Deltas in Depth scientific sessions		
Deltas in Depth Theme 1. Decision support tools and risk assessment		
DD 1.4 Changing weather and impacts		
Chair	John Church FAA, FTSE, CSIRO Fellow, Centre for Australian Weather and Climate Research, Australia	
Presentations	•	PhD/P.Eng. James Young, ARCADIS SENES Canada Inc., Canada
	•	Prof. Efi Foufoula-Georgiou, University of Minnesota, USA
	•	Maminul Haque Sarker, CEGIS, Bangladesh

Climate modelling – the needs and realities of cities, PhD/P.Eng. James Young, ARCRADIS SENSES Canada Inc., Canada

A high number of Canadians live in the city. Cities are important to life and a good infrastructure is the key to a well working city.

Global and region climate models provide information on the future extremes and averages, yet these predictions do not go into deep detail.

When municipalities have to replace aging infrastructure, future climate projections should be taken into account. But these replacements are very costly, so you want the decisions that are made about the implementations stand up to what is expected from climate change in the future. When the replacement of the infrastructure is not adapted to future climate predictions, costs of the impacts will incur higher.

This study examines a combined global and regional climate model and weather forecast model, to created time period related, future hourly averaged data and the amount of weather extremes. This data is applied on a dynamically downscaled grid of 1 by 1 kilometre over the Greater Toronto Area.

The used time period is from 2040 till 2049. If you compare future projections with weather extremes and maxima from 2000-2009, you will see the clear differences in the amount of storms and intensity. There has been concluded that within these 10 years (2000-2009), almost every year there has been a record achieved in Toronto's weather events.

This study points out that in 2040-2049 the amount of storms overall will decrease by 23% throughout the year and in summer by 57% fewer. However the intensity of these storms will go up. For example; the equation of 2000-2009 and 2040-2049 concluded that in 2000-20009 the intensity of rainfall, within 1 hour, with a return period of 10 years can go up from 20,2 mm/hour to 39,0 mm/hour. Also the amount of days of 30 degrees or more days increase with roughly 300%.

Finally the study points out a summary of these expected impacts whose are important issues to municipalities and can be used as information for implementations on the infrastructure, so the solution will be temporally and spatially.

Satellite rainfall retrieval over coastal zones, prof. Efi Foufoula-Georgiou, University of Minnesota, USA

Damages caused by flooding, hazards, cyclones and rising sea-level make flooding typical for Asian deltas.

Because these deltas do not have the needed knowledge and capabilities to protect and recuperate, damages of such disaster can still cause problems to nature and residents in areas over a year.

The current sources for information about accurate estimations of precipitation on a smaller scale in the delta areas are lacking in information because of the ground radars or observations from rain gauges. The most reliable information about this subject will be offered by satellites.

This information is important for predictions on flooding, sediment and nutrient transport, hazard control, but also for climate studies.
Although satellites give the most reliable information, accurate land-water interfaces will still be an laborious estimation with microwave satellites, such as TRMM(Tropical Rainfall Measuring Mission). In February 2014 a constellation of GPM-satellites was launched. GPM(Global Precipitation Measuring Mission) will improve the results, including issues with land-water interfaces.
To improve measurements/predictions of especially extreme storms at high spatial resolutions and rainfall retrieval over coastal zones, there has been developed a new algorithm. This uses storms or elements of spectral responses of variant rainfall profiles. The final improvements will occur when these new results - within the area of the Ganges, Mekong and Amazon deltas- are compared to current approaches.

Assessing the rate of subsidence in the Bengal delta, Maminul Haque Sarker, CEGIS, Bangladesh
Over the last couple of years there has been a lot of research carried out assessing High Rate of Relative Sea Level Rise (RSLR). Sea level rise is a common symptom for delta's and also for the Bengal delta.
These researches of RSLR in the Bengal Delta point out a variety of 10 to 25 mmy-1 RSLR. In this particular delta the main contributor to RSLR is subsidence. The results of relative sea level rise show a long-term of implications for Bangladesh, which in some cases, areas will become unsafe for residents.
Local people, investors, decision makers and development partners are forced to come with a solution. The question is if residents will be encouraged to migrate or invest in flood control.
Rivers in the Bengal delta yearly carry 1 trillion m^3 of water and 1 billion tons of sediment. Sediment makes rivers and estuaries more dynamic.
In this study there has been done a lot of research for the best approach on flood control. It points out that groundwater mining due to high rate of extraction causes very high rate of subsidence.
There are a few approaches to assess the RSLR:

- Change river courses and land forms
- Carbon dating data
- Changes in tidal water level
- Archaeological monuments

Archaeological monuments in the tidal plains have been taken further into consideration for assessing the subsidence.