Title Analysis of air temperature distribution inside a cold store by means of geostatistical methods

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Abstract

The objective of temperature control in cold storage systems is to maintain an average temperature limited by a maximum temperature deviation within the produce. Temperature is a key factor in postharvest quality that is usually supported by the belief that it is well controlled and uniform in cold storage systems. Cold stores show non-uniform air temperature distributions and produce quality problems related to cold and hot spots are well-known. Air temperature control in storage systems is usually related to one or a limited number of temperature sensors in the store that are placed in locations easy accessible. The aim of this study was to model and analyze spatio-temporal temperature distributions in vertical plans along a cold store by means of a geostatistical approach. The use of this information to determine the minimum number of air temperature sensors needed and their location for better climate control is discussed. The spatio-temporal air temperature variation was assessed inside an experimental cold store applying geostatistical methods. The cold store (3.75×2.64×2.38 m) was equipped with an A/C unit. A vertical grid of 36 regularly distributed air temperature sensors was installed. It was shifted 0.35 m each day in order to cope with the 3.75 m length of the cold store in 10 vertical planes. Each plane was set to take measurements during 24 hours periods at 1 datum/min frequency. Empirical variograms were constructed for each vertical plane. Various variogram models were evaluated to fit the dataset, and an ordinary spatio-temporal kriging method was used to predict temperature values. The results show temperature distribution gradients that have to be accounted for when studying postharvest processes in cold storage systems. Geostatistical methods proved to be a useful tool for the study of spatio-temporal air temperature distributions that will contribute to better postharvest produce uniformity through improved climate control performance.