



Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto

A.N.GELA VENETO: AN APPLICATION FOR THE SPRING AND AUTUMN FROST NOWCASTING"

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Abstract

The frost nowcasting system A.N.Gela (Nowcasting Algorithm for frost events in Veneto Region), was developed in the Region Friuli Venezia Giulia (F.V.G.) by ARPA-CSA. Its application to the environment of the Region Veneto was possib the sensor measure height of the forecasted temperature, and the information broadcasting modality. The calibration, realized using the historical series 1996-2004, has indicated a good performance of the model also in Veneto.

The Project

The project goals consist of the elaboration of short term frost predictions for Veneto, and their real-time broadcasting to the farmers; this information enables them to activate cultivation protection systems to prevent frost damages



A.N.GelaVeneto is a simulation model that forecasts the evolution of the hourly minimum air temperature, from dusk to dawn, in different sites of Veneto's plain where the agrometeorological monitoring stations are located. The A.N.GelaVeneto forecast system integrates the following different elements: Subjective forecast of minimum temperature: this forecast is based on post-processing of the numerical large scale models;

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Hourly measurement of night temperatures; Temperature relationships existing between the different agro-meteorological stations of Veneto Region

hour, from dusk to dawn, the Reuter algorithm (Cicogna et al., 1999) is calculated to the temperature data measured by the stations network; in this way the algorithm recalculates the forecasted minimum temperature. The nightlime minimum temperature forecasted from the weather forecaster coincides with the sunset model initialization data; this forecast, elaborated by the forecaster, is modified by the model in function of the hourly minimum temperatures measured by the agrometeorological station network. The obtained results are broadcasted weather forecaster coincides with the sunset model initialization data; this forecast, elaborated by the forecaster, is modified by the model in function of the hourly minimum temperatures are measured by the agrometeorological station network. The obtained results are broadcasted from the by WEB and SMS each hour. In **A.N.GelaVeneto** the forecasted temperatures are measured at 50 cm and 2 meters; the temperatures of each station are compared to a restricted number of stations belonging to a same area (totally 7 areas); in this way the validation of the data is done comparing stations not too far away from each other.

and any non-construction outcome.



Methods and materials

For the model validation, the minimum temperature forecasts of the period 1996-2004 were not available in Veneto. For this reason the "historical forecasts" have been simulated in the 7 areas considered; the minimum temperature forecasted in each area, "virtual forecasts", have been obtained calculating the average of the minimum temperature forecasted in each area, "virtual forecasts", have been obtained calculating the average of the minimum temperature forecasted by the stations belonging to each area, lowered by 3.5°C. This value (-3.5°C) is the average error forecasted, in analogous conditions, by the forecaster in Friuli Venezia Giulia during the period 1995-2003.

2003..
With this method 165 nights resulted having a forecasted minimum temperature below zero, in at least one of the 7 areas considered. In this way a data set of 12605 cases has been obtained, where each case is represented by the minimum temperature measured in each of the 78 agrometeorological stations of Veneto's plain.
The registered data have been compared with:
the minimum temperature forecasted from the virtual forecaster (subjective forecast)
the minimum temperature hourly forecasted by the model in each station, during the night

Results

All the differences between the minimum temperature forecasted and the minimum temperature measured have been classified in 5 classes

1) 2)

- ForeseenT-MeasuredT <-2 °C (heavy false alarm) -2 °CjÅ ForeseenT-MeasuredT <-1°C (false Alarm) -1°C jÅ ForeseenT-MeasuredT jÅ+1°C (correct forecasts) +1°C >ForeseenT-MeasuredT jÅ+2°C (missed alarm) ForeseenT-MeasuredT >+2 °C (heavy missed alarm)

In Figure 1, have been represented % of cases of each class, belonging to the subjective forecasts and to the model forecasts at n hours from sundown. The forecasts elaborated from A.N.GelaVeneto, also at 12 hours from dawn, are more precise than those elaborated from the "virtual forecaster" (class 3 – correct forecasts); with the acquisitior of new temperature data, the model precision increases. It is interesting to point out that the percentage of cases classified in the class 4 and 5 (missed alarms), is always higher for the model respect to the "virtual forecaster"; in the cases classified classes 1 and 2 (fase latarms) the values are always lower in A.N.Gela. At 6 hours from dawn, at midnight, the percentage of correct forecast (class3) amounts to 50% for the model, and or to 9% for the "virtual forecaster". del. and only

Another element describing the quality of the toolb is the mean deviation between the forecasted minimum temperature and the measured minimum temperature: ∑ (forecasted T - measured T)/12605 As defined above, the "virtual forecaster" produces a deviation of -3.5 °C, while A.N.Gela at 12 hours from dawn has better performances around (-2.4 °C); at 6 hours from dawn this value decreases to -1.4 °C.



Case Study Models (ECMWF.DWD.LAMBO.....) Meteorological data Climatology ANGELA HOURLY ELABORATION AGNA STATION MONITORING 17 Minimum night temperature forecast for Veneto's Southern Plains, to which Agna station belongs to; 4 April 2005: min T = 3°C Web table: measured and ANGELA forecasted nightlime temperatures in Agna agrometeorological station Web map: minimum nighttime temperature, forecasted from ANGELA model at 22:00 p.m., 4 April 2005 frost alarm by SMS

Conclusions

The impact of frost events on Veneto's Agriculture is important. In the period 1978-2003, 16 events for a total number of 90 municipalities have been refunded due to frost damages, by the National Solidarity Fund; for this reason ANGELA is a useful and reliable nowcasting instrument After only four days from the activation of the service, 50 farms subscribed to it. Reflecting this need, the performances of A.N.Gela Veneto are positive.

Biolography: Chiaudani A., et al. 2005. Le avversità atmosferiche in agricoltura nella Regione Veneto nel periodo 1978-2003. www.arpa.veneto.it/cmt/agrometeo/fix/avversita_web.pdf Cicogna A., Bellan A., Giaotti D., 2000. Angela (algoritmo di nowcasting per le gelate) a tool of frost forecast Acta 3 European Conference on Applied Climatology Cicogna A., Gani M., 2004. AN Gela e le mutate frequenze delle gelate in Finuli Venezia Guita: verifica di un sistema automatico per la pervisione a breve termine della temperatura minima. AiamNews 8,1 pp 26-27 Scheifinger H., Menzel A, Koch E., Peter Ch., 2003. Trends of spring time frost events and phenological dates in Central Europe Theor. Appl.Climatol. 74, 41-51



comparison between the forecasted temperatures and the measured temperatures, in 165 nights with frost events in 78 monitoring stations