frost: an R package - prediction of minimum temperature for frost forecasting in agriculture

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Keywords: predictive modeling, dew point estimation, frost events, viticulture, agriculture

1 Introducción

We present the package **frost** which aim is to survey prediction techniques of minimum temperature for agronomic frost prediction in viticulture and agriculture. The version 0.0.1 of the package **frost** introduces two empiric methods used by agronomic engineers and farmers: the first one is recommended by FAO (Food and Agriculture Organization of the United Nations) [2], and the second one is used in Mendoza, Argentina. This package can be downloaded from its GitHub repository [1] under the MIT open source license.

2 Methods

The first of the empiric methods implemented in the **frost** package is a simple minimum temperature forecast model suggested by FAO [2], which uses a linear model for estimating the coefficients (a, b, c) of the prediction formula:

$$T_{min} = (a * T) + (b * T_{dw}) + c$$

This model predicts the *minimum temperature T* taking as input the ambient temperature (*T*) and dew point (T_{dw}), both measured two hours after sunset. This method can only be applied in frost nights with wind speeds less than 2.0 m s-1 and clear skies, i.e., without cloud cover or fog.

The second method included in the package, for predicting the minimum temperature T_{min} , is the one used in Mendoza and mentioned in Maldonado [3], described formally by:

$$T_{min} = \left(\frac{\left(T_{max} + T_{dw} \right)}{2} \right) - K$$

, where T_{min} is the minimum temperature, T_{max} is the maximum temperature and T_{dw} is the dew point temperature and K is a constant that varies with the place and time of the year. The package offers the necessary functions to estimate K to insert on the former expression. The package offers the necessary functions for estimating K.

Many predictive models of minimum temperature use the dew point as a variable of interest. The package **frost** implements methods [4,5] to estimate the dew point temperature given the ambient temperature and relative humidity.

We are currently working to include other prediction techniques for minimum temperature, more sophisticated prediction models, and application which can be used by farmers or agronomic engineers to make decisions to improve frost prediction and further increase the probability to reduce frost consequences on their crops.

Referencias

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