**Analysis of extreme sea levels around the Canadian coastlines – the effect of temporal inhomogeneities**

**Mercè Casas-Prat1, Xiaolan L. Wang1, Yang Feng1**

1Climate Research Division, Science and Technology Directorate, Environment and Climate Change Canada, Toronto, Ontario, Canada. E-mail: [MerceCasasPrat@ec.gc.ca](mailto:MerceCasasPrat@ec.gc.ca)

**Abstract**

Storm surge is a key driver of coastal flooding. In Halifax (Nova Scotia, Canada), a 1.63 m storm surge occurred in 2003 while Hurrican Juan made landfall, and water levels reached 2.9 m above chart datum, the highest level recorded to date at this location. Extensive damage to buildings, docks, boardwalks and trails occurred in the region, including eight deaths and an estimated total cost of $30,900,000. With 243,000 km of coastline, the combination of extreme storm surge with rising sea level is expected to have costly infrastructure damages in Canada.

In the past years, there has been an increasing effort to better characterize extreme coastal water levels using numerical and statistical modelling that, in turn, rely on observations for validation and/or calibration. However, observations are commonly affected by temporal inhomogeneities, which can bias the results of studies on extremes.

This study aims to homogenize the water level data from the tide gauges of the Canadian Station Inventory, focusing on stations of at least 50 years of data. We check for possible (undocumented) checkpoints and produce adjusted time series of daily maximum water levels using two methods: Quantile Match (QM) and mean adjustment. We investigate the impact that these adjustments have on mean and extreme statistics. Moreover, we compare the original and adjusted time series with a modern hindcast and perform an analysis of spatial dependence.