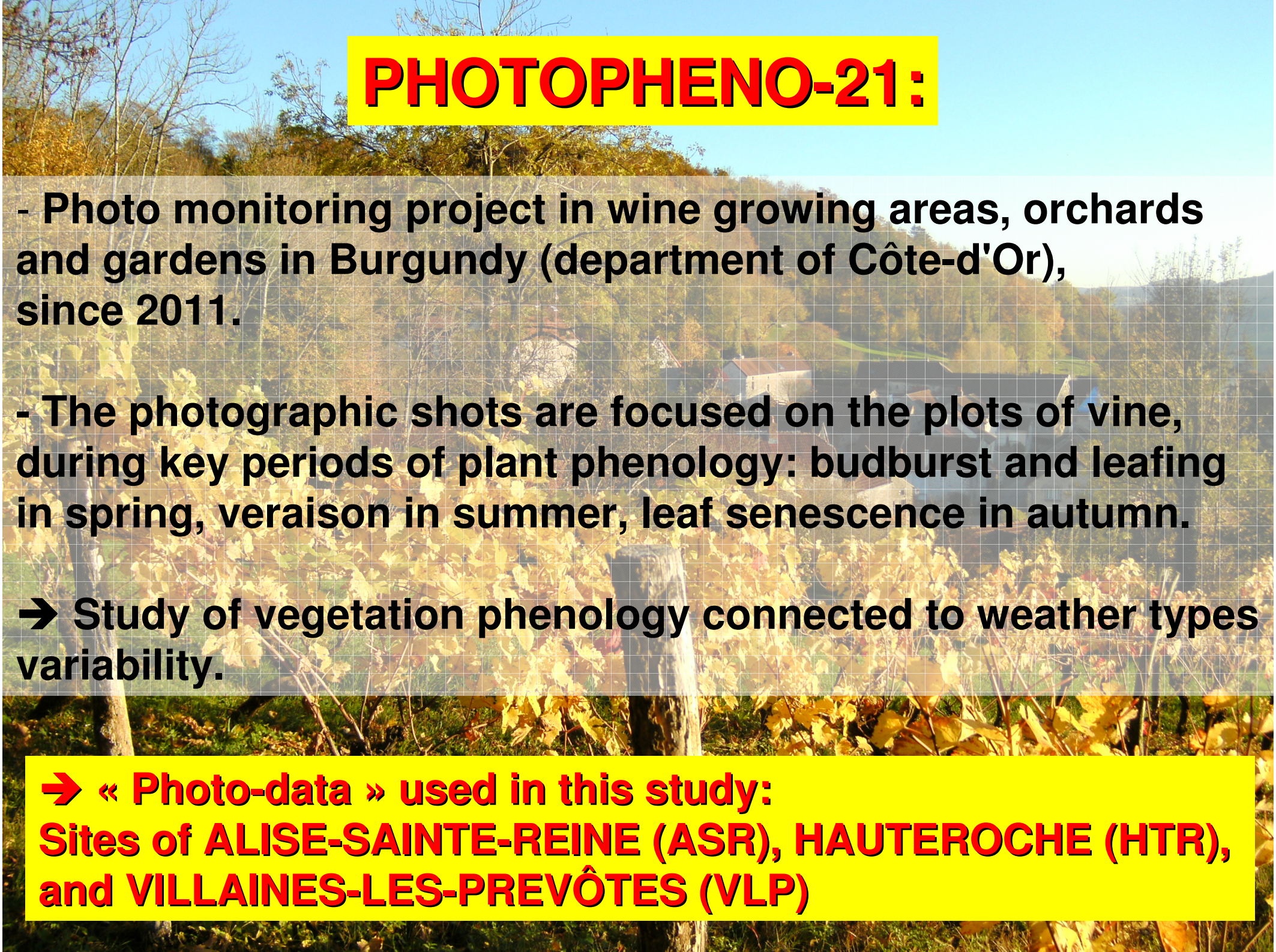
Meteorological considerations of grapevine damage due to temperature variations: the 2019 late spring frost and summer heat wave events in Burgundy



Olivier Planchon[1], Olivier Cantat[2], Benjamin Bois[1,3], François Beauvais[2], Catinca Gavrilescu[1], and Matthieu David[2]

[1]CNRS, Biogéosciences, Université de Bourgogne, Dijon, France
[2]LETG-Caen Géophen, Université de Caen Normandie, Caen, France
[3]Institut Universitaire de la Vigne et du Vin, Université de Bourgogne, Dijon, France



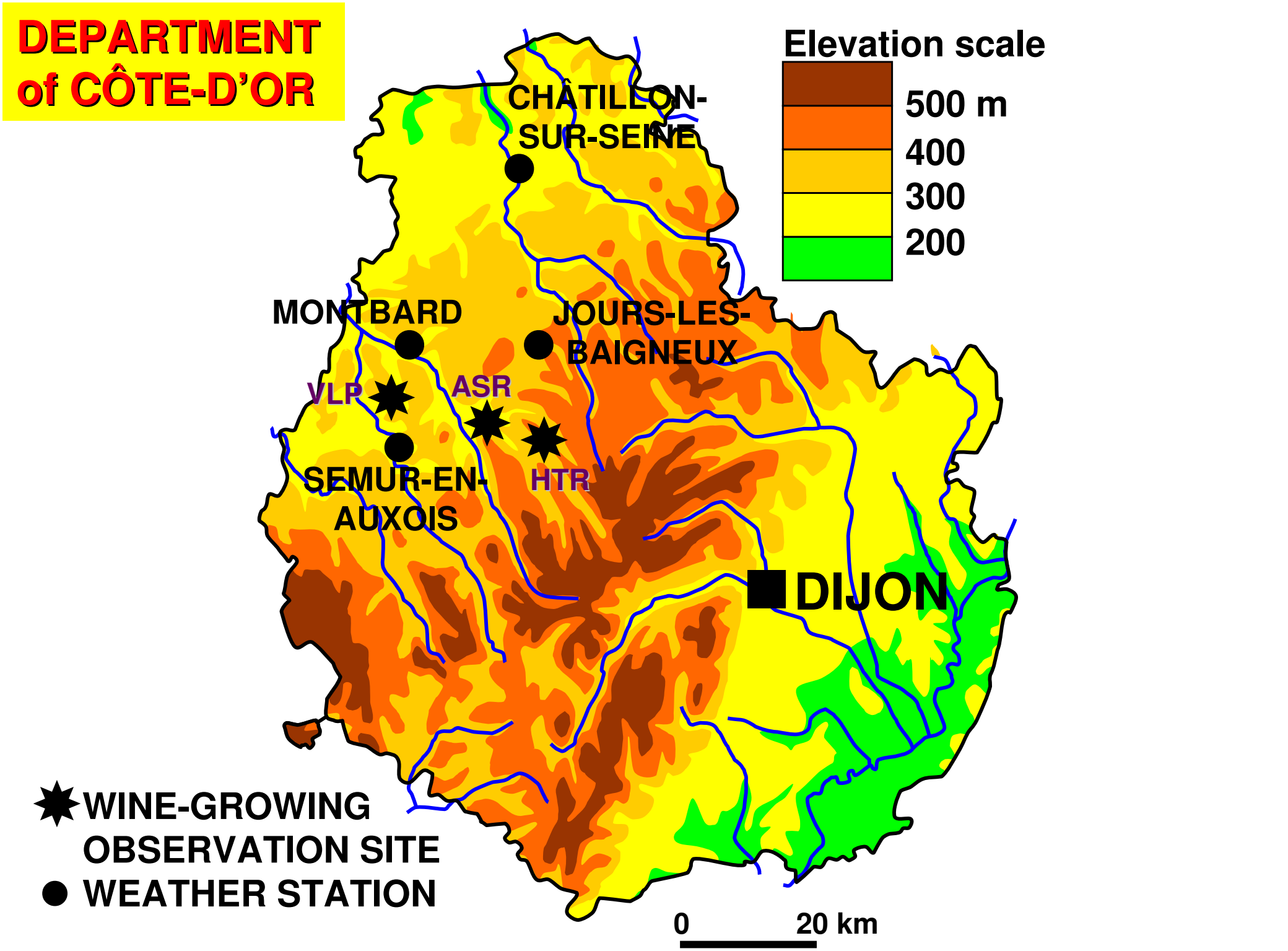
PHOTOPHENO-21 :

- Photo monitoring project in wine growing areas, orchards and gardens in Burgundy (department of Côte-d'Or), since 2011.

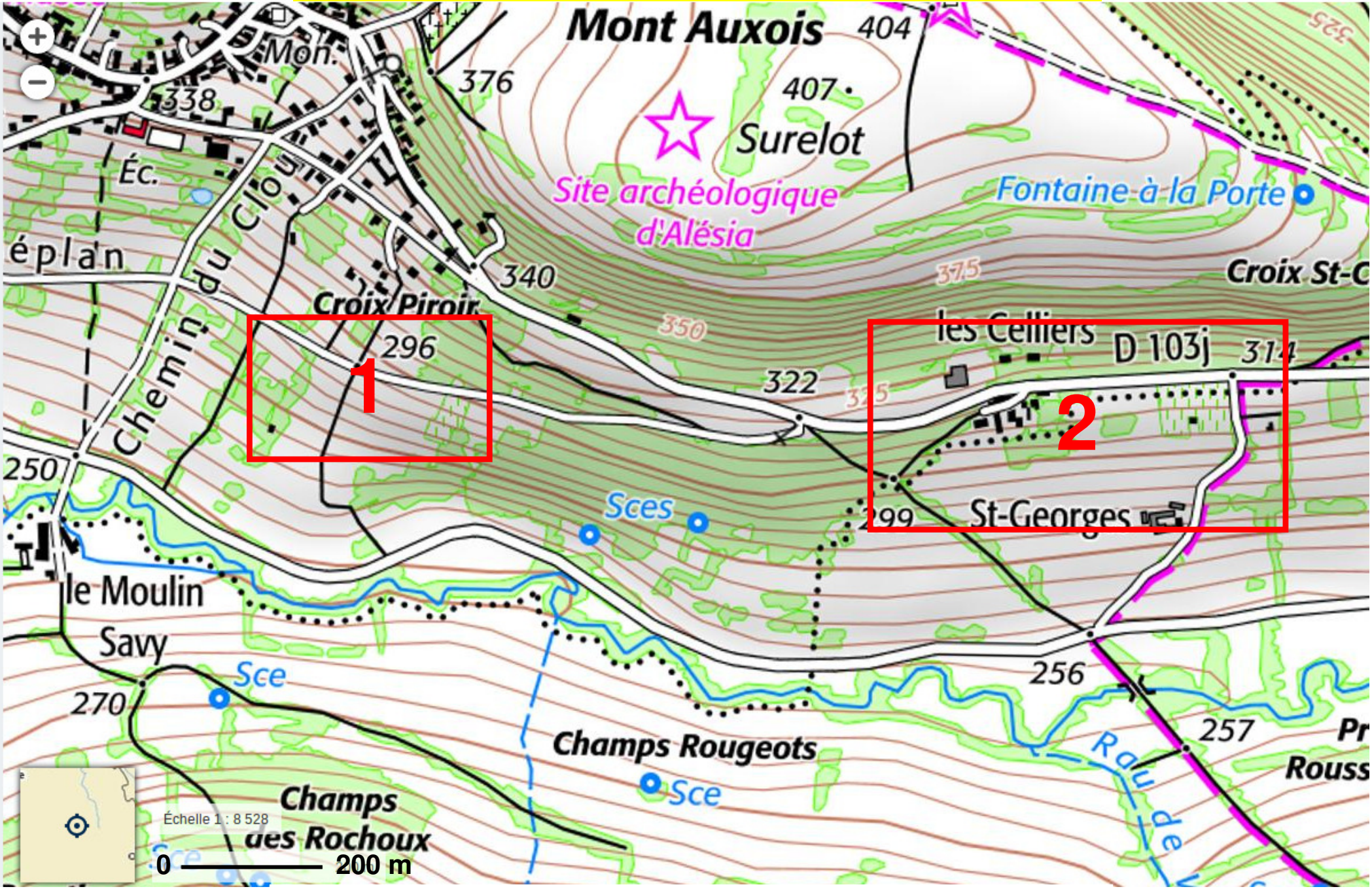
- The photographic shots are focused on the plots of vine, during key periods of plant phenology: budburst and leafing in spring, veraison in summer, leaf senescence in autumn.

➔ Study of vegetation phenology connected to weather types variability.

➔ « Photo-data » used in this study:
Sites of ALISE-SAINTE-REINE (ASR), HAUTEROCHE (HTR), and VILLAINES-LES-PREVÔTES (VLP)

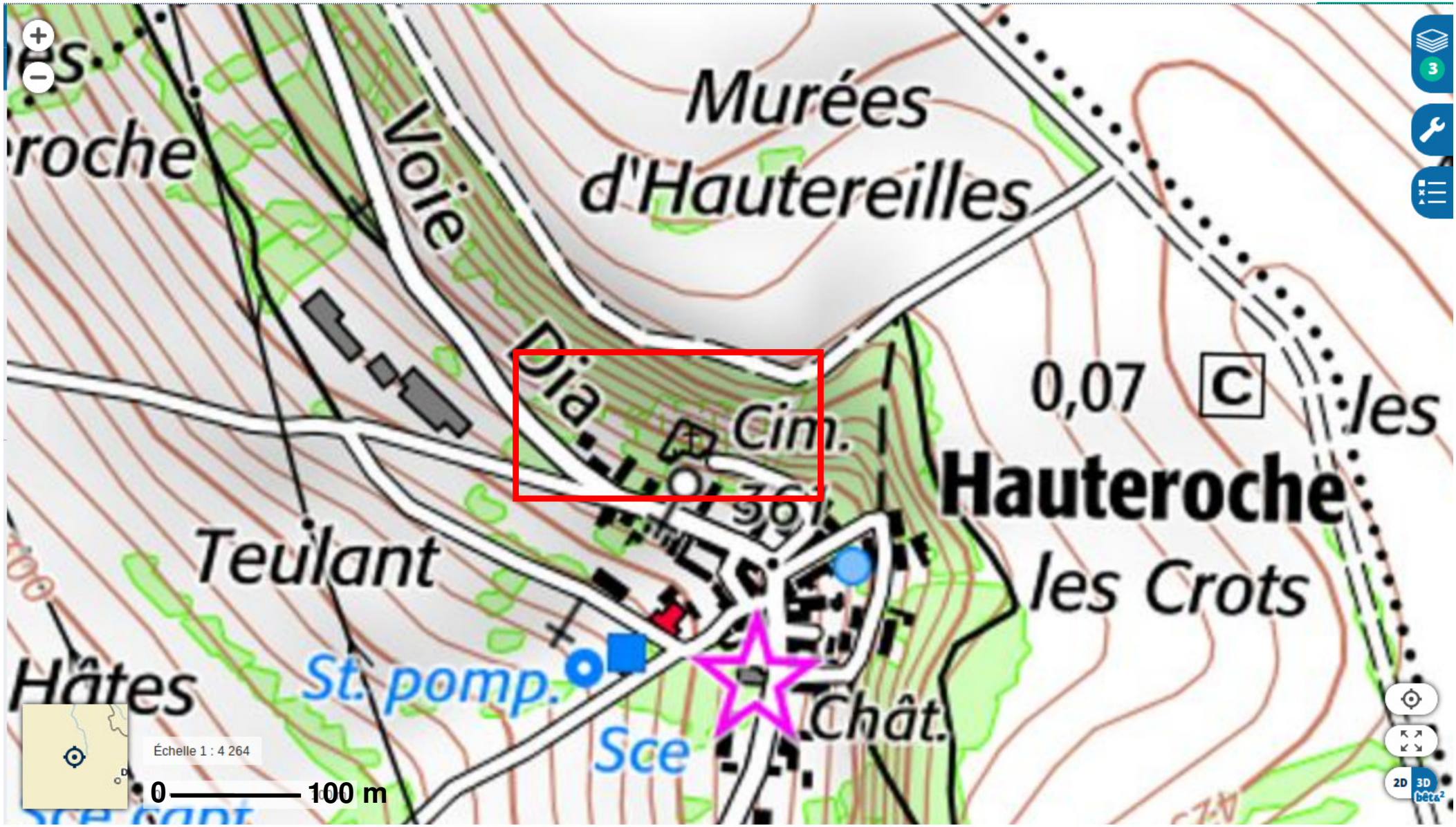

DEPARTMENT of CÔTE-D'OR
Elevation scale
500 m
400
300
200
CHÂTILLON-SUR-SEINE
MONTBARD
JOURS-LES-BAIGNEUX
VLP
ASR
HTR
SEMUR-EN-AUXOIS
DIJON
WINE-GROWING OBSERVATION SITE
WEATHER STATION
0
20 km

SITE OF ALISE-SAINTE-REINE



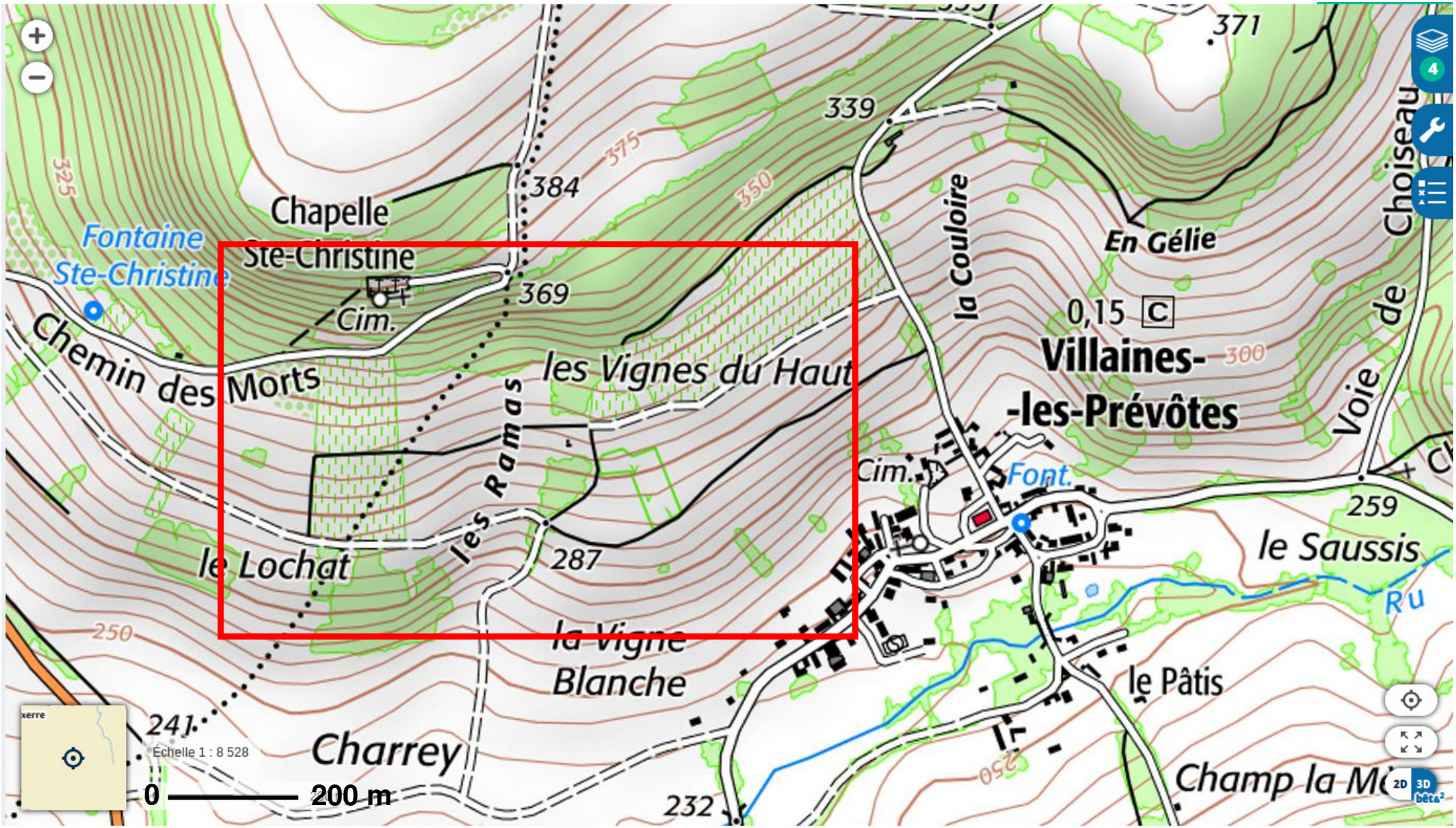
Source : *Géoportail* / www.geoportail.gouv.fr

SITE OF HAUTEROCHE



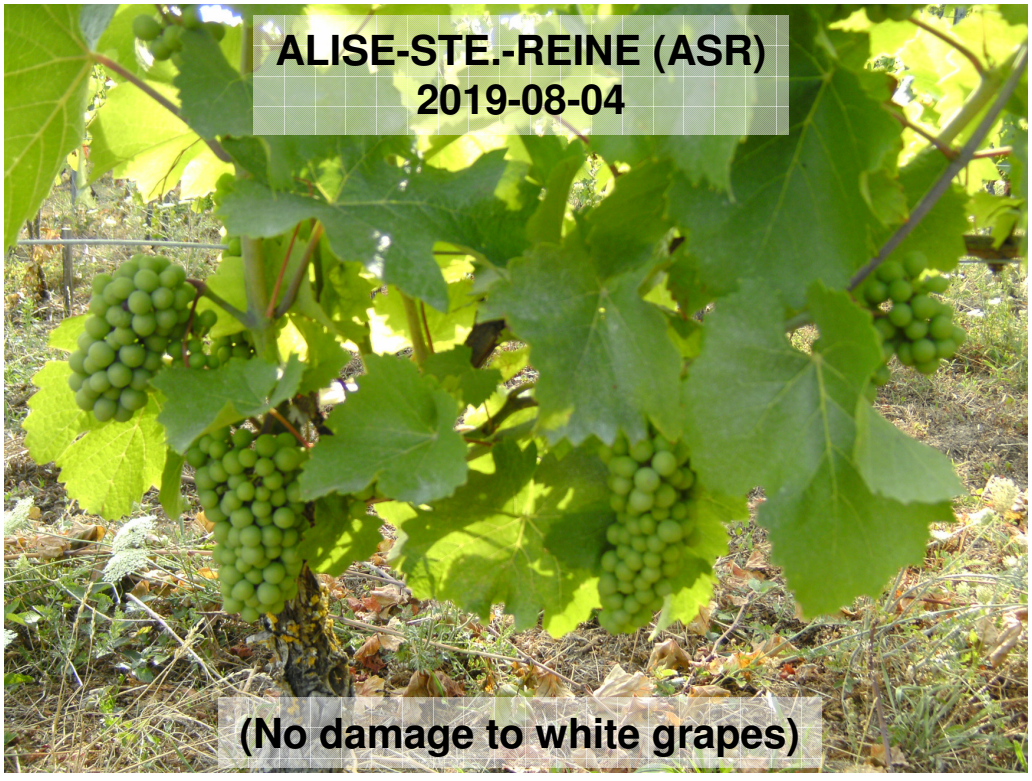
Source : *Géoportail* / www.geoportail.gouv.fr

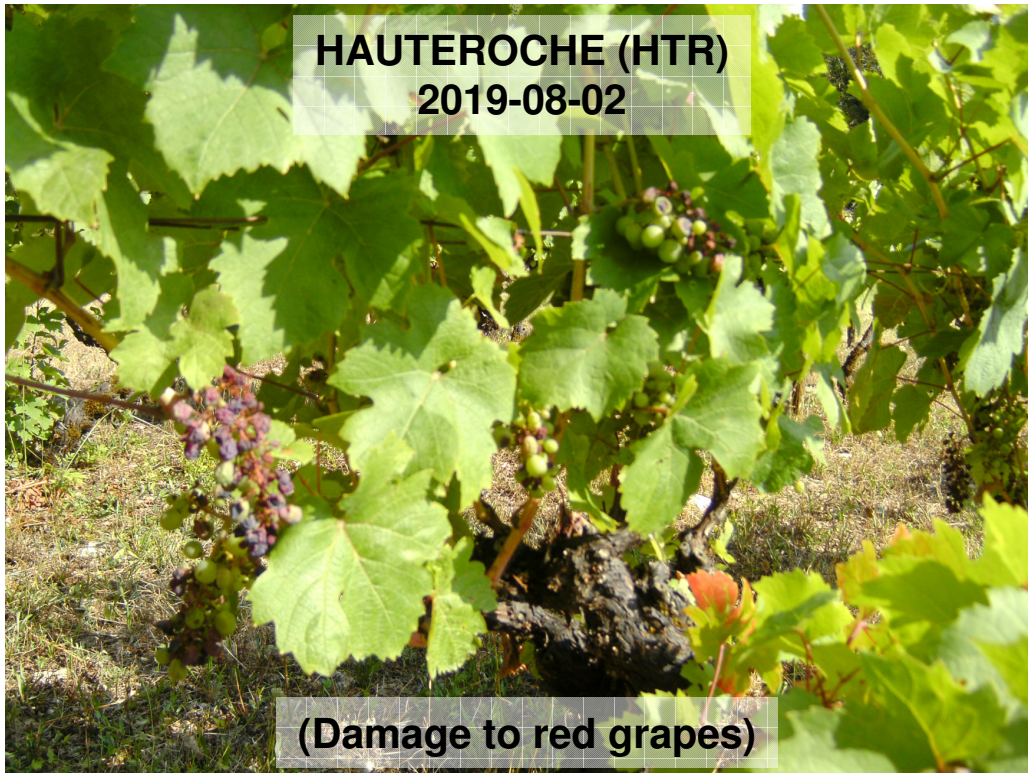
SITE OF VILLAINES-LES-PRÉVÔTES

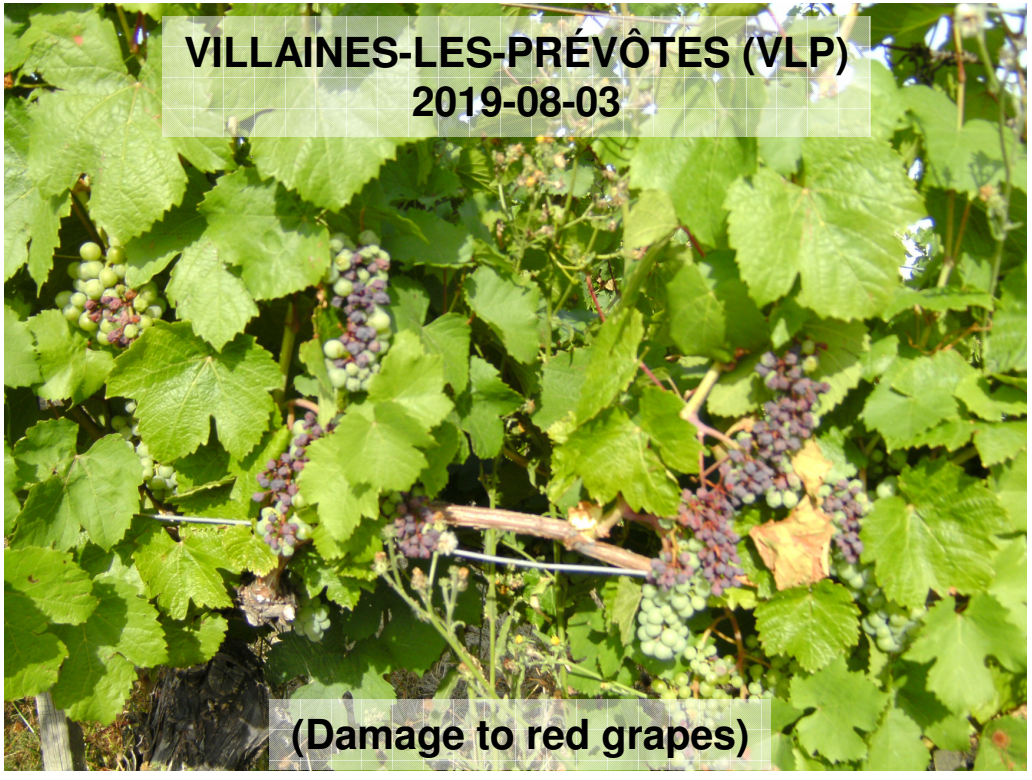


Source : *Géoportail* / www.geoportail.gouv.fr


ALISE-SAINTE-REINE (ASR)
2019-05-01
(Before the frost event)
ALISE-STE.-REINE (ASR)
2019-05-07
(Damage to leaves)


ALISE-STE.-REINE (ASR)
2019-08-04
(No damage to white grapes)


HAUTEROCHE (HTR)
2019-08-02
(Damage to red grapes)


VILLAINES-LES-PRÉVÔTES (VLP)
2019-08-03
(Damage to red grapes)

HESS-BREZOWSKY WEATHER PATTERNS:

List of *Grosswetterlagen* (GWL), according to James (2007)

	Grosswetterlagen / translated definition (English)	**GWL**
01	Anticyclonic Westerly	WA
02	Cyclonic Westerly	WZ
03	South-Shifted Westerly	WS
04	Maritime Westerly (Block E. Europe)	WW
05	Anticyclonic South-Westerly	SWA
06	Cyclonic South-Westerly	SWZ
07	Anticyclonic North-Westerly	NWA
08	Cyclonic North-Westerly	NWZ
09	High over Central Europe	HM
10	Zonal Ridge across Central Europe	BM
11	Low (Cut-Off) over Central Europe	TM
12	Anticyclonic Northerly	NA
13	Cyclonic Northerly	NZ
14	Icelandic high, Ridge over Central Europe	HNA
15	Icelandic high, Trough over Central Europe	HNZ
16	High over the British Isles	HB
17	Trough over Central Europe	TRM
18	Anticyclonic North-Easterly	NEA
19	Cyclonic North-Easterly	NEZ
20	Scandinavian High, Ridge over Central Europe	HFA
21	Scandinavian High, Trough over Central Europe	HFZ
22	High over Scandinavia-Iceland, Ridge over Central Europe	HNFA
23	High over Scandinavia-Iceland, Trough over Central Europe	HNFZ
24	Anticyclonic South-Easterly	SEA
25	Cyclonic South-Easterly	SEZ
26	Anticyclonic Southerly	SA
27	Cyclonic Southerly	SZ
28	Low over the British Isles	TB
29	Trough over Western Europe	TRW

HESS-BREZOWSKY WEATHER PATTERNS:

List of Major types (*Grosswettertypen*)

NORTHEAST & EAST:

NEA, NEZ, HFA, HFZ, HNFA, HNFZ

SOUTH:

SWA, SWZ, SA, SZ, TB, TRW, SEA, SEZ

WEST:

WA, WZ, WW, WS

NORTHWEST & NORTH:

NWA, NWZ, NA, NZ, HNA, HNZ, HB, TRM

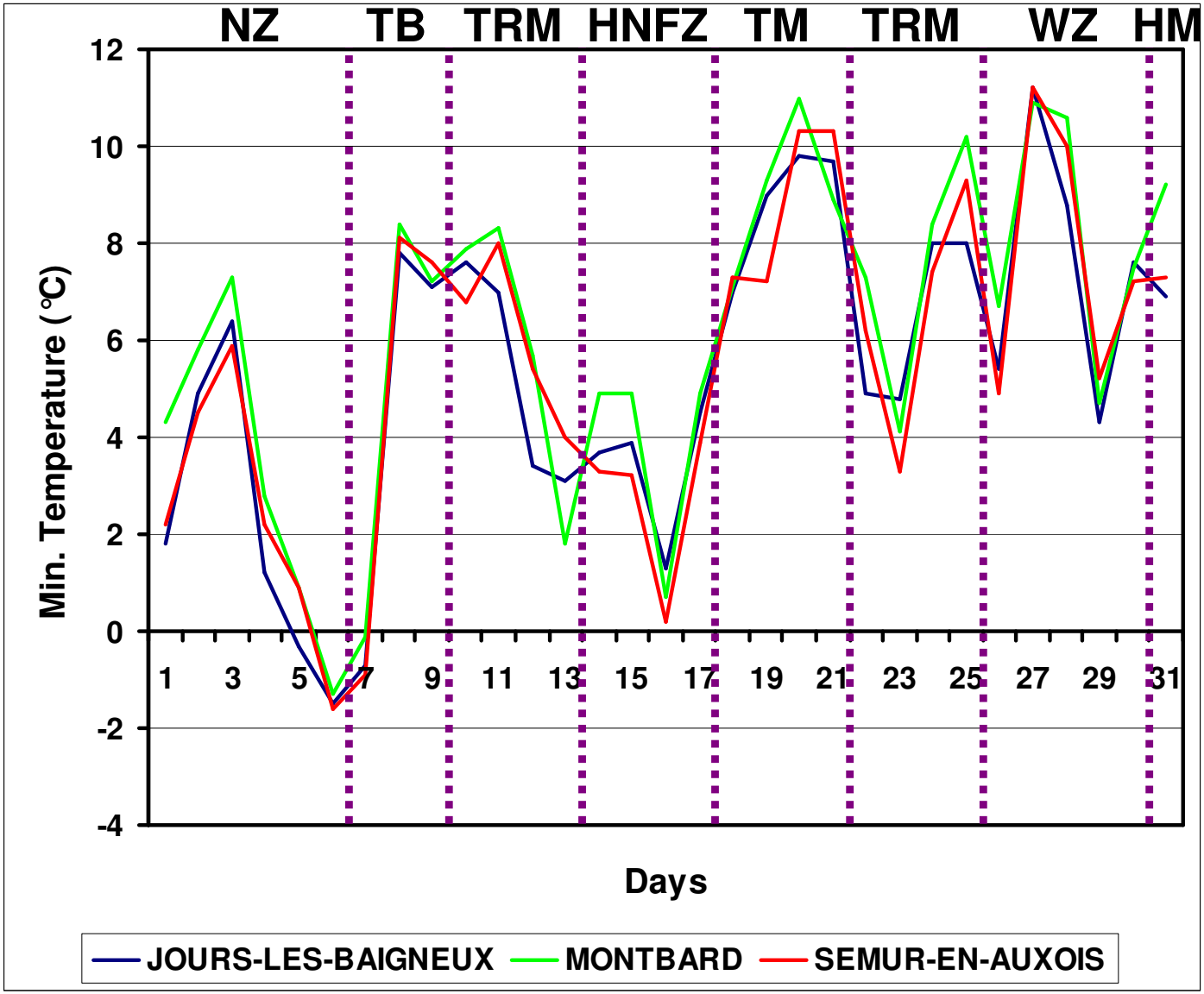
Main high/low pressure area over CENTRAL EUROPE:

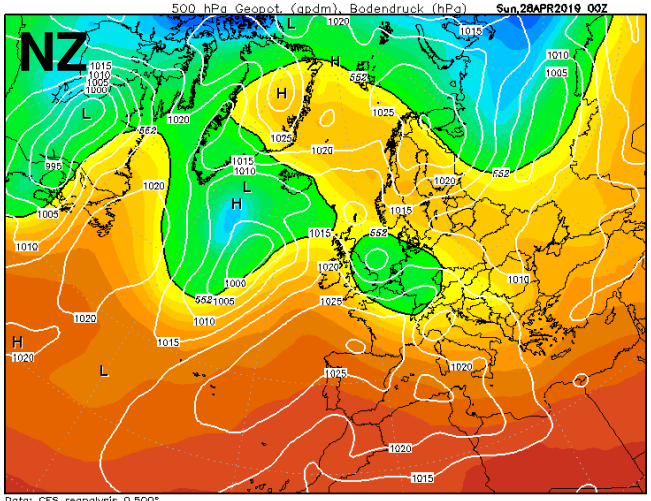
HM, BM, TM

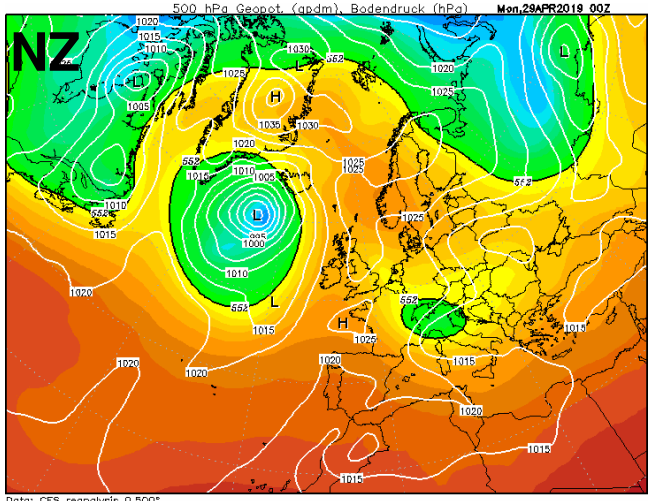
UNCLASSIFIED:

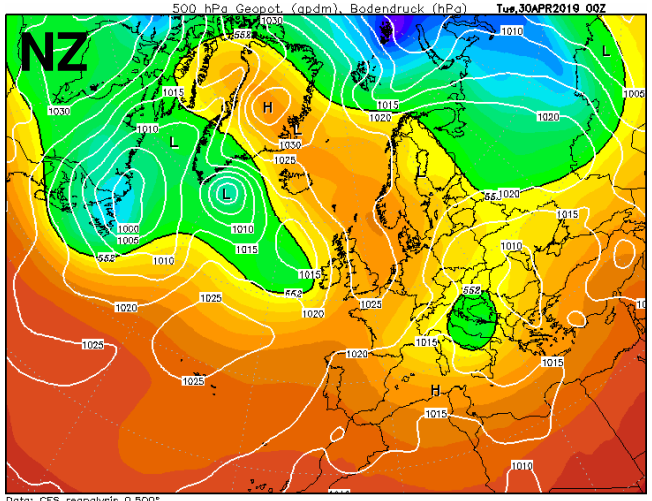
Unclas.

MAY 2019: DAILY MINIMUM TEMPERATURE

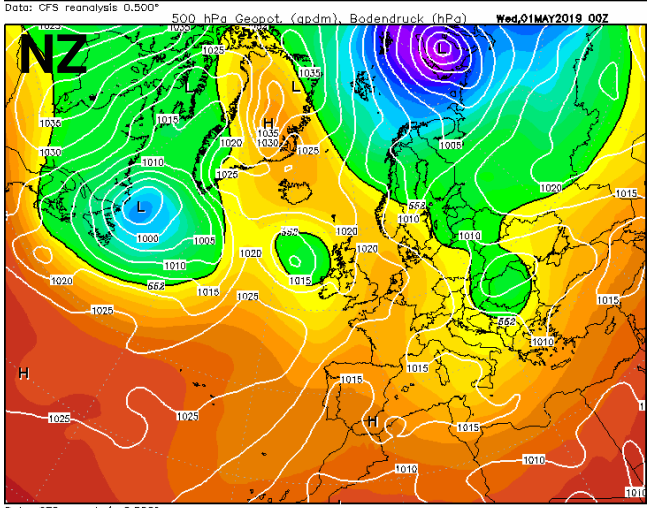


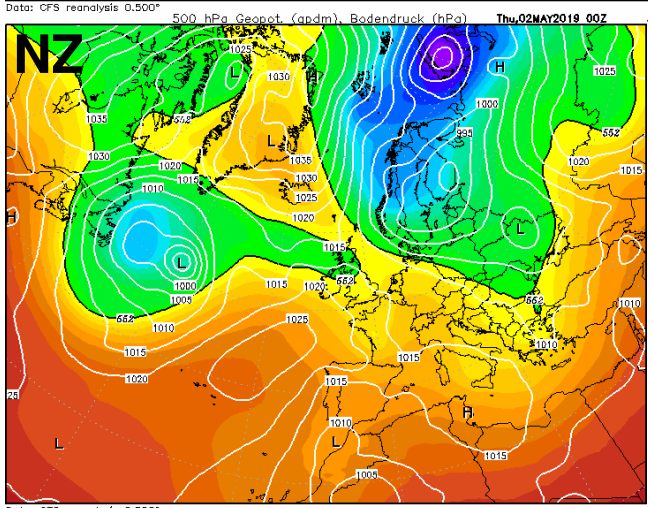


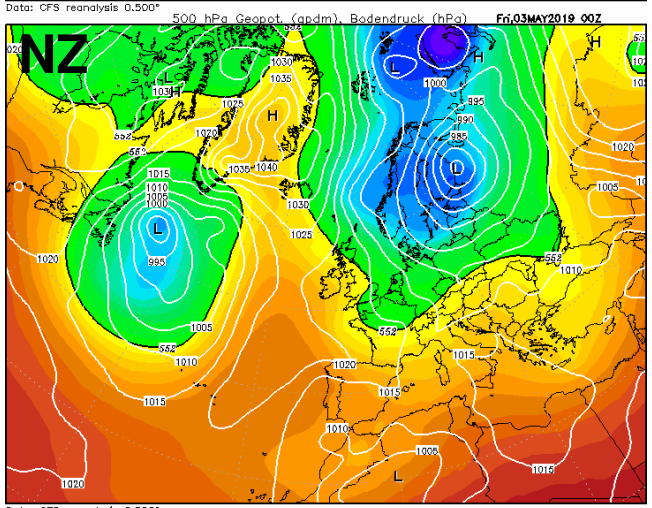




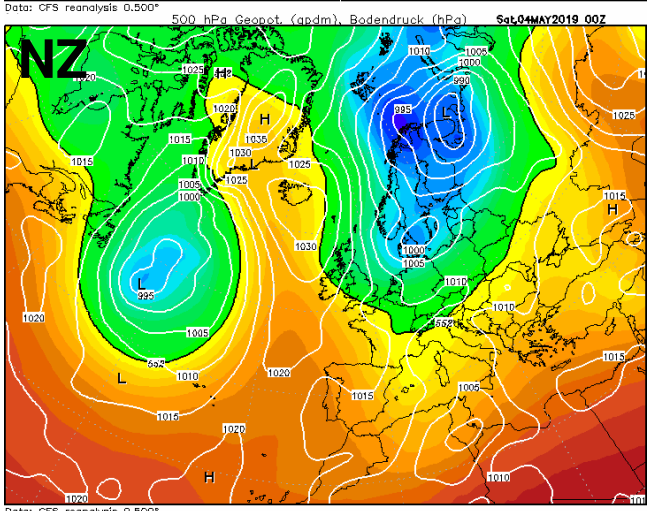
Data: CFS reanalysis 0.500°

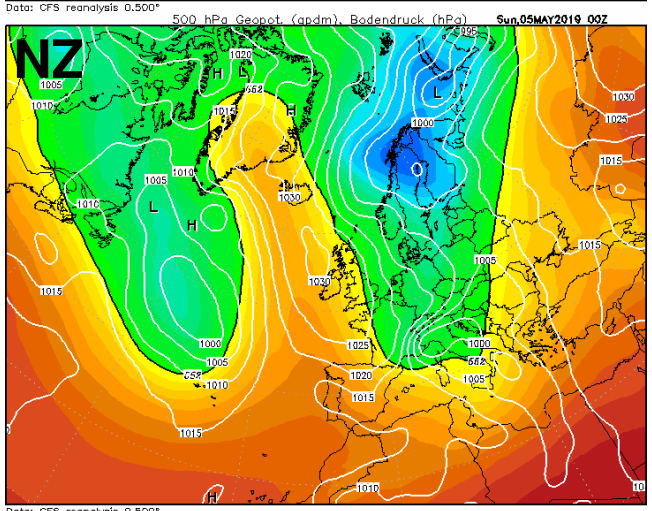


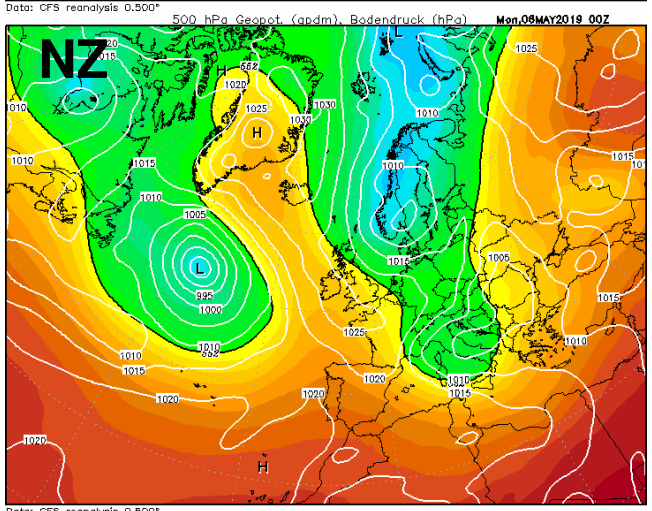




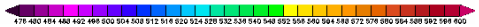
Data: CFS reanalysis 0.500°







Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de

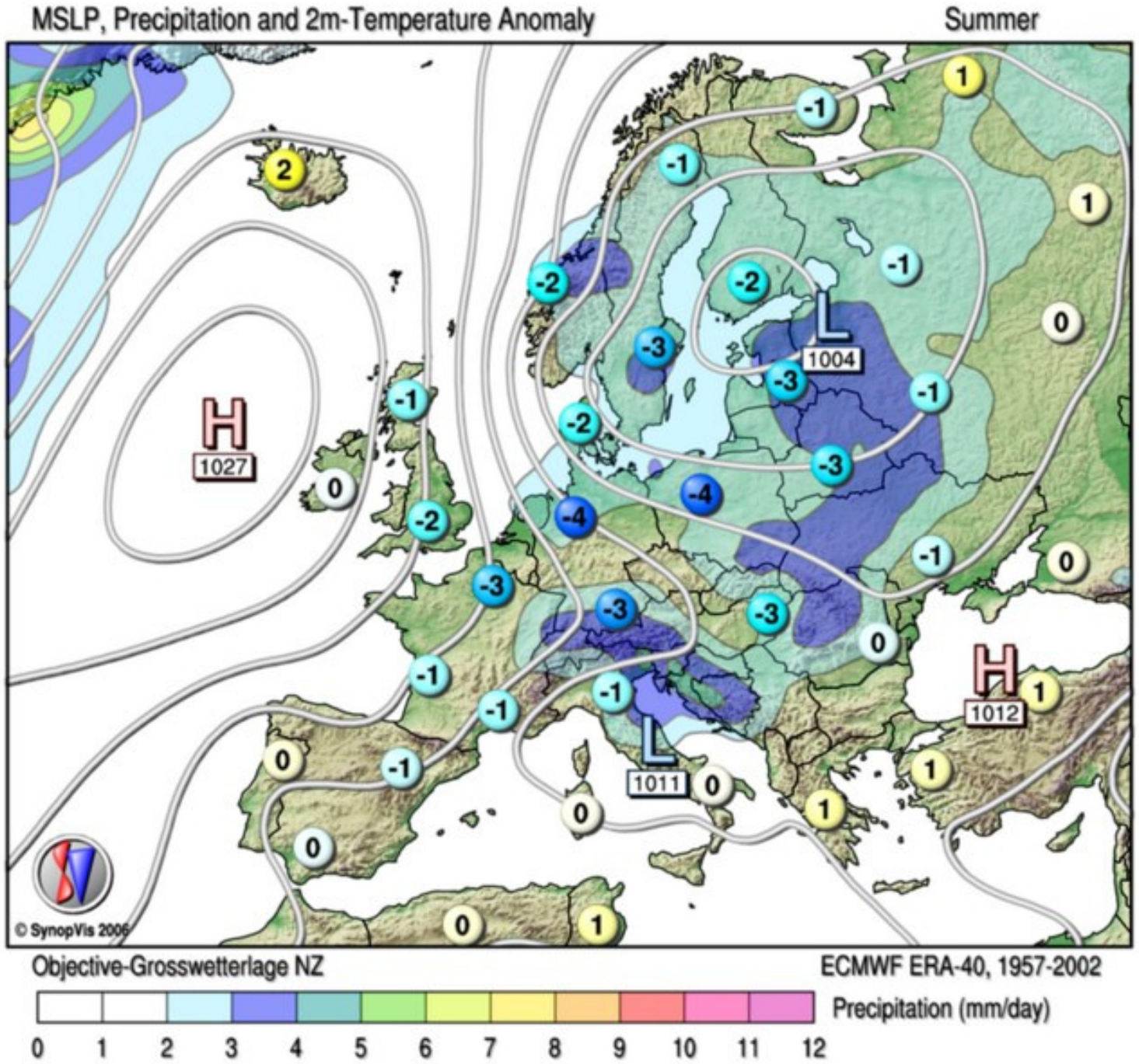


Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de



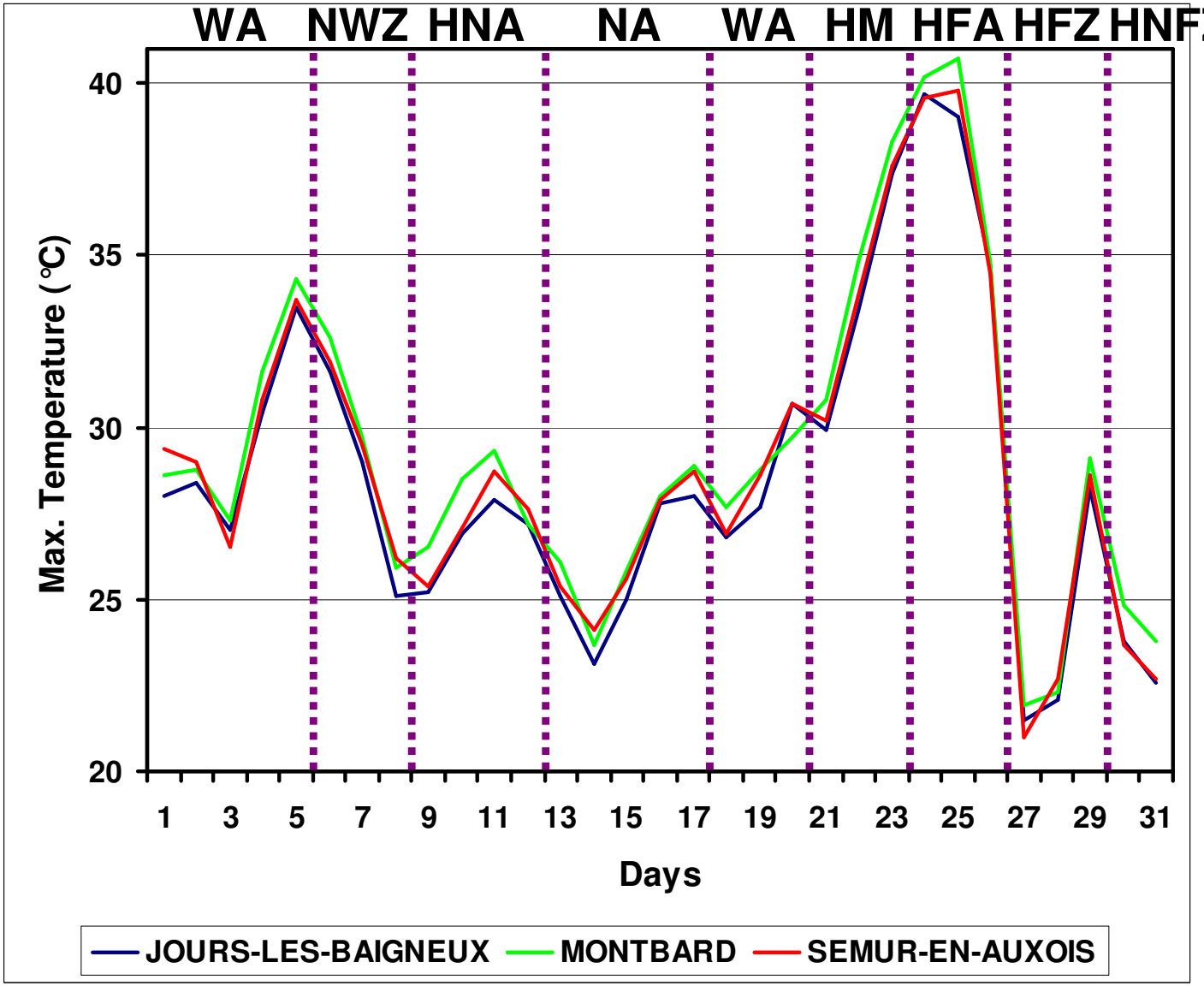
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(C) Wetterzentrale
www.wetterzentrale.de

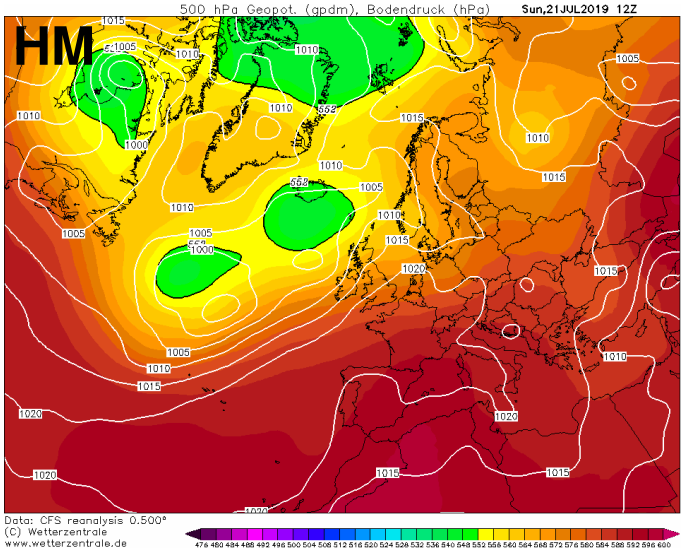


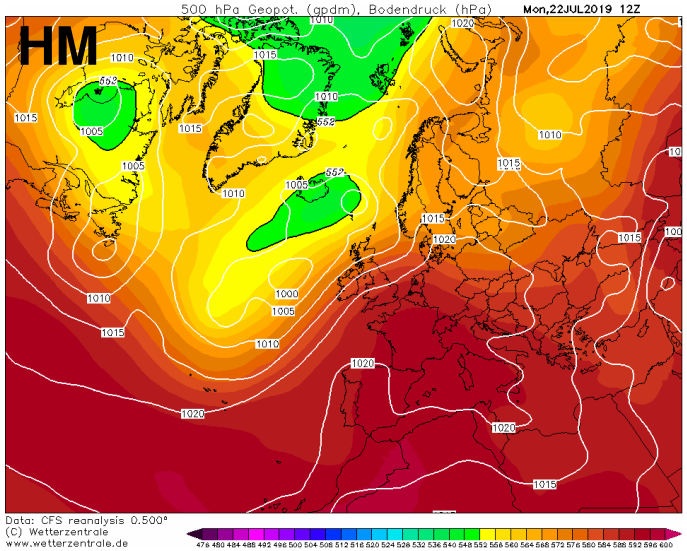


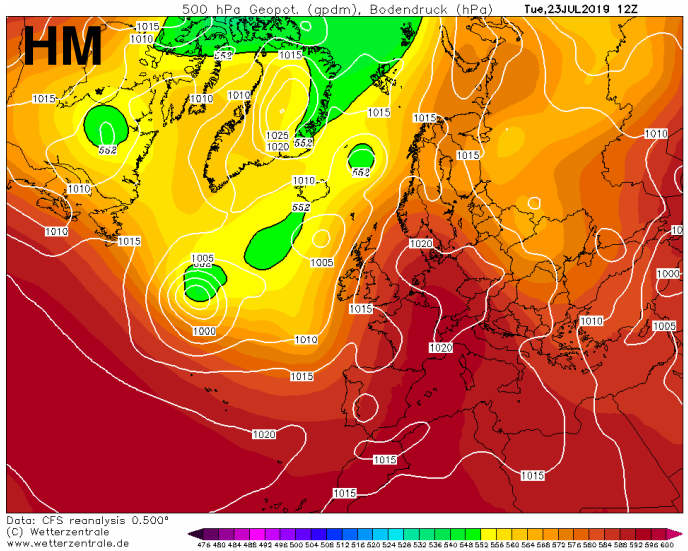
James, P.M. (2007): An objective classification for Hess and Brezowsky Grosswetterlagen over Europe. Theoretical and Applied Climatology 88, pp. 17-42.

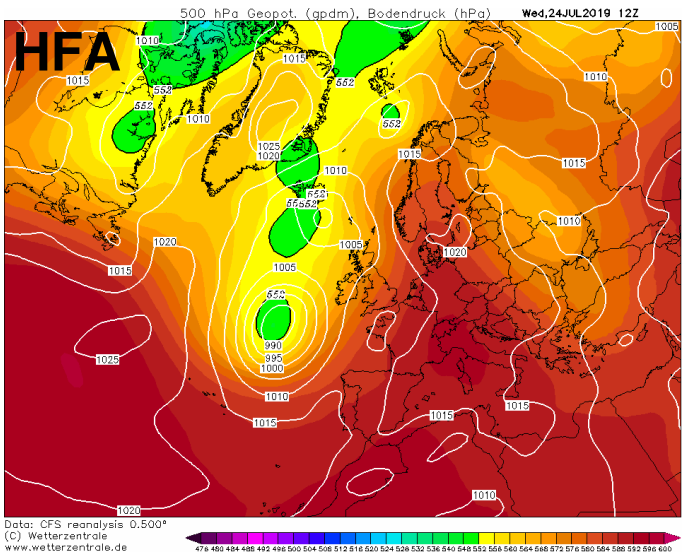
JULY 2019: DAILY MAXIMUM TEMPERATURE

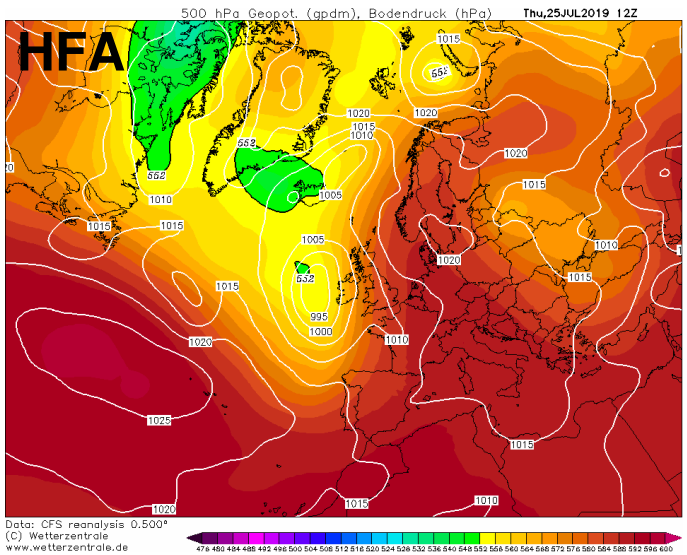


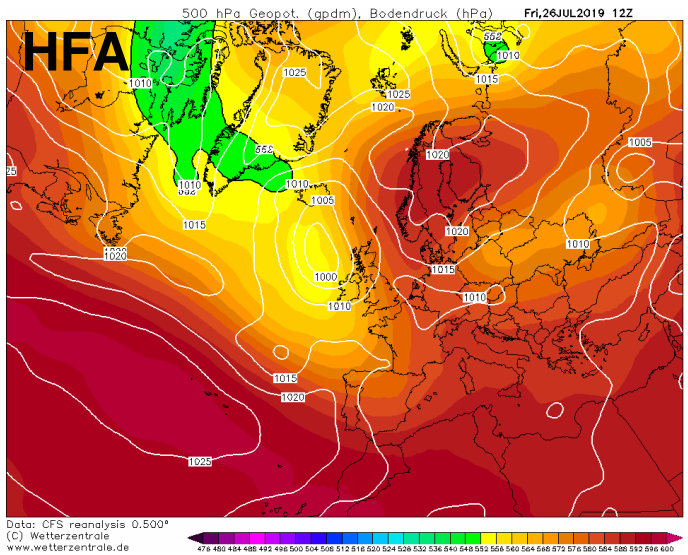

500 hPa Geopot. (gpdm), Bodendruck (hPa) Sun,21JUL2019 12Z
HM
Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de

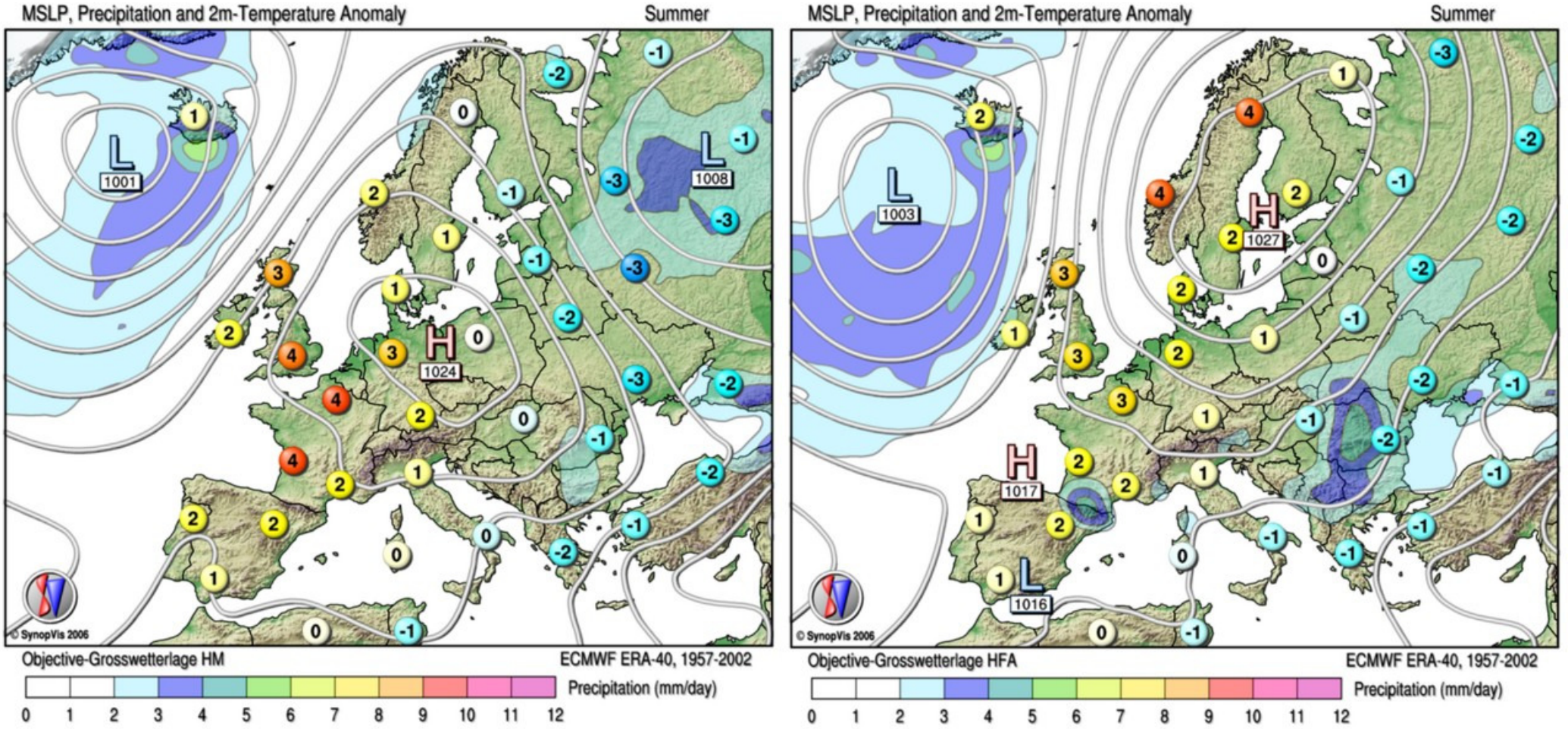

500 hPa Geopot. (gpdm), Bodendruck (hPa) Mon,22JUL2019 12Z
HM
Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de


500 hPa Geopot. (gpdm), Bodendruck (hPa) Tue,23JUL2019 12Z
HM
Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de


500 hPa Geopot. (gpdm), Bodendruck (hPa) Wed,24JUL2019 12Z
HFA
Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de

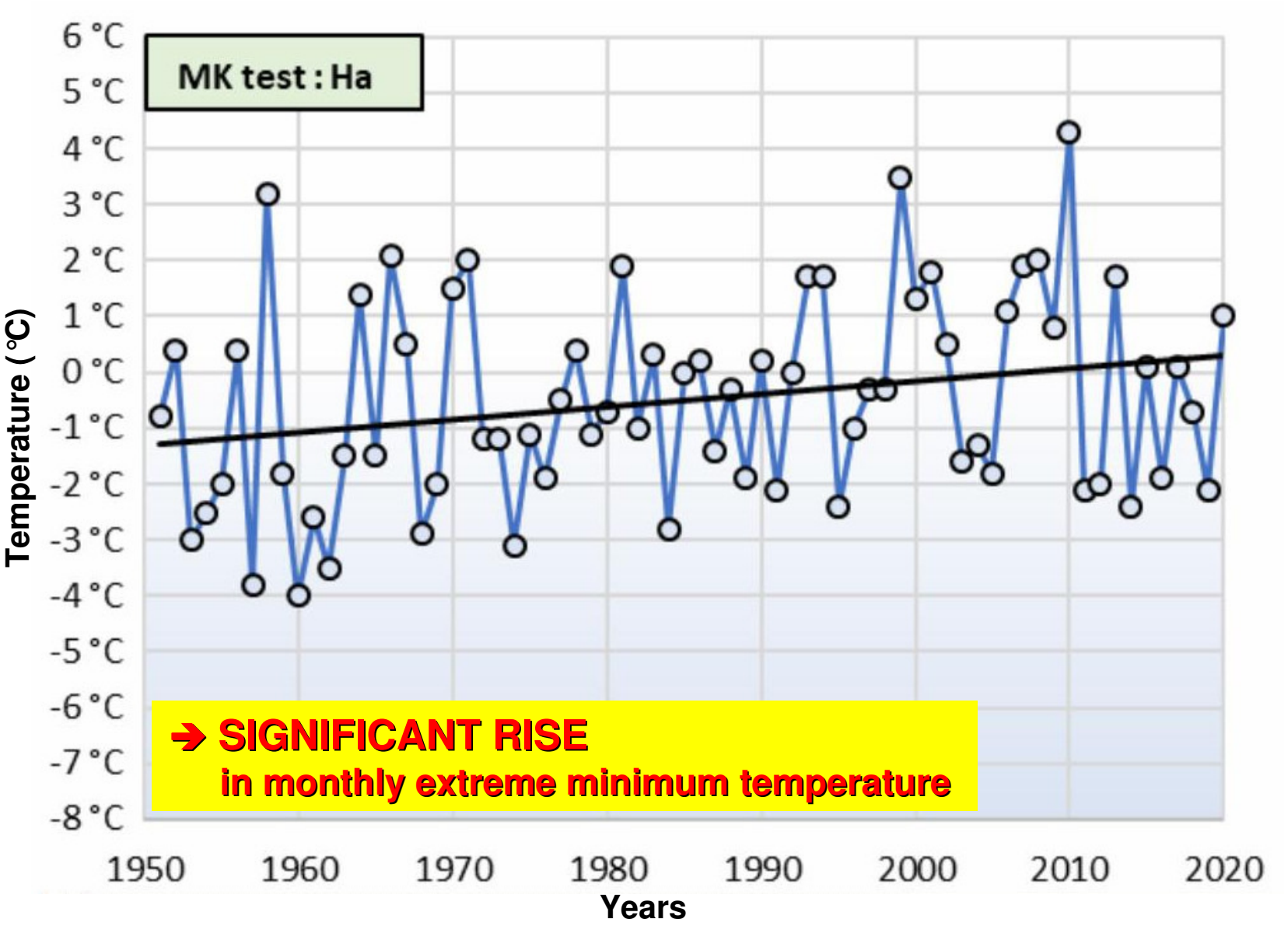

500 hPa Geopot. (gpdm), Bodendruck (hPa) Thu,25JUL2019 12Z
HFA
Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de


500 hPa Geopot. (gpdm), Bodendruck (hPa) Fri,26JUL2019 12Z
HFA
Data: CFS reanalysis 0.500°
(C) Wetterzentrale
www.wetterzentrale.de



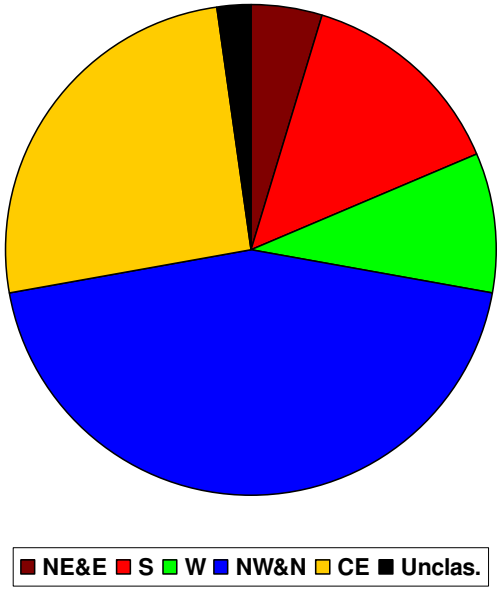
James, P.M. (2007): An objective classification for Hess and Brezowsky Grosswetterlagen over Europe. Theoretical and Applied Climatology 88, pp. 17-42.

CHÂTILLON-SUR-SEINE
Monthly extreme mininimum temperature: May 1951-2020

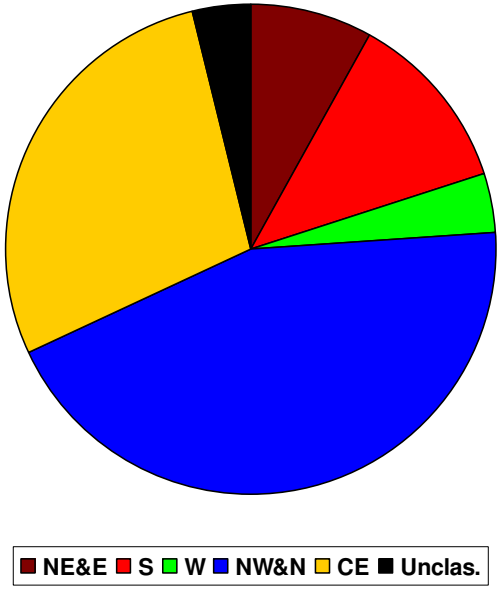


CHÂTILLON/SEINE: proportion of May extreme min. temp. ≤ 0°C for each Hess-Brezowsky major type

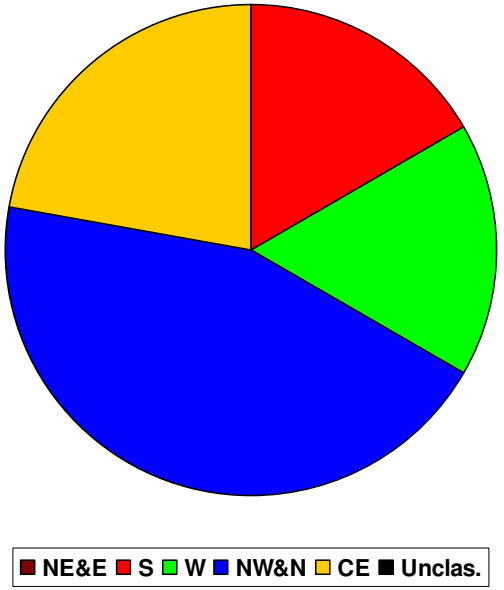
MAY 1951-2020



MAY 1951-1985

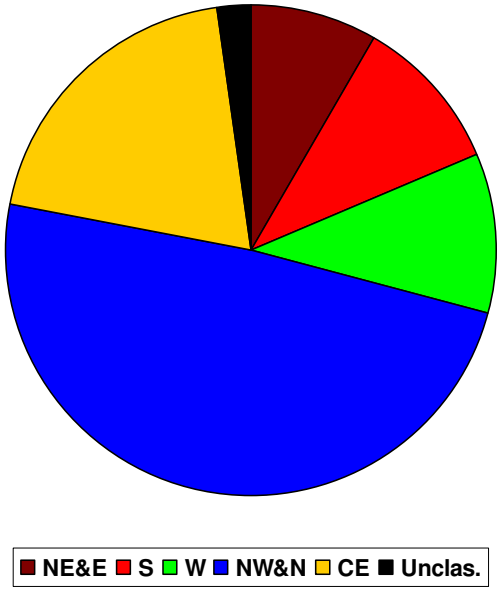


MAY 1986-2020

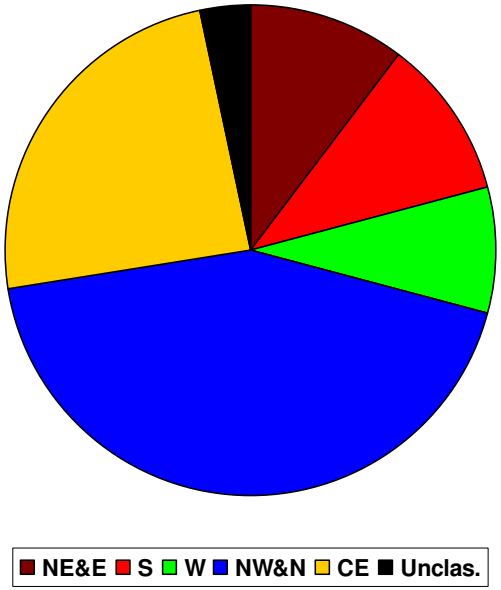


CHÂTILLON-SUR-SEINE: proportion of May frost days for each Hess-Brezowsky major type

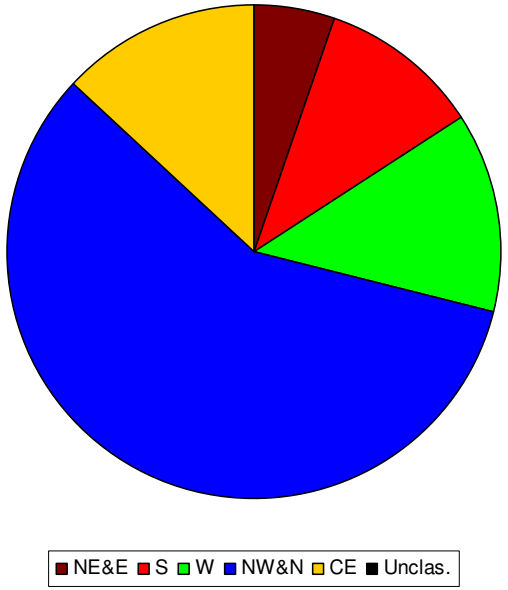
MAY 1951-2020



MAY 1951-1985



MAY 1986-2020



CHÂTILLON-SUR-SEINE (1951-2020): Number of days with maximum temperature ≥ 40°C and Hess-Brezowsky circulation types associated with the heat waves

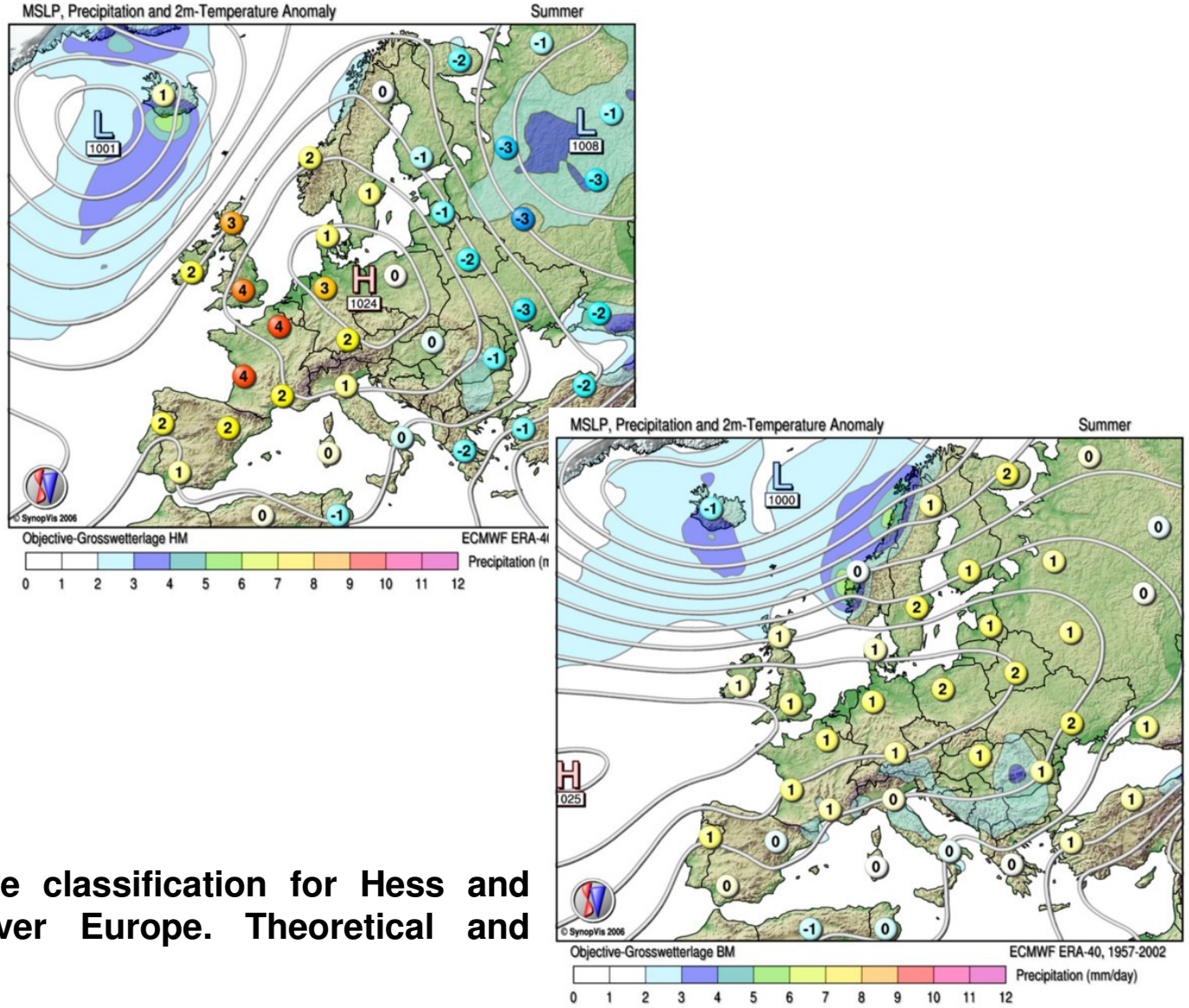
1983: 1 (07/28-31: BM)

2003: 4 (07/22-08/04: BM)
(08/05-13: HNA)

2012: 1 (08/16-18: HM)
(08/19-26: WZ)

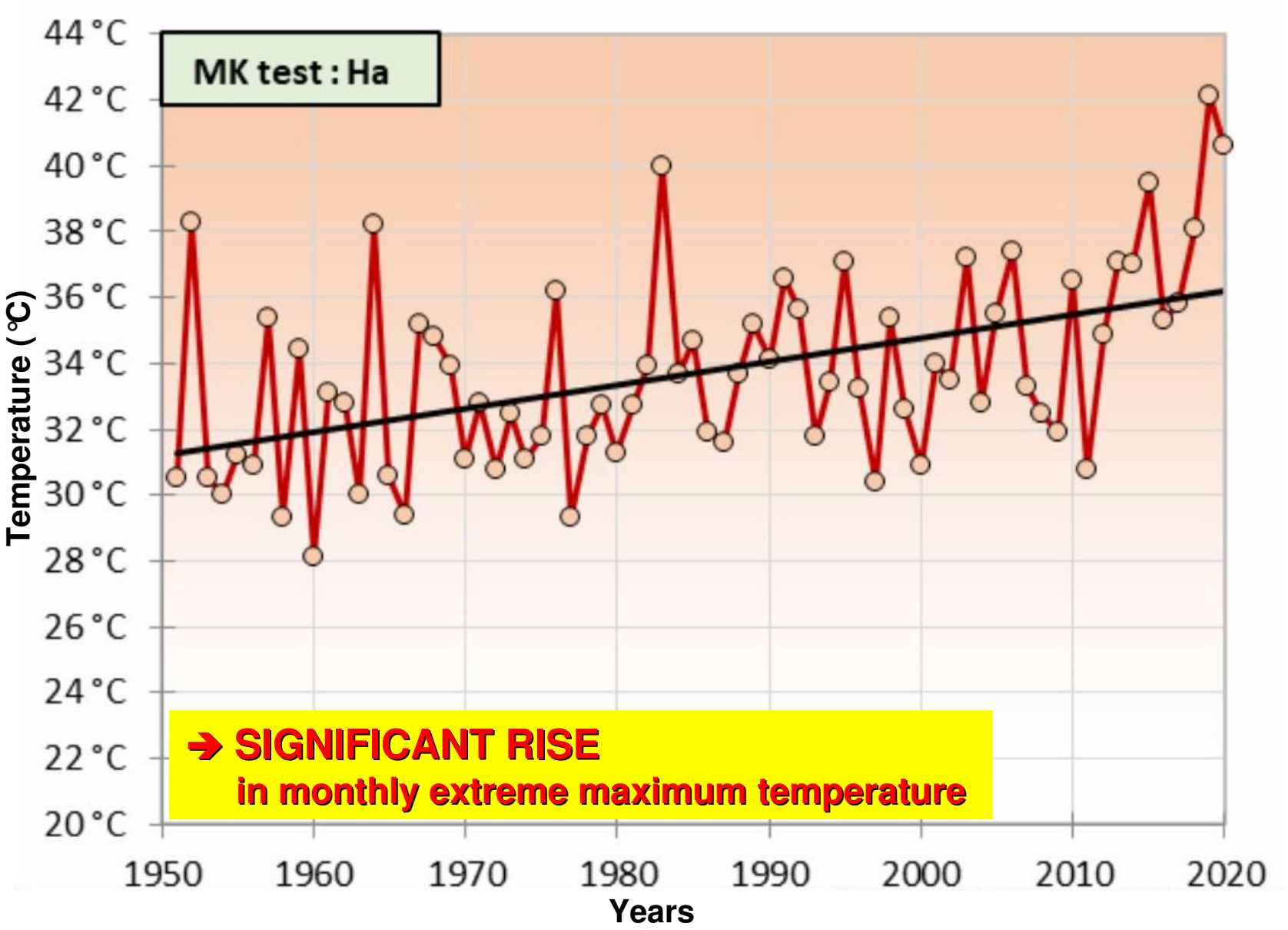
2019: 2 (07/21-23: HM)
(07/24-26: HFA)

2020: 1 (07/29-31: HM)



James, P.M. (2007): An objective classification for Hess and Brezowsky Grosswetterlagen over Europe. Theoretical and Applied Climatology 88, pp. 17-42.

CHÂTILLON-SUR-SEINE
Monthly extreme maximum temperature: July 1951-2020



FURTHER STUDIES

Damage to vegetation was uneven within each site. These observations rise up the question of the influence of very fine-scale environmental conditions and the impact they might have on the different vegetative growth stages.

The variation in physiological response among grape varieties and its effect on their sensitivity to the occurrence of different weather hazards will need to be considered.





ACKNOWLEDGEMENTS

Loïc **AUBRY** (Précy-sous-Thil)
Christiane **GUYOT** (Pouillenay)
Bernard **HAIGRE** (Villaines-les-Prévôtes)
Marianne **PLANCHON** (Montbard)

…And the vine-growers of Alise-Sainte-Reine, who have shown us their interest in this work !