science and Engineering Research Council (NSERC) as a collaborative project with the Chaucer reinsurance company. We had funds for three years to do the research.

I was responsible for the flood part of the research, mapping and development of the website for publishing this information. My collaborators were working in different stages over the period of three years.

**WT: If you are hoping to go to real-time, one of the things WT has been following is the new SWOT satellite that will begin downloading data sometime in August, is that the kind of data you would be using? Are you involved with SWOT at all?**

**Simonovic:** No. Usually, for this type of work, you need real-time data during the response phase. Real-time data is basically the water level at the location you are protecting, and the area you are concerned about.

The planning process, as I indicated is usually based on analyzing the longer period of recorded observations, the historical data, and now with climate change being one of the concerns, looking into the future projections that many of the climate models are providing. So, this type of work is not directly benefitting from real-time observation except in the stage of response. For the response, we have a particular kind of information that is necessary.

This is where if you look at different government agencies, the responsibility is divided: ECCC is responsible for providing this data, then Public Safety is very much concerned about the protection of infrastructure and property, then you have NRCan which is interested in providing information related to the level of risk and how this risk can be managed.

**WT: One interesting thing I noticed, is the quotes I have seen from you, you are saying by 2100, 30% more of Canada may be underwater. The disturbing thing to me is that the depth of that**

**water would increase by 60%. To frame that for people, how do you explain this to the public?**

**Simonovic:** Let me explain these two numbers. The 30% increase in inundation means the area that could be under the water in the future, can increase up to 30%, the maximum increase. It doesn't mean these areas will be flooded all the time. At any location across the country. It means Canada may expect a maximum increase of up to 30% (more areas at risk of flood inundation).

60% doesn't mean that at all locations the water depth will increase by 60%. The depth depends on the topography as well as the flow. So 60% means the water depth will be different, and may increase up to 60%.

You need to understand, this comparison and obtained two numbers are for the worst-case climate scenario. The governments and mitigation efforts are trying to reduce that risk in the future.

We looked into three scenarios in developing our maps. One is the current conditions (using historical observations). Another one is the near future, looking to 2060, and the far future - until 2100. We looked at two emissions scenarios also. These are all the future projections. We don't have a crystal ball to tell us what is going to happen tomorrow, but based on the best knowledge we have right now, and potential different future emission scenarios we can find out the potential change in flooding conditions. Out of these six scenarios suggested by the IPCC, we used one less conservative (including impacts of mitigation efforts) and one very conservative (almost assuming no change in our behaviour and no mitigation). When I use the word "scenario", that means the way the future will unveil: economy, food production, population, land use, and so on. For the comparison of the two scenarios, we used results in the 30 and 60 -- 30% for inundation and 60% for depth change. These two numbers show the range of uncertainty that comes from the fact that we do not have a crystal ball.

**WT: The personal part of this, if this is your personal commitment, according to one article I read, how long have you been thinking Canada needs a national flood map?**

**Simonovic:** I am a senior water resources engineer, I have been in this area of work for the last 40 years. One area of my research expertise is flood management. I also personally lived through the flood of the century in Winnipeg (1997). At that time I was a professor at the University of Manitoba. After the flood, I was also appointed by our government to the International Joint Commission's task force looking at floods of that magnitude and higher.

There were five Canadian experts and five American experts charged by the Governments of Canada and the US to provide advice on floods of 1997 magnitude and higher. We worked closely with all the communities in the Red River basin over 4 years. That was a life-changing experience for me. This particular work, according to the principles of the International Joint Commission, took me across the Red River basin through the municipalities and rural areas meeting with people; people who lost everything and people who successfully managed the situation.

I was saying after that, I don't have difficulties teaching students how to design a dike, but conveying the message, of how are the particular locations hit by the flood risk, and the particular consequences on people's lives, is much harder to explain and understand. That was a very strong

personal motivation to continue working in this area and use all my knowledge and expertise to help the general public and responsible authorities to find the best ways for increasing resilience to flooding and reducing the risk from it. As a demonstration of my commitment, I am leading the large international organization devoted to the management of floods - International Conferences on Flood Management (ICFM – information available at [www.icfm.world](http://www.icfm.world)).

**WT: The country needs more of you, Professor. Before I sign off when I harass NRCan with questions about when the flood map will be ready, and whether can I get just the Ontario map or the Quebec map, I guess I can stop bothering them now, as that would be you I should come to.**

**Simonovic: I hope our work and generated maps provide at least a starting point. If you want to go deeper, to get to more details, I would say more work is required.**

Many places in Canada are developing more detailed maps. They are developed first under different regulatory conditions because the provinces have different standards and criteria. Secondly, they are developed using different methodologies, so what Ontario is using may not be the same as what Alberta or British Columbia are using.

Therefore, comparing the level of information we can see that the level of preparedness is pretty uneven across the country. I think our effort to look at the publicly available information was of value too. There is some public climate data available in the form of re-analysis projects. Our work did answer the question “Can this information be useful to assess flood risk across the whole country using the same methodology?”. It does give us initial information, to give us a sense of the level of concern different regions are exposed to and then decide what the next steps should be.

**WT: I want to thank you for doing this, NRCan will be relieved! We will consider this the end of the interview, have a good day.**

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