



Joint occurrence of daily temperature and precipitation extreme events over Canada

Barbara Tencer

School of Earth and Ocean Sciences, University of Victoria, Victoria, Canada (btencer@uvic.ca)

The occurrence of individual extremes such as temperature and precipitation extremes can have a great impact on the environment. Agriculture, energy demands, and human health, among other activities, can be affected by extremely high or low temperatures and by extremely dry or wet conditions. However, the simultaneous or proximate occurrence of both types of extremes could lead to even more profound consequences. For example, a dry period can have more negative consequences on agriculture if it is concomitant with or followed by a period of extremely high temperatures. The relationship between temperature and precipitation has been studied mostly in terms of mean values. This study analyses the joint distribution of extreme temperature and precipitation on a daily basis by describing the occurrence of very wet conditions and high/low temperature events at meteorological stations across Canada during the 20th century. Almost half of the stations showed a significant relationship between warm nights (daily minimum temperature greater than the 90th percentile) or warm days (daily maximum temperature above the 90th percentile) and heavy precipitation events (daily precipitation exceeding the 75th percentile), with the greater frequencies found in the east and southwest coasts in fall and winter. Cold extremes occur together with intense precipitation more frequently during spring and summer.

The existence of a significant statistical relation between these extremes could help reduce the uncertainties associated with projections of extreme precipitation events for a future warmer climate. Since projected changes in temperature are usually less uncertain than changes in precipitation, the use of a statistical relationship between extreme temperature and precipitation applied to projected changes in extreme temperature for a future climate may help to constrain projections of changes in heavy precipitation events and thereby reduce the large uncertainties commonly associated with this type of projection. Therefore, in this study the North American Regional Climate Change Assessment Program (NARCCAP) model runs are also examined to verify whether regional climate models are able to simulate the relationship between heavy precipitation and extreme temperature events depicted by station data. RCM simulations show good agreement with observations in the seasonal and spatial variability of the joint distribution, especially when an ensemble of simulations was used. However, the models tend to overestimate the occurrence of heavy precipitation events during warm extreme events, and underestimate it during cold extremes.