

Microclimate patterns in an agroforestry intercropped vineyard: First results

Juliette Grimaldi, Rémy Fieuzal, Charlotte Pelletier, Vincent Bustillo, Thomas Houet, David Sheeren

▶ **To cite this version:**

Juliette Grimaldi, Rémy Fieuzal, Charlotte Pelletier, Vincent Bustillo, Thomas Houet, et al.. Microclimate patterns in an agroforestry intercropped vineyard: First results. 3ème congrès européen de l'agroforesterie - EURAF 2016, May 2016, Montpellier, France. European Agroforestry Federation (EURAF), 21 p., 2016, 3rd European Agroforestry Conference 2016: Celebrating 20 years of Agroforestry research in Europe. hal-01600201

HAL Id: hal-01600201
https://hal.science/hal-01600201

Submitted on 3 Jun 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

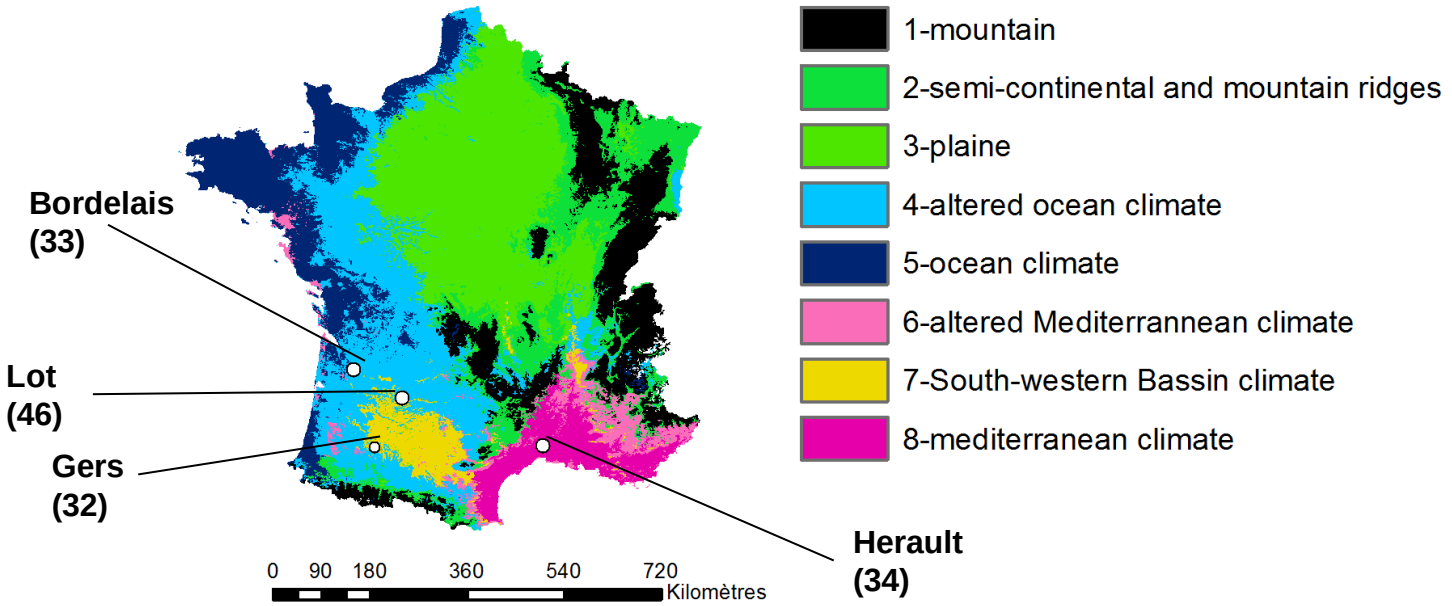
Microclimate patterns in an agroforestry intercropped vineyard : first results

Grimaldi Juliette[1], Fieuzal R[1], Pelletier C[1], Bustillo V[1], Houet T[2], Sheeren D[3]

(1) UMR CESBIO, University Paul Sabatier, Toulouse, France
(2) UMR GEODE, University Jean Jaures, Toulouse, France
(3) UMR DYNAFOR, INP-ENSAT, Toulouse, France

PROJET SOUTENU PAR FONDATION DE FRANCE

Vitiforest research project



Joly, Daniel, Thierry Brossard, Hervé Cardot, Jean Cavailhes, Mohamed Hilal, and Pierre Wavresky. 2010. “Types of Climates on Continental France, a Spatial Construction.” *European Journal of Geography*. doi:10.4000/cybergeo.23155.

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Vitiforest research project





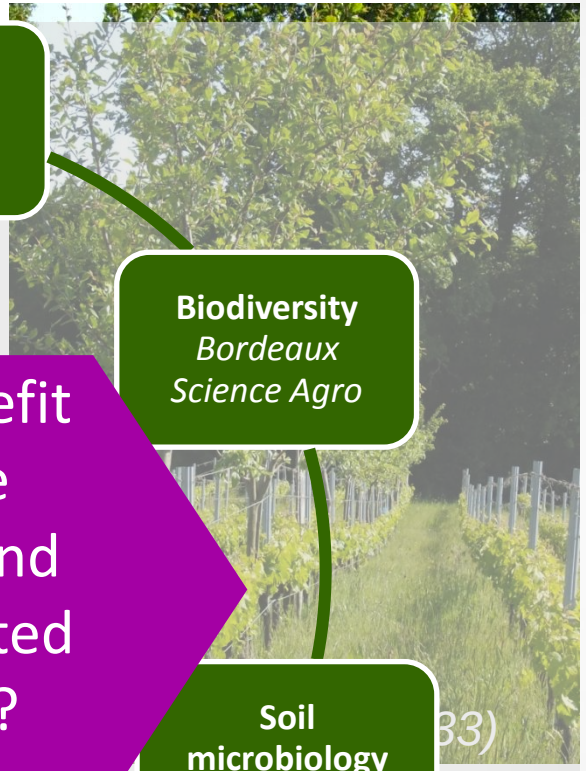




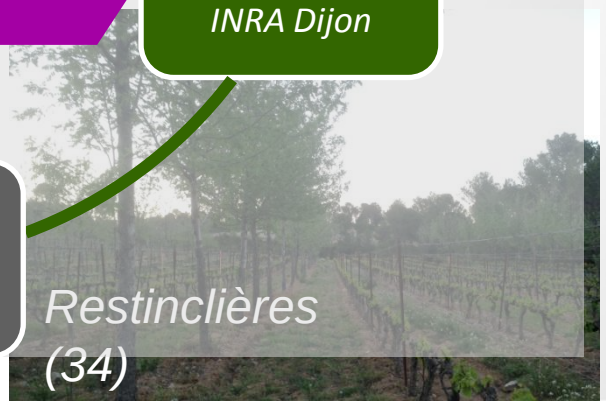
Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Vitiforest research project









Yield and grape quality
IFV

Biodiversity
Bordeaux Science Agro

Soil microbiology
INRA Dijon

Coordinator
Arbre et Paysage 32

Economy
Bordeaux Science Agro

Microclimate
CESBIO

Do trees benefit to the wine production and to the cultivated ecosystem ?

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Vine faces climatic challenges

Climate dynamics

Vine transpiration ➔ Temperature regulation

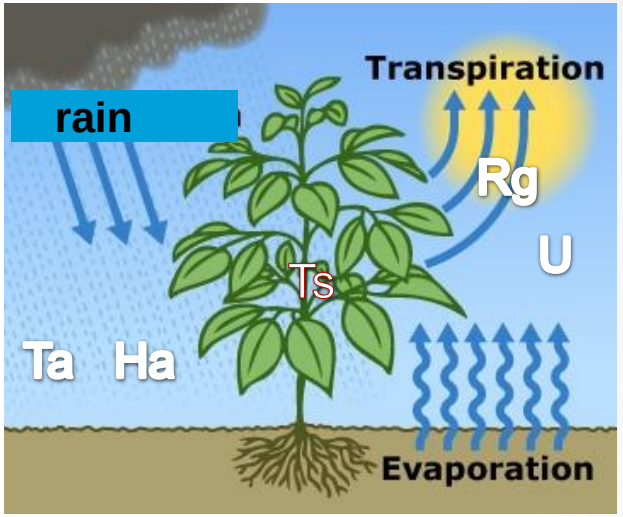
Extreme events

Extreme temperatures may cause irreversible damage.

Heat waves and droughts may become more frequent and intense in future years (IPCC, 2014)

Tree regulatory potential

- Water availability
-Transpiration
- Shade
- Wind interception
- Heat radiative transfers



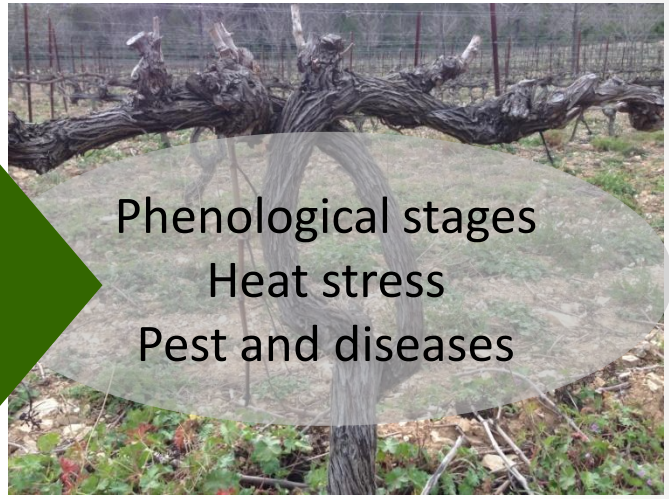


Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Main questions

What is the impact of intercropped trees on temperature dynamics and extreme values ?

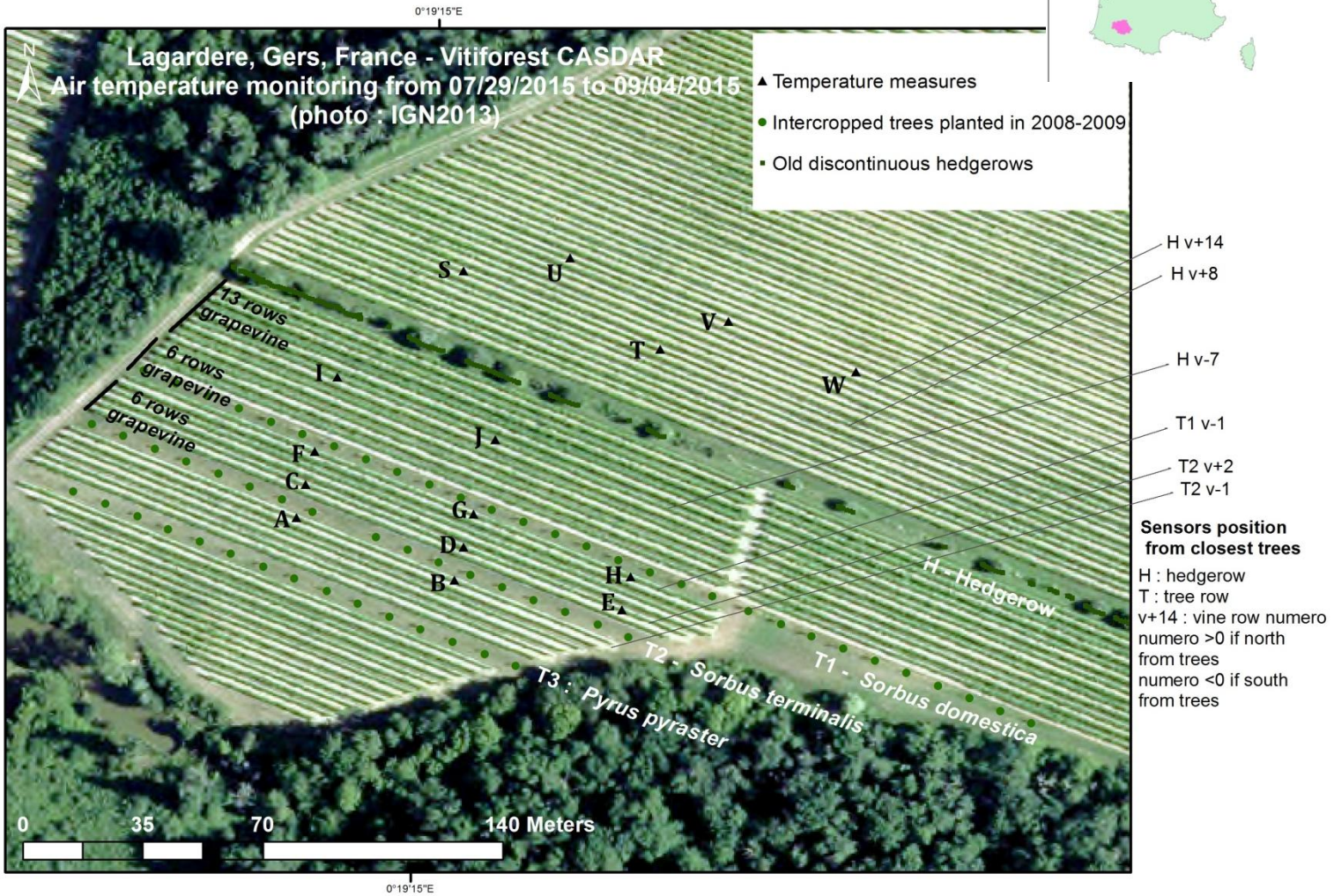
What is the spatial extent of their effects ?



Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'AGRICULTURE DE L'AGROALIMENTAIRE ET DE LA FORÊT
Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Summer 2015 : a test campaign in Lagardère (32)

1 domain – 15 sites





Sensors position from closest trees

H : hedgerow
T : tree row
v+14 : vine row numero
numero >0 if north from trees
numero <0 if south from trees

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Summer 2015 : materiel and method

Plot

1 domain – 15 sites

Measures

17 Tair measures (2 repetitions)
36 days from 07/29 to 09/04/2015
Frequency = 20’
Accuracy = 0.5° C
Meteo reference in Auch

Analysis

Rewriting by rolling mean
Sorting daytypes
Daily means and metrics calculation
Classification (Hierchical Cluster Analysis)



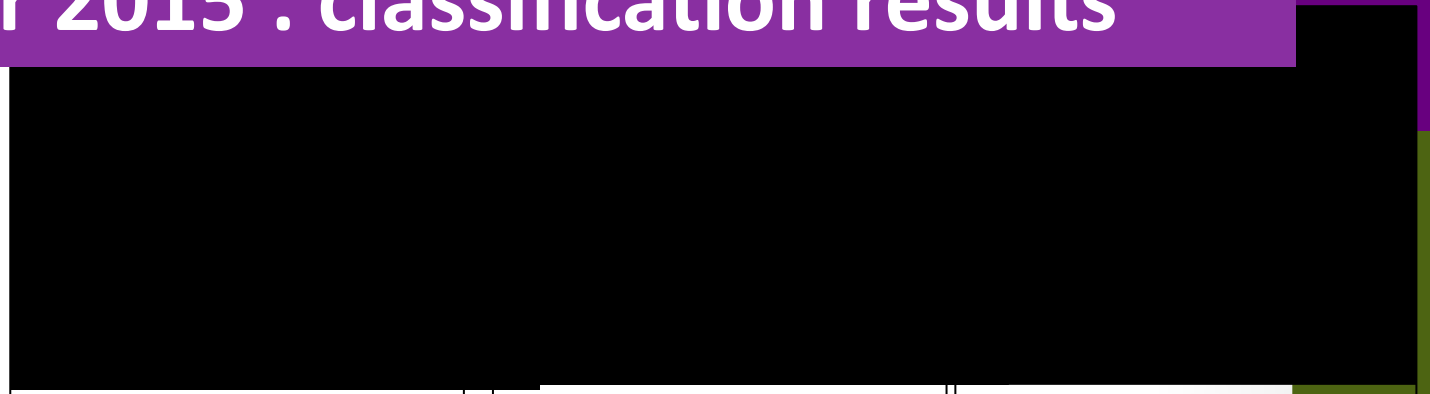


Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'AGRICULTURE DE L'AGROALIMENTAIRE ET DE LA FORÊT
Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Summer 2015 : classification results

Are the temperature dynamics similar between sites ?

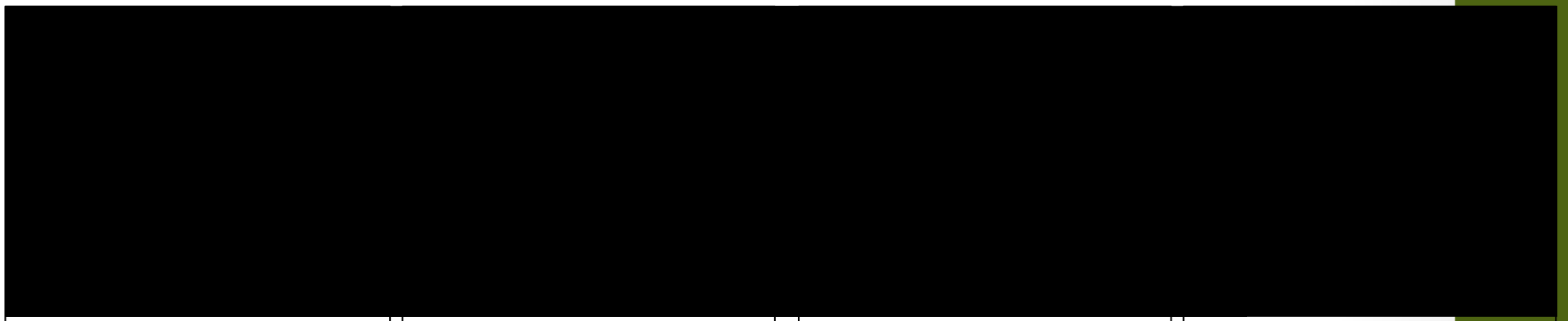
a. Overall time series



b. Daily Mean TS

c. Daily standard deviation TS

d. Daily rangeTS



e. Daily Minimum TS

f. Hour when min is reached TS

g. Quantile 10% TS

h. Ratio T < 15° C TS



i. Daily maximal TS

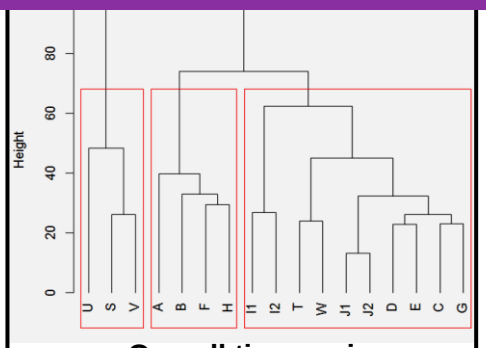
j. Hour when max is reached TS

k. Quantile 90% TS

l. Ratio T > 35° C TS

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Summer 2015 : classification results



a. Overall time series

b. Daily Mean TS

c. Daily standard deviation TS

d. Daily rangeTS

e. Daily Minimum TS

f. Hour when min is reached TS

g. Quantile 10% TS

h. Ratio T < 15° C TS

i. Daily maximal TS

j. Hour when max is reached TS

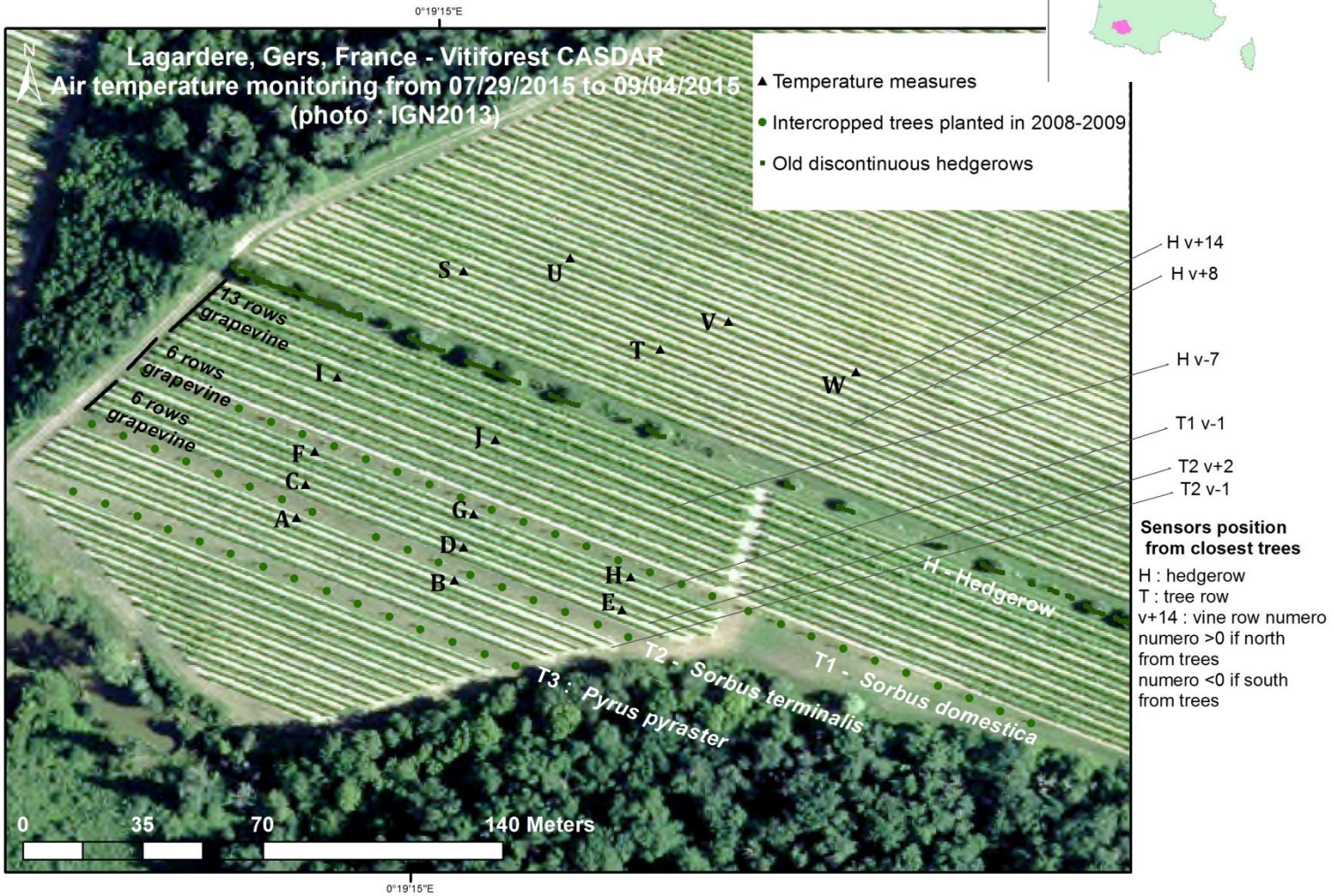
k. Quantile 90% TS

l. Ratio T > 35° C TS

Avec la contribution financière du compte d'affectation spéciale « développement agricole et rural »

Summer 2015 : a test campaign in Lagardère (32)

1 domain – 15 sites



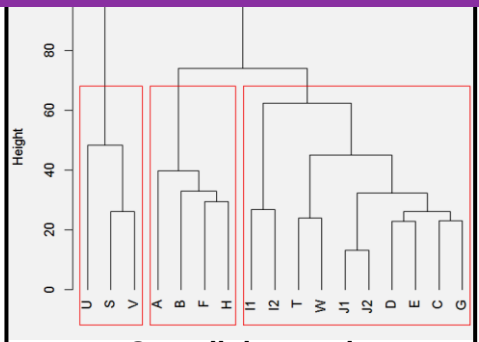


Sensors position from closest trees

H : hedgerow
T : tree row
v+14 : vine row numero
numero >0 if north from trees
numero <0 if south from trees

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Summer 2015 : classification results



a. Overall time series

➔ What are the main climatic parameters responsible for these clusters ?

b. Daily Mean TS

c. Daily standard deviation TS

d. Daily rangeTS

e. Daily Minimum TS

f. Hour when min is reached TS

g. Quantile 10% TS

h. Ratio T < 15° C TS

i. Daily maximal TS

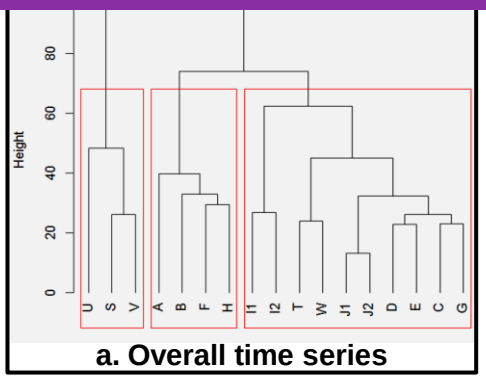
j. Hour when max is reached TS

k. Quantile 90% TS

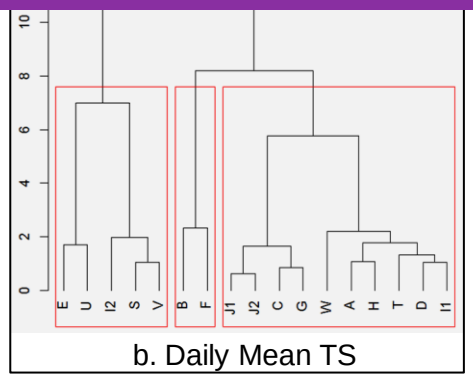
l. Ratio T > 35° C TS

Avec la contribution financière du compte d'affectation spéciale « développement agricole et rural »

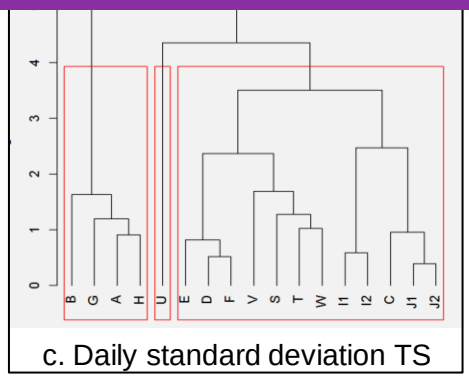
Summer 2015 : classification results



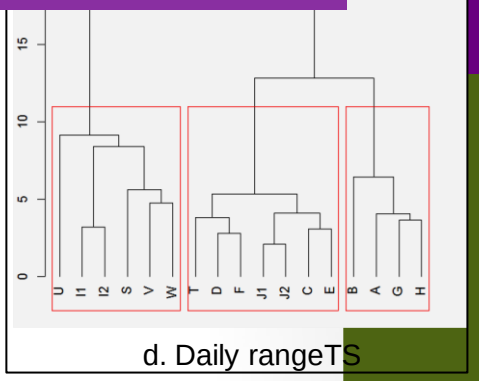
a. Overall time series



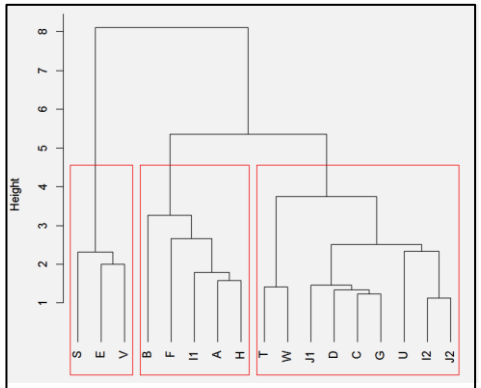
b. Daily Mean TS



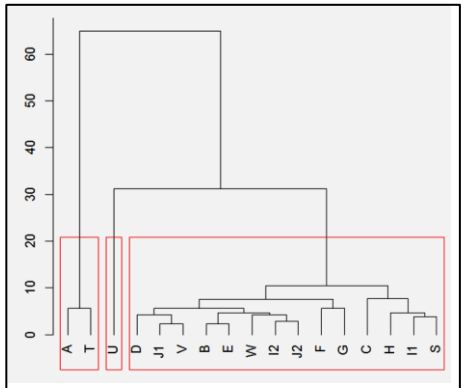
c. Daily standard deviation TS



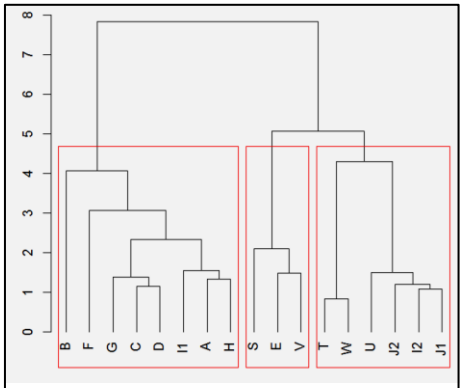
d. Daily rangeTS



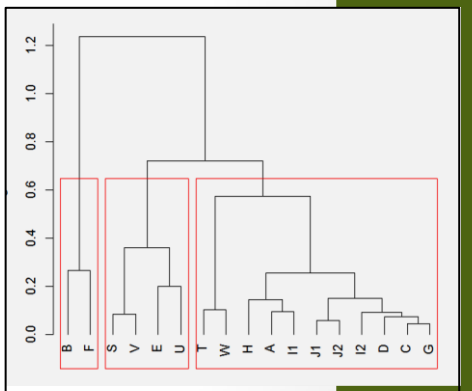
e. Daily Minimum TS



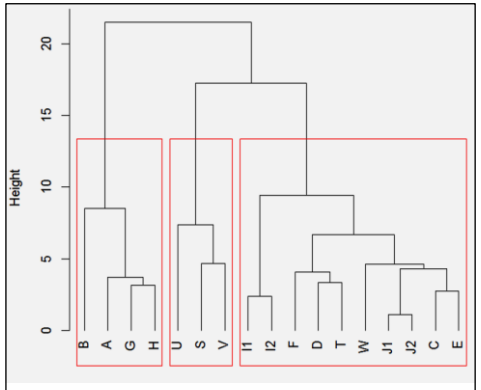
f. Hour when min is reached TS



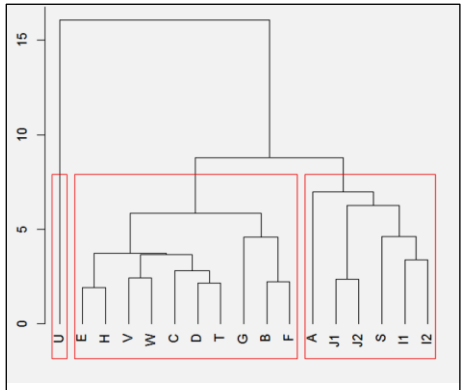
g. Quantile 10% TS



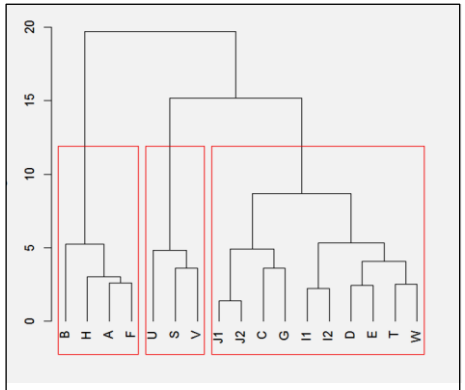
h. Ratio T < 15° C TS



i. Daily maximal TS



j. Hour when max is reached TS



k. Quantile 90% TS

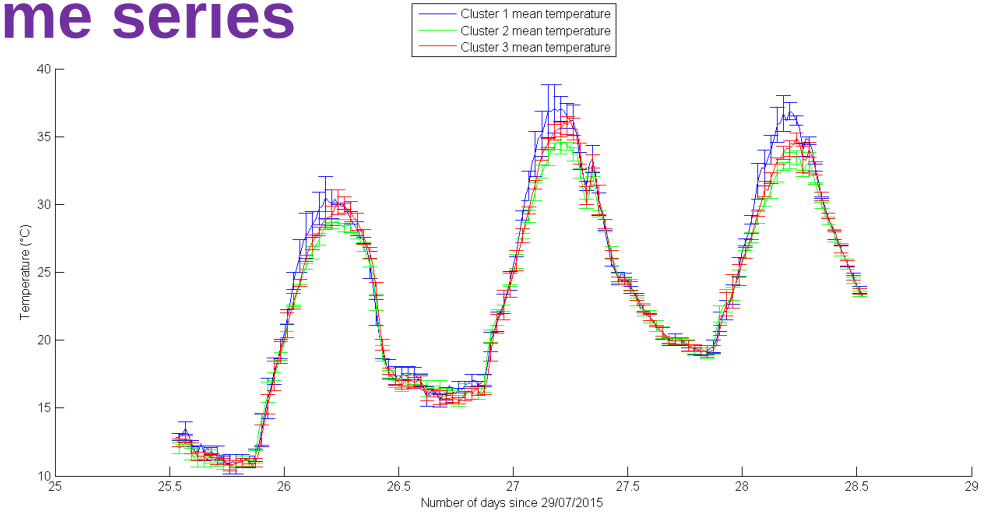


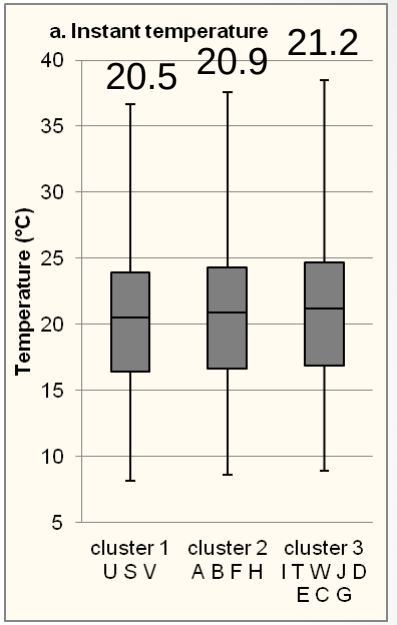
l. Ratio T > 35° C TS

Avec la contribution financière du compte d'affectation spéciale développement agricole et rural

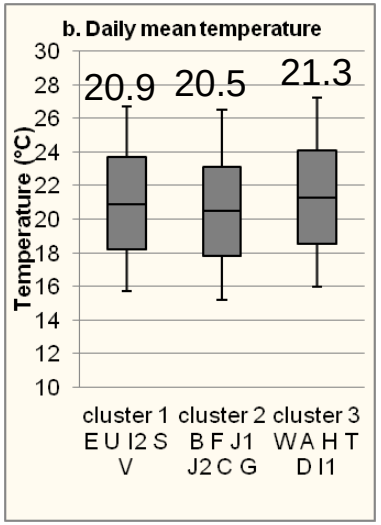
Summer 2015 : climatic patterns

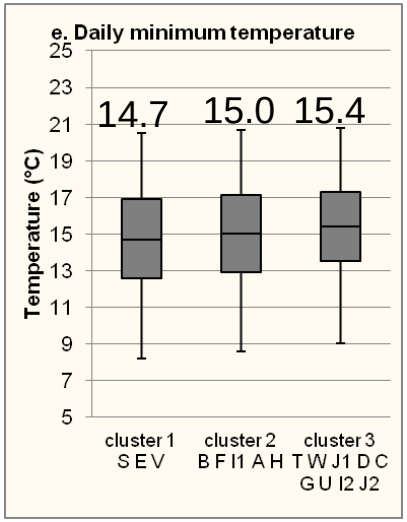
Overall time series

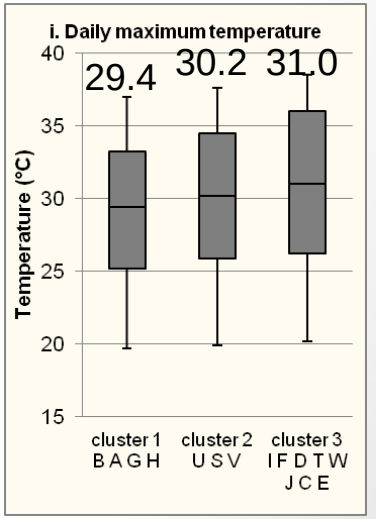




Daily mean, minimum and maximum







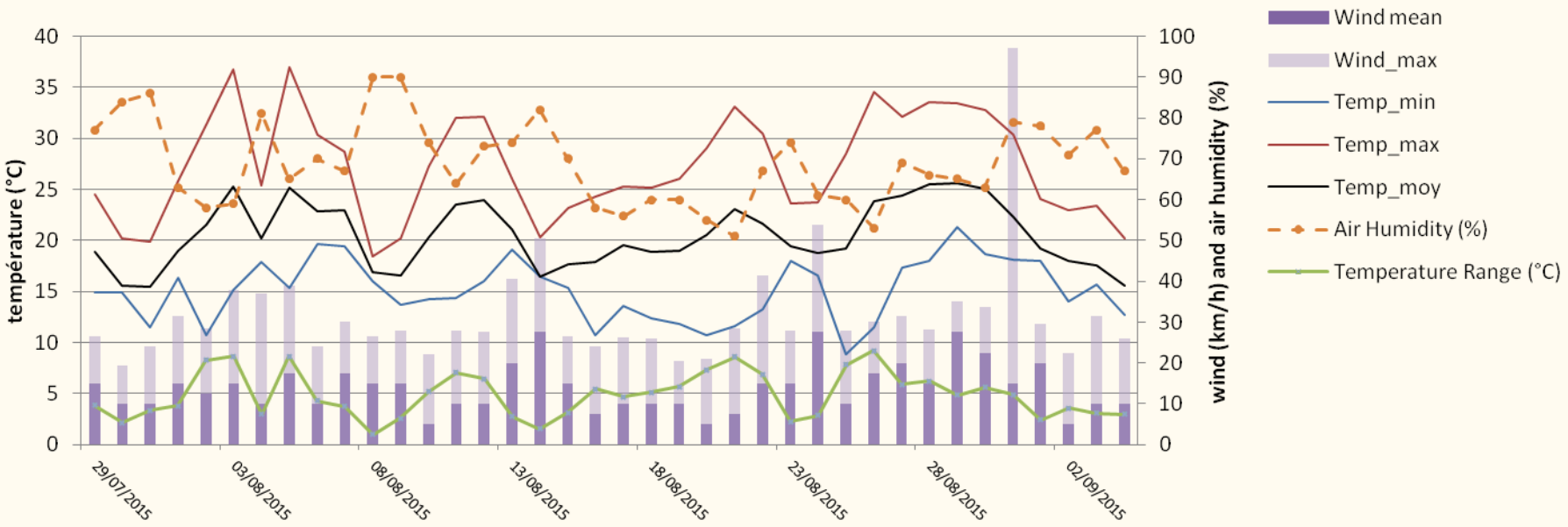
Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»



Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Summer 2015 : wheather influence

Climate records at Auch meteorological station (25 km)



Classification of day types

Wind speed classes X Solar duration classes

Nb days type 1 : cloudy and no wind days	11	29%
Nb. days type 2 : mixed or sunny and no wind days	15	39%
Nb. days type 3 : sunny and windy days	12	32%

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Daily mean

Mean TS		Min	Max	Mean	Std.
DayType1	Cluster 1 : A C D G H I1 T W	15.56	23.89	19.29	2.86
	Cluster 2 : B F	15.12	23.21	18.88	2.87
	Cluster 3 : E I2 J S U V	15.74	24.25	19.57	2.87
DayType2	Cluster 1 : A C D G H I J S T V W	16.28	25.28	20.54	2.61
	Cluster 2 : B F	15.57	24.91	20.12	2.67
	Cluster 3 : E U	16.50	24.89	20.90	2.70
DayType3	Cluster 1 : A B D E F H I1 T W	15.66	26.81	22.40	3.27
	Cluster 2 : C T J	17.43	26.81	22.66	3.07
	Cluster 3 : I2 S U V	16.77	27.33	22.99	3.32

Daily minimum

Minimum TS		Min	Max	Mean	Std.
DayType1	Cluster 1 : A C D G H I1 T W	11.50	18.60	15.08	2.33
	Cluster 2 : B F	11.00	18.10	14.76	2.37
	Cluster 3 : E I2 J S U V	11.60	19.00	15.41	2.28
DayType2	Cluster 1 : A B F	8.00	19.10	14.16	2.77
	Cluster 2 : C D E G H I J T U W	8.50	19.10	14.53	2.72
	Cluster 3 : S V	9.00	19.50	14.98	2.72
DayType3	Cluster 1 : A B C D F G H I J T	10.00	21.10	15.35	3.20
	Cluster 2 : E S V	11.00	21.00	15.83	3.10
	Cluster 3 : U W	10.00	20.60	15.34	3.19

Daily maximum

Maximum TS		Min	Max	Mean	Std.
DayType1	Cluster 1 : A D F G H J T	19.00	36.60	27.15	5.10
	Cluster 2 : B	19.00	35.00	26.08	5.10
	Cluster 3 : C I S U	20.00	37.00	27.65	4.94
	cluster 4 : E V W	19.00	37.50	27.70	5.48
DayType2	Cluster 1 : A B G H	22.50	36.10	28.79	3.69
	Cluster 2 : C D E G J T W	23.00	36.60	29.42	4.01
	Cluster 3 : I S U V	24.00	37.00	30.11	3.97
DayType3	Cluster 1 : A B F G H	23.50	38.00	32.26	4.01
	Cluster 2 : C D E I J T W	23.50	38.50	33.22	3.92
	Cluster 3 : S U V	25.00	39.50	34.45	4.34

Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

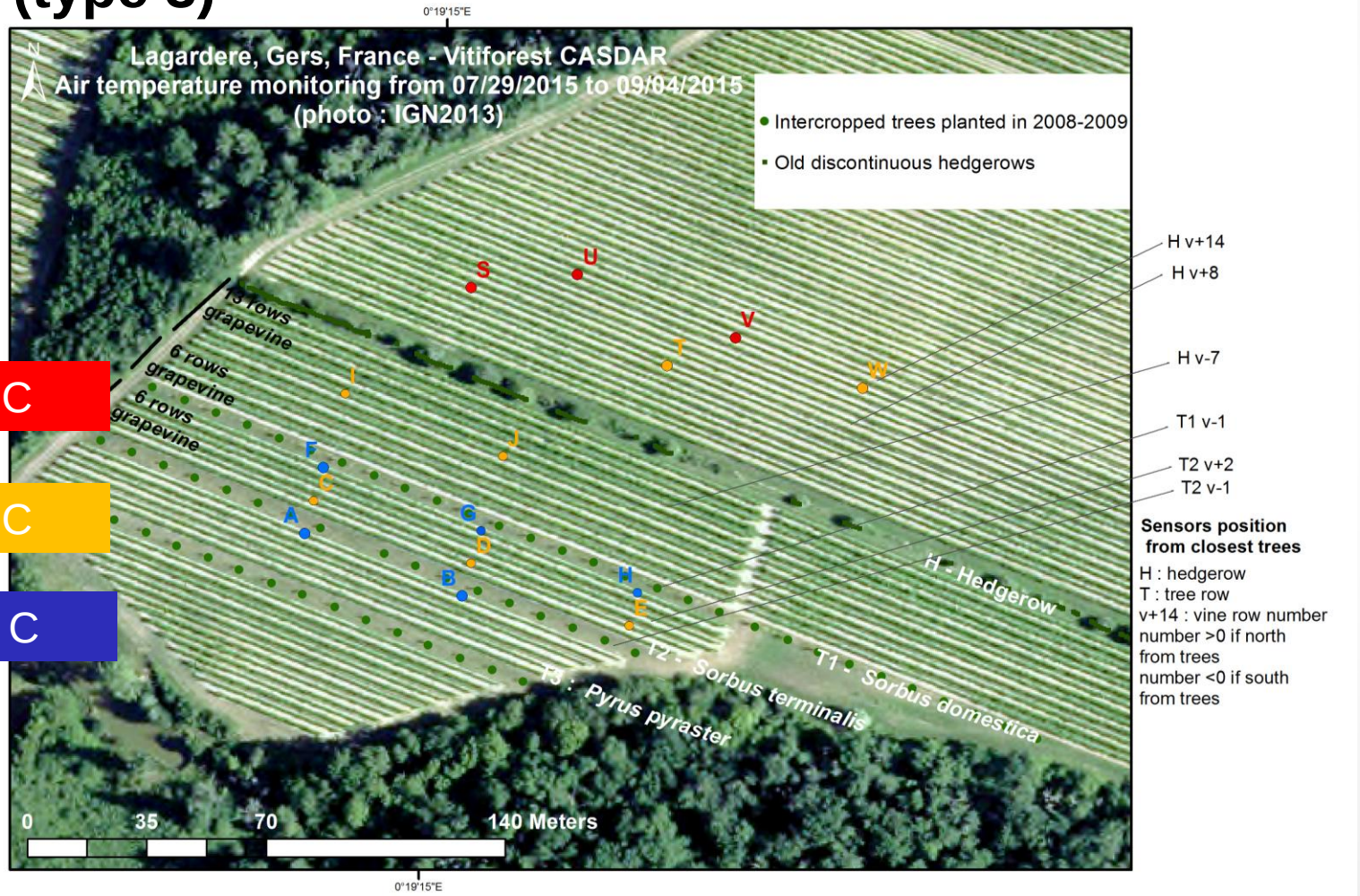
Summer 2015 : weather influence

Daily maximum temperatures during warmest days (type 3)

34.5 ° C

33.2 ° C

32.3 ° C



Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Conclusion on 2015 results

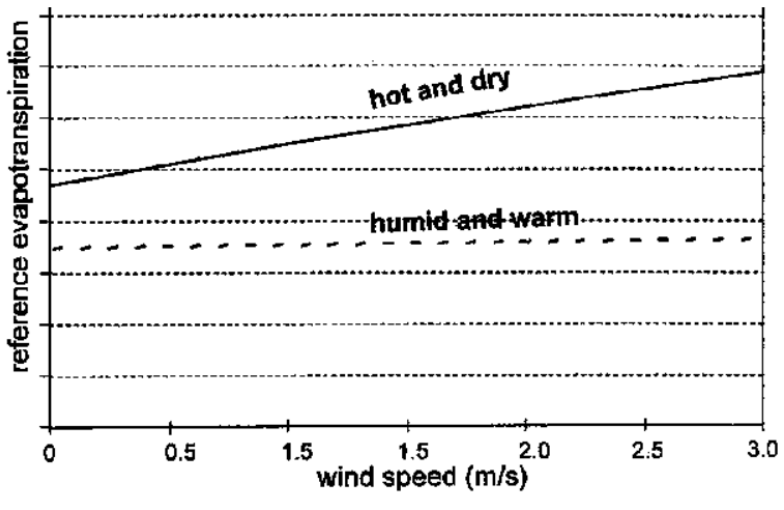
Maxima temperatures may be mitigated by tree rows right next to vine rows

High variability of measurement

Air humidity should be considered in day type classification

Effect of wind speed on evapotranspiration in hot-dry and humid-warm weather conditions

(Chapter 3, Meteorological Data – FAO – online - http://www.fao.org/docrep/x0490e/x0490e07.htm)



Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Coming soon : 2016 campaign

A more complete trial

3 vineyards
100 plots
Soil and air temperatures and HR
Continuous records from March to September
Spatialised wind speed
Sptialised solar radiation

RGB - Domaine de Restinclières (34)





NDVI - *Lapouyade (33)*



What do drones bring us ?

infra-red thermal images at 20 cm of resolution
2 NDVI captures

➔ to calibrate and validate a statistical model











Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»

Thank you for your attention !



Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'AGRICULTURE DE L'AGROALIMENTAIRE ET DE LA FORÊT
Avec la contribution financière du compte d'affectation spéciale «développement agricole et rural»