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Spatial and temporal variability of the chilling hours over an agricultural area through satellite-derived surface temperatures

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Many plants need a certain amount of time under cold temperatures, especially during winter dormancy, when buds and seeds are unable to grow mainly due to hormonal factors. The chilling hours (CH) is a parameter that counts the number of hours below a certain temperature threshold during the cold period of the year. The number of CH that each plant needs depends on the species. Therefore, to know the amount of CH of a region is crucial to decided the crops that will be cultivated there and guarantee their quality.

The main goal of this work is to identify the spatial and temporal variability of the CH in the island of Mallorca through satellite-derived Land-Surface Temperatures (LST) from Meteosat Second Generation. Hourly LST fields are used for the period 2007-2018 and they are converted to 2-m air temperature through the lineal fit proposed by Simó et al. (2018) over the area of interest. Afterwards, for each pixel, it is counted the number of hours below a certain threshold (here taken as 8ºC) from September to August next year.

Results show that the largest number of CHs are found in the center of the three main basins, where cold pools are generated as it was described in Jiménez et al. (2015). Most of CH are accumulated between December and March, the coldest months of the season. During the 10 years analyzed, the CH averaged over the island are about 550 (for all the studied years the CH are between 400 and 650). The spatial and temporal variability of the CH estimated from satellite (at about 16km^2 resolution) are compared to those obtained through the surface observations at some locations in the center of the island, where agriculture is the main economical activity. Furthermore, observations of the surface weather stations (wind, temperature, humidity and precipitation) are analysed to characterize the physical mechanisms that take place when the observed temperatures are lower than 7ºC, contributing to the anual value of the CH at each site.