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IMPACT OF RADAR PLUVIOMETRY DATA ON THE MODELISATION OF DOWNY MILDEW IN BORDEAUX VINEYARDS

INTRODUCTION

IFV, French Vine and wine Institute, is trying to lower chemical inputs by modeling and ,by doing so , to predict diseases development, such as downy and powdery mildews, on the vineyards.

EPIcure Information System is a Decision Support System between Climate (weather station network), Parasite (mildew models made by SESMA) and Plant (untreated plot network)

The GIS (http://www.vignevin-epicure.com) initial goal was to give a spacialized risk evaluation at a small-scale region.

Models are used in input rainfall & the temperature measured by weather stations. IFV tried to increase the number of points with radar technology based on the reflectivity formula : $Z = a * R^b$

Novimet Hydrix Radar

Novimet Radar put on water tower of Ambès

METHODS

IFV bought data from Météo France. Antilope is a product that gives precipitation data for a surface about 1 km2 (data based on radar for location and weather stations for calibration of the rainfall). Temperature was calculated by Safran product.

Having one virtual pluviometer at a kilometer scale means IFV has 10000 pluviometers at Gironde department scale resumed to 6 000 precipitation data in Bordeaux vineyards Consequently, it is obvious we can see local phenomenon with radar technology. For instance, on May 24th 2007, a small area near village of Fougueyrolles was hitted by a big strong storm. The radar recorded a daily rainfall of 106.4 mm but the network of station only measured 8mm.

On the other hand, IFV observed a big difference of impact between two neighbour parcels (TIA on August 1st, 2007) exactly as shown by the model.

This one- year study showed a good rainfall cell detection but the quantification of rain could be improved. There is still a big room between the simulated and observed data. Nevertheless, it gave an important impact on the project especially for:

- good spatialisation of the information at the vineyard scale

- historical referential meteo data files must be reconsidered
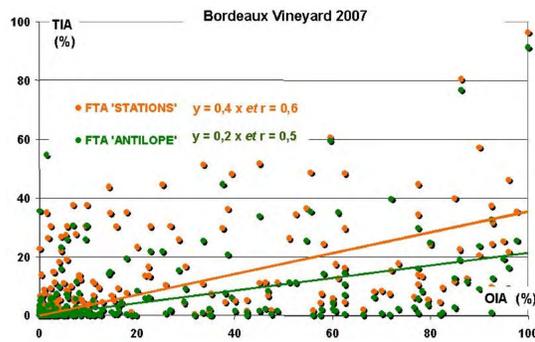
Theoretical incidence of downy mildew attack simulated with Antilope and weather station rainfalls compared to observed frequency of attack on untreated plot network


6000 virtualized meteo stations around Ambès

RESULTS

IFV is able to produce Downy mildew risk map with radar data

• Improve radar calibration using more weather stations
• Test a new Radar technology (Radar Hydrix from Novimet society)
• Develop a more precise spatialisation of temperature (1km²)
• Improve monitoring inquire on attacked cells

IFV tested a protocol of investigation to ensure a fine space validation of the development of the diseases. It is based on Google Maps technology. With a web map a farmer can precisely locate a punctual phenomenom. IFV validated this tool during a very severe series of storms which strongly damaged the vineyards in May 2009. This data were correlated with collected during three day in the vineyards with smartphone using GIS application. So if wine grower or technician proceeded to the same type of evaluation on diseases, IFV could have data to calibrate our model.
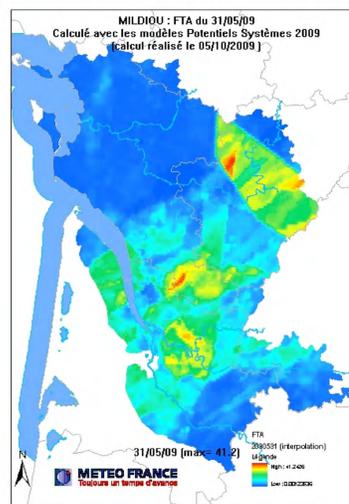
Modelisation with 13000 calculated points with Météo France data
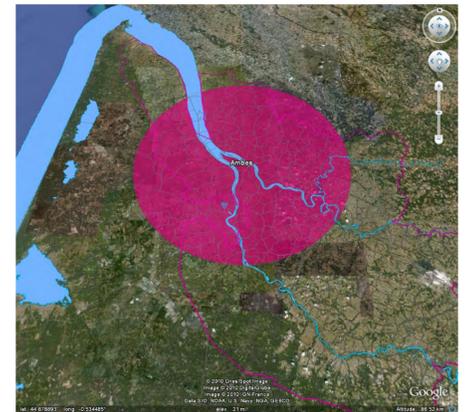
Range of experimental radar
(30 km now - 60km in the future)

Novimet is a young start-up which designs X-band radar Hydrix ®. This polarimetric radar uses a special algorithm called ZPHI®.

HYDRIX® is a radar specialised in the measurement of the precipitation.It offers the accuracy of 11 000 raingauges distributed within a 60 kms radius. Compact - its antenna is a 1,5 meter dish- and light, it offers a large flexibility for installation, and requires a reduced infrastructure only. Its investment cost is 2 to 3 times less than those of the usual systems.

Equiped with ZPHI® software, its performance is much improved compared with those of the "big" C band and S band radars deployed by the national met offices.

It makes possible new functionalities:
- To distinguish the differents types of precipitation : rain, snow, melting snow or hail.
- To measure the rainfall at ground, with an accuracy much improved with respect to that from a rain gauge.
- To separate precipitation echoes from the surface clutter (ground clutter or sea clutter)
- To estimate the kinetic energy of the raindrops.

CONCLUSION

IFV started a new program, thanks to European research funding FEDER, which allows IFV to test and experiment the new Hydrix radar technology giving a direct measuring of the amount of rainfall. This radar quantifies the amount of rain for each km² on a 60 km distance It is also susceptible to quantify rainfall with a good precision on a 200 m² scale of a 30 km distance. Coupled with a CNRS method for spatialize temperature, IFV would be able to have a high precision prevision model.