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SPACE-TIME VARIABILITY OF SPRING MINIMUM TEMPERATURES IN THE CHAMPAGNE VINEYARD (NE FRANCE)

ABSTRACT: MADELIN M. & BELTRANDO G., S*pace-time variability of spring minimum temperatures in the Champagne vineyard (NE France).* (IT ISSN 0391-9838, 2013).

Spring frost damage in Champagne vineyard (NE France) is a major issue among growers. When this natural hazard is due to a cold air mass advection, frost protection methods are generally inefficient because low temperatures occur over the entire region. In contrast, this is not the case when freezing occurs in radiative conditions (clear sky and calm wind), when marked temperatures differentiation can be observed due to a complex interplay between wind, topography, land cover, etc. To better understand the spatial and temporal distribution of nocturnal minimum temperatures during radiative conditions, we applied the numerical model MesoNH and confronted its results to observed data (network of weather stations). In this paper, a particular night in March 2003 is examined, a period during which frost was particularly intense. We find that the model reproduces quite well the direction of wind flow, but it tends to overestimate the minimum temperatures for the coldest sites. Moreover, it gives a clear illustration of the interaction between calm regional wind and local breeze, and its influence on spatial temperature distribution.

KEY WORDS: Frost, Champagne vineyard, MesoNH model, Minimal temperatures, Space-time variability, NE France.

INTRODUCTION

The Champagne vineyard, one of the most northerly in the World, covers about 33,600 ha, two thirds of which being located in the department (*i.e.*, administrative subdivision in France) of Marne, and correspond to the area studied in this article (fig. 1). It develops on hills with moderate slopes (average of 12%), between 90 and 300 m (a.s.l.), mainly on the south, southeast and east slopes (fig. 1). The region is bordered on the west by limestone plateau covered with forests, in the centre by a curved cuesta overlooking the agricultural plain, in the east (wheat, beet). The vineyard of this region is concentrated on a cuesta and on both sides of the Marne Valley.

Located at the north limit of the «world of wine» (49.5 °N in Reims), the climate of this region is called «transition oceanic climate» and has a double influence, oceanic from the west and continental from the east. These conditions for vineyard are modulated by two characteristics: (i) a deep underground chalk, which allows good drainage and planting on slopes, so that (ii) the best vineyards are exposed to solar radiation in order to reduce the stagnation of cold air (which is drained down the hill outside the cultivated area). Collectively, temperate oceanic climate, continental influence and latitudinal position explain spring frost episodes that may be harmful to the vines, especially when they occur after the restart of vegetation growth (budburst). During this period (late March to early May), as the sap rises in the aerial parts, the plant becomes very sensitive to frost, especially when the bud appears. Air temperatures below –2 °C (at 2 m a.g.l.) are enough to causes the destruction of the primary buds, located near the surface (at 50 cm a.g.l.). In April 2003, 48% of the potential harvest froze during a cold episode that lasted only 3 days (CIVC, 2013a).

Due to this frost hazard and the high economical stakes (323 million bottles of Champagne sold in 2011 and 4.4 billion euro; CIVC, 2013b) associated with the Champagne vineyard, the Comité Interprofessionnel du Vin de Champagne (CIVC) has commissioned several studies, in particular to Météo-France and Umr Prodig/University Paris-Diderot, in order to improve local frost forecasting in susceptible areas for a variety of weather conditions and eventually to better organise the frost protection. As a former example, Météo-France proposes, during the spring

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