Frost alert prediction model

Frost events can be seriously dangerous for agriculture, in particular during spring season, and can damage your crops.

A number of equipments are available, in order to protect your cultivation or artificially increase local temperatures (even few tenths of degree can significantly reduce frost risks).

Those equipments often requires to be started and operated during night time, and problems can arise especially when several equipments are located in different areas, maybe at different altitudes or exposures.
Therefore, accurate forecast models can be decisive to successfully protect your crops. against frost events.

MeteoSense weather station and AgriSense/VineSense wireless units, equipped with air temperature and humidity sensor, helps you to protect your cultivation from the risk of dangerous night time spring frost which can jeopardize the result of the entire season and result in money loss.
The SMS option enables your mobile phone to receive a frost alert, thus allowing you to undertake appropriate preventative measures.

With wireless units, specific frost risk is evaluated on each air temperature and humidity sensor, installed on these units, resulting in a specific microclimatic analysis.

Prediction model description

An advanced real-time prediction model is implemented: it considers air temperature, humidity and dew point, and it has been optimized for night frost event prediction (*radiation frost*).
Starting from 3 pm, the algorithm evaluates sampled data received from your weather station and calculates the probability of frost event occurring before next dawn, assuming temperatures increasing after sunrise.
Therefore, daily frost events can not be predicted.

The prediction model runs on local data: relevant changes of weather situation (e.g. wind rotation etc.) may cause significant differences between model results and observations. Accurate results are gained during stable weather conditions, where thermo-hygrometric trends can be better estimated.,

Mathematic formulation of the implemented algorithm is reported in the following:

$$\alpha \cdot \frac{\left(\overline{T} - \overline{R} + \kappa\right)}{\left(\partial R - \partial T\right)}$$

Where:
$\overline{T}$ is the average air temperature
$\overline{R}$ is the average dew point
∂R and ∂T are temperature and dew point gradients
α and κ are compensation coefficients, based on installation sites.

Formula output is the probability of frost event: a positive contribution represents an increase of probability of frost event during the night. As the sum of such contribution increases, the overall probability of frost events become higher.

Data acquisition with Netsens equipments

Netsens equipments are designed to acquire and transmit data very often: MeteoSense, AgriSense and VineSense main units sample data every 30 sec, and send average data every 3 or 5 minutes.
Wireless units sample and send data every 15 minutes.
The real-time communication features available with Netsens systems, even when operating in GPRS mode, are essential for retrieving significant information from prediction model.

It is also required that main units, when operated with solar panels, run with well charged battery and not in "power save" mode; else, longer sampling time and/or data sending intervals (enabled in order to save battery) may significantly affect frost prediction model.
Netsens technical staff is available for supporting you and suggest battery replacement or recharge when needed.
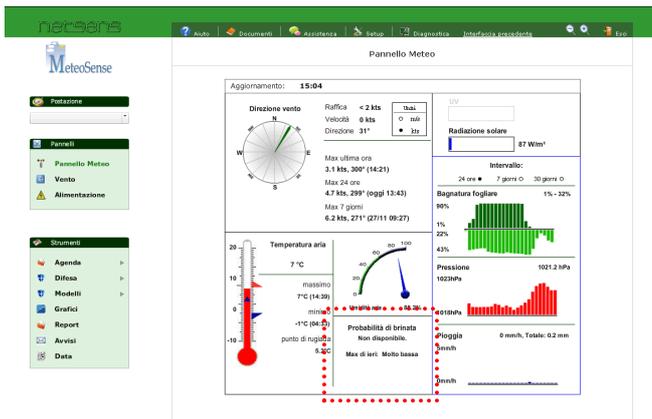
Data display on Netsens LiveData user interface

An indication of frost event probability is displayed on main panel of weather station or main unit, and on wireless unit panels (if available).
During daytime (until 3 pm), main panel display "data not available" label; then, algorithm start to evaluate air temperature and humidity data, and calculate probability index (in percentage).
On the same panel, the previous day probability index is still reported, in order to compare the result with local observation.
Also, by clicking the panel, a graphical representation of air T, RH and frost probability is displayed.

AgriSense, VineSense e MeteoSense are manufactured by Netsens s.r.l. in Italy
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By comparing air temperature, humidity and dew point graphs, a number of important parameters can be easily gathered: for example, when temperature get near to dew point (that is, temperature get low faster than dew point), air condensation is expected.

If this occurs at temperatures lower than 0 °C, frost events are expected (therefore, dew point become *frost point*).
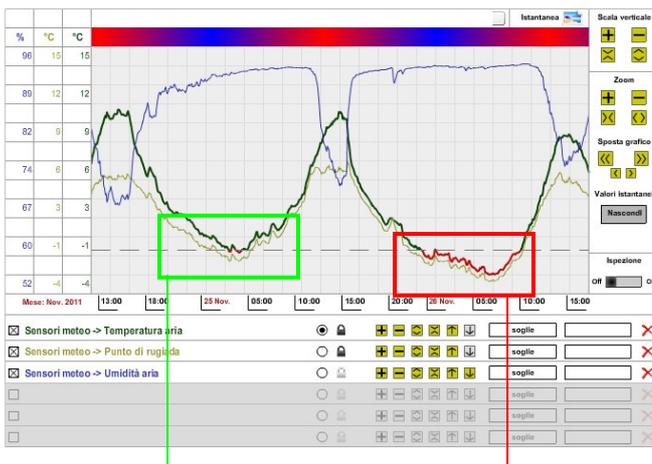
Temperature and dew point get closer at T above 0°C: low probability

Temperature and dew point get closer at T below 0°C: high probability

MeteoSense weather station for frost prediction

The minimal setup needed for run frost prediction model and display data on LiveData internet interface is:

MeteoSense main unit: main unit with GPRS communication module, 230VAC power supply adapter or solar panel kit.
Sensor setup: TH Sense digital thermo-hygrometer
Installation tools: mounting pole
Software services: LiveData software and user interface configuration. LivePlus option recommended for historical data analysis.

Features:: real time data display, data analysis and historical data comparison, frost prediction model, GDD (growing degrees/day) agronomical model.

AgriSense/VineSense system for frost prediction

The minimal setup needed for run frost prediction model and display data on LiveData internet interface is:

Main unit: main unit with GPRS communication module, 230VAC power supply adapter or solar panel kit.
Wireless unit(s): one or more wireless units with TH Sense digital thermo-hygrometer
Installation tools: mounting pole
Software services: LiveData software and user interface configuration. LivePlus option recommended for historical data analysis.

Features:: real time data display, data analysis and historical data comparison, distributed frost prediction model and GDD (growing degrees/day) agronomical model.

IMPORTANT NOTE
Netsens equipments are designed for reliable professional use. Anyway, Netsens does not undertake any liability for ant direct or indirect damage that may be related with any system malfunction.

Netsens takes care of its Customers
Netsens Technical staff supports our Customers to fulfill their requirements and needs.
A continuous remote survey of your equipment is always available, as well as professional storage and backup services of data collected.

For further technical or commercial information, please contact Netsens s.r.l. or your local Reseller.

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