Statistical methods to characterize climatological air temperature distribution

Contents

1 Introduction

The freeze-thaw cycles can have considerable consequences soil structure change (Xie et al., 2017), plant growth (Nilsen et al., 2020), glacier mass balance (reference) and pothole development in roads (Biswas et al., 2018). It affects approximately 55% of the global land surface (Makoto *et al* 2014). Price (1986) pointed out that these instances are most common in high, tropical mountains. These are driven by the air temperature swings at around 0°C.
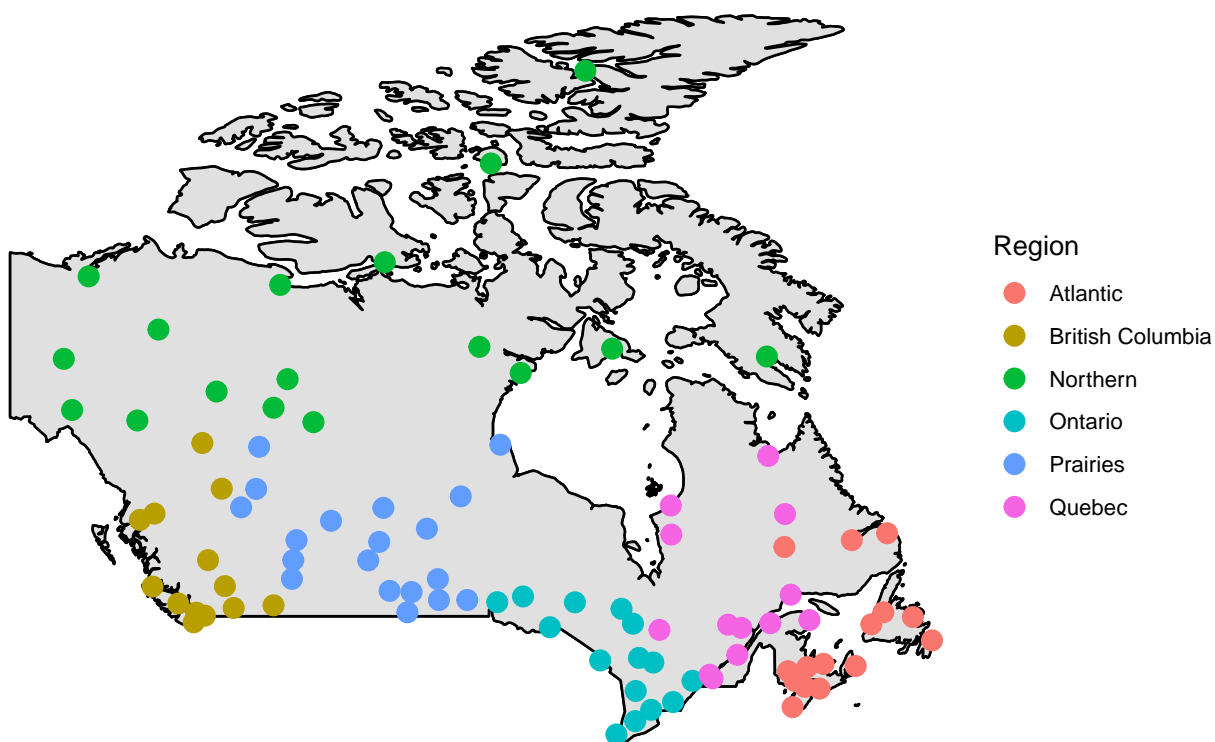
2 Methodology

2.1 Dataset

Figure 1: The spatial distribution of the meteorological stations used for this analysis, by province

2.2 Statistical method

Figure 2: Exemples of temperature distribution, in Celcies.

Figure 3: Different estimations of the density of the distribution of temperature of

2.3 Estimation of the number of peaks for each station

Figure 4: mode tree for Peace River station. Starting at the top with the bandwidth of h=4, we see only one peak around 10 until h=2.94 (see for example the distribution with h=3.5 at the right/top). Decreasing h shows two peaks until h=0.88 (see for example the distribution with h=1.8 at the right/middle, with the

peaks at 1.5 and 11). At a bandwidth of h=0.88 a third peak is discovered, around the value -12, and the situation is stable until multiples peaks appear below h=0.44.
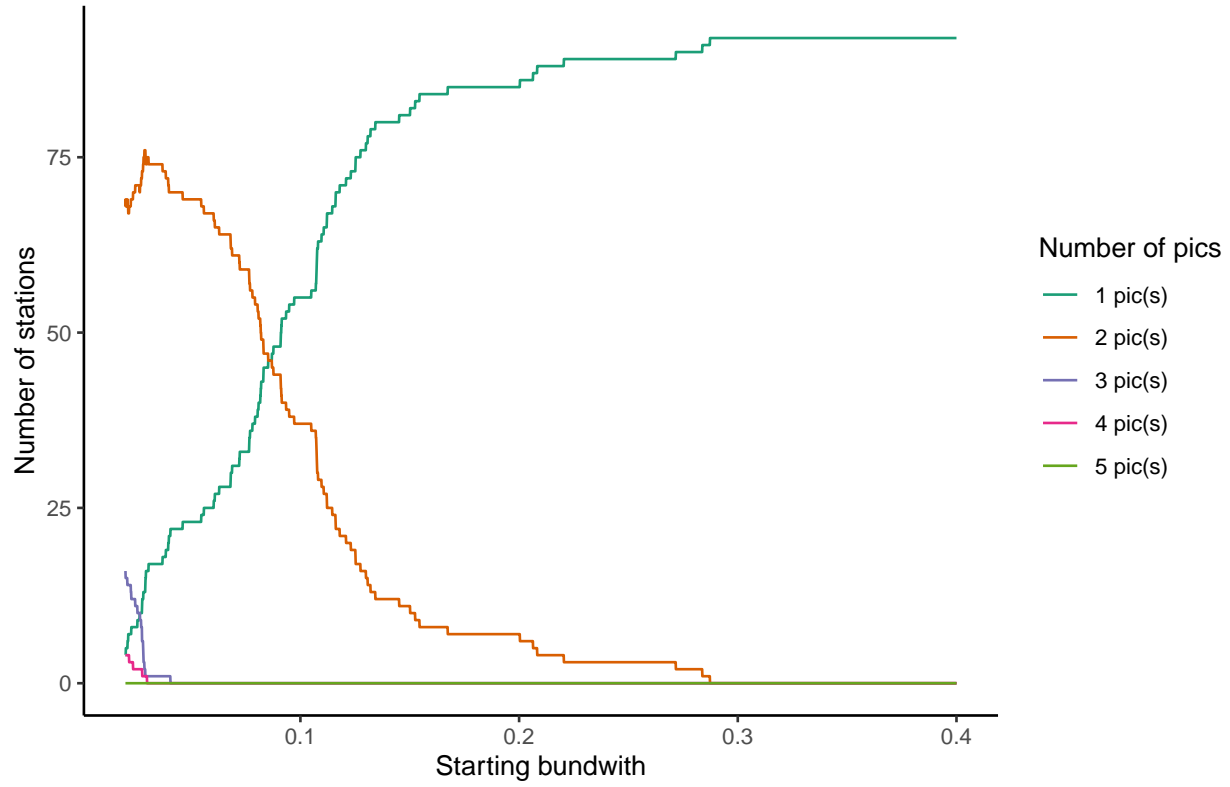

Figure 5. Relation between the initial number of bins, and then the bandwidth of the kernel method starting the mode tree method.

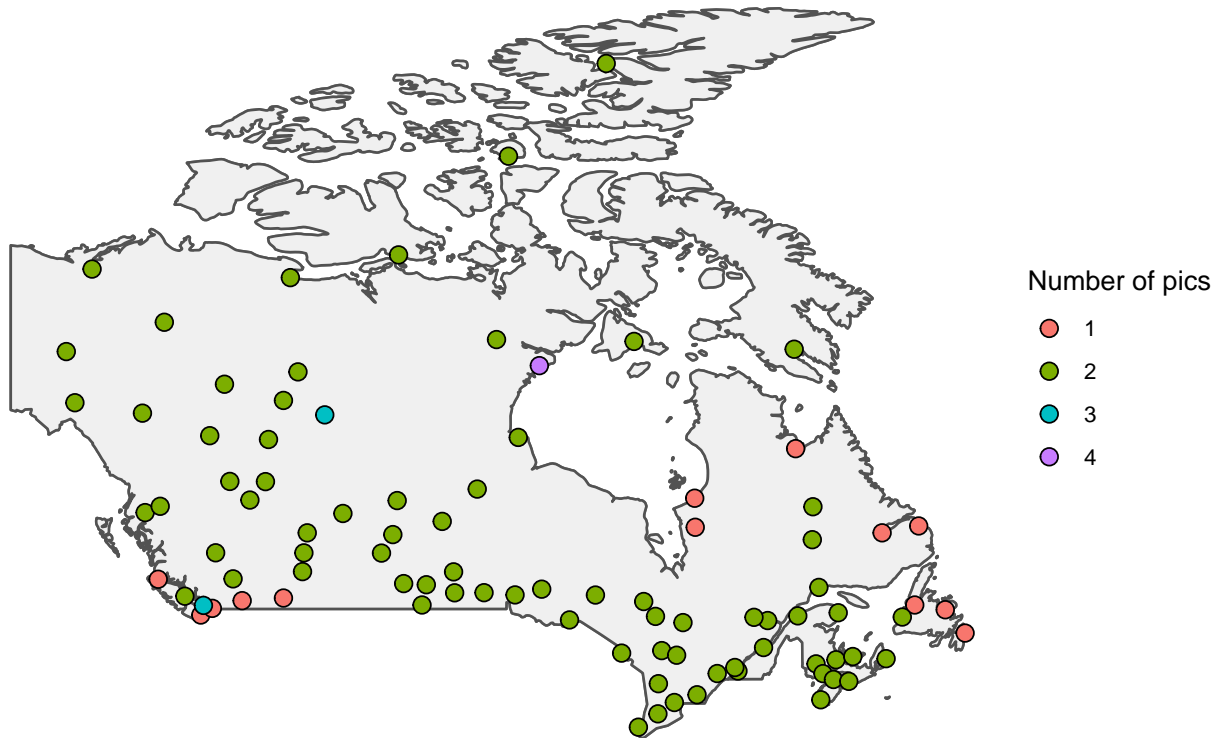# 3   Temperature distributions across Canada

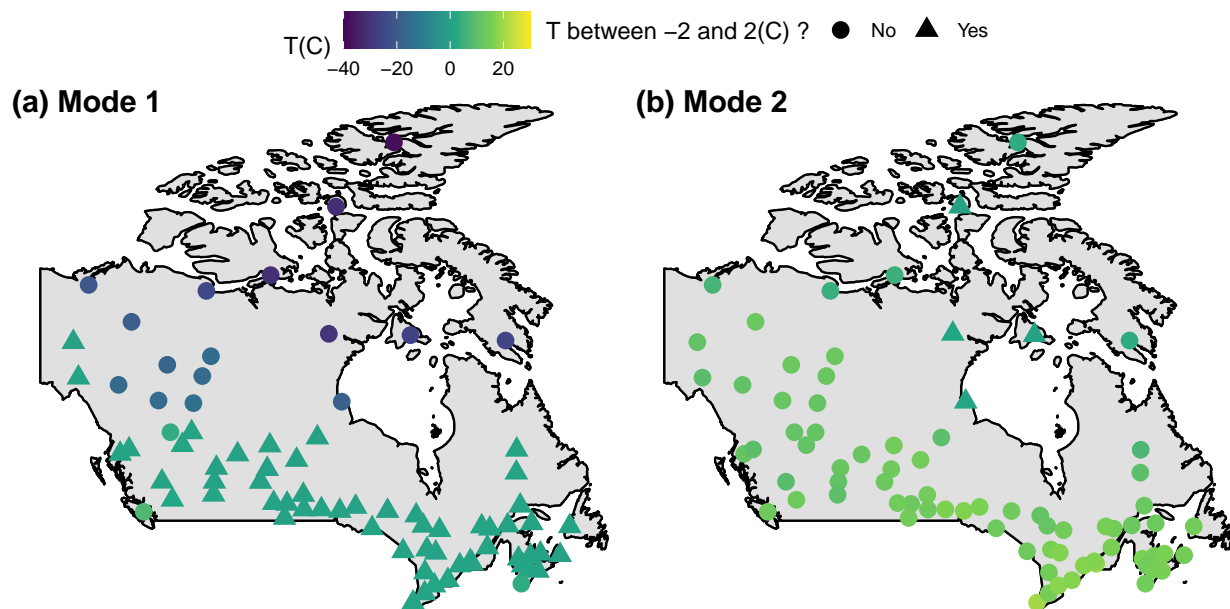Figure 6: Number of estimated peaks for each station (31 years)

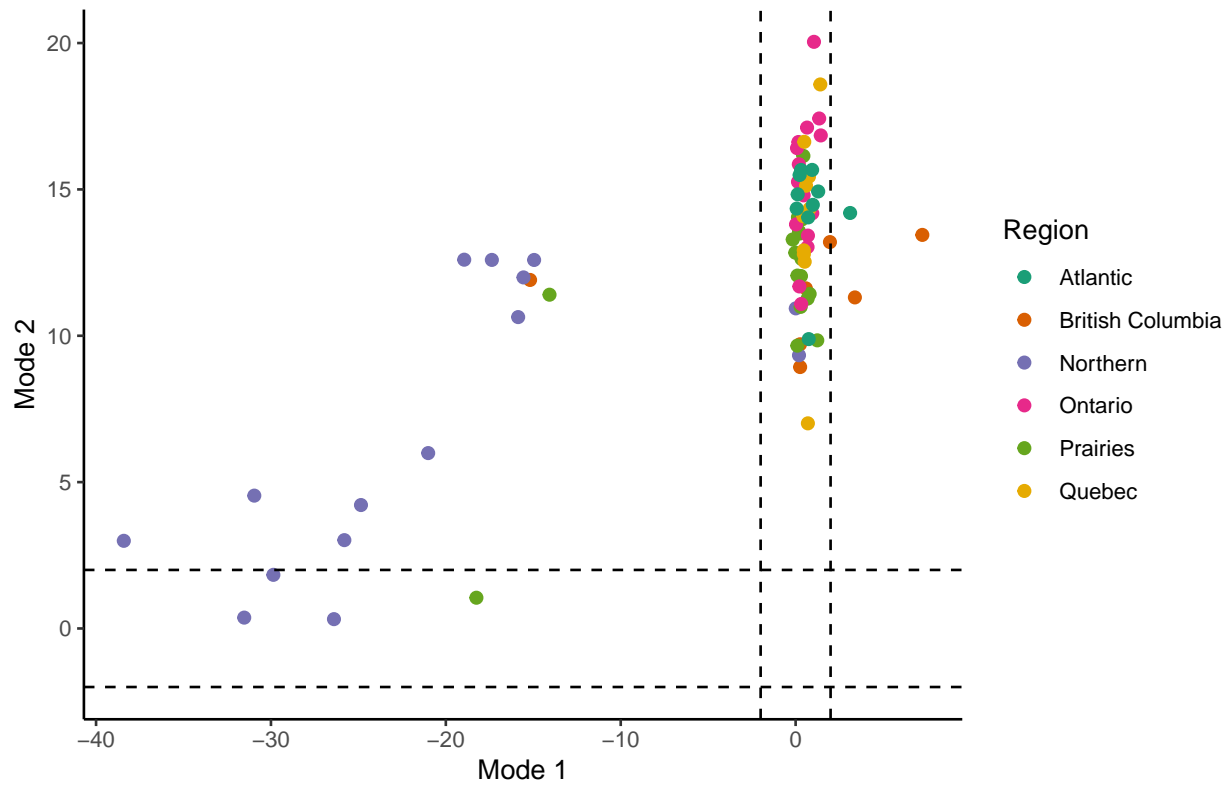Figure 7: Estimation of mode 1 and mode 2 using 31 years of observations

Figure 8: Links between Mode 1, which is the colder associated with the coldest air temperature and the Mode 2, which is the warmest one
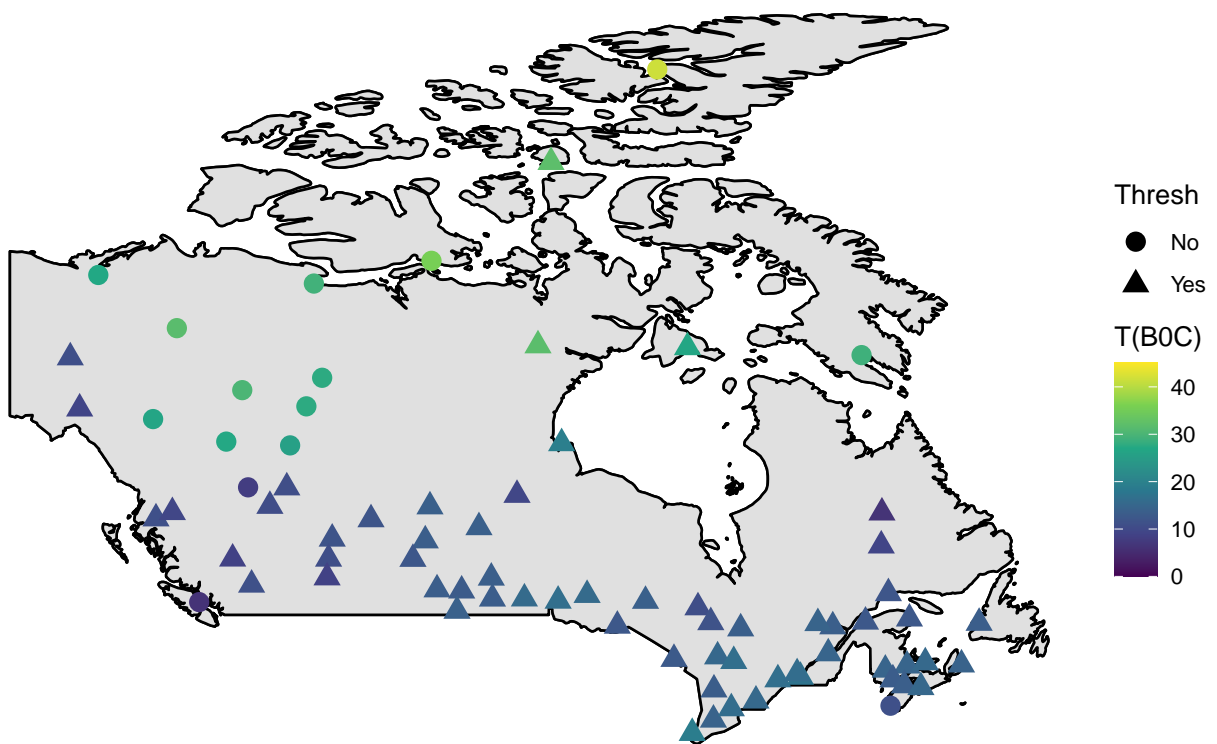

Figure 9: Difference between Mode 1 and Mode 2 with 31 years of observations.