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Contrasted warming patterns in both hemispheres result in divergent blooming trends for apple.

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This study aimed to compare the difference of temperature and apple phenology patterns and their relationships, in contrasting climates of Southern (SH) and Northern (NH) Hemispheres, using long historical series of data. Relatively high divergences of temperature and blooming patterns were found. The most important changes were observed in the NH sites, experiencing a significant warming of temperatures (especially maximum temperature) in whole year and mainly during early-spring. The oceanic and Mediterranean sites of Europe were also warmed during winter. Similarly, important increase of heat during early-spring was found in all sites and a strong decrease of chill during winter was highlighted in the mild sites of Europe. We outlined that blooming dates toward early for some apple cultivars with a higher advance in the continental regions (cold). In these colder regions, we found a strong relationship between blooming dates and heat accumulation during early-spring (February and March). In the mild sites, advance is lower and moderate relationship with heat accumulation in the mild sites can be linked to chill decrease during winter, leading us to consider this zone as more vulnerable to climate changes. By contrast, in the SH sites, only the continental site (Caçador) outlined a little warming and small advance of the blooming dates. Significant correlations were found between blooming dates and accumulated chilling doses, supporting the idea that blooming dates are mainly controlled by winter temperatures, especially June one's. We concluded that blooming dates and blooming duration are distinctly determined according climate pattern. The important warming of European sites led us to predict that apple crop in this region can be soon (around 2050) under climatic conditions observed today in mild climate regions like Southern Brazil, and, consequently, submitted to the same cropping difficulties.