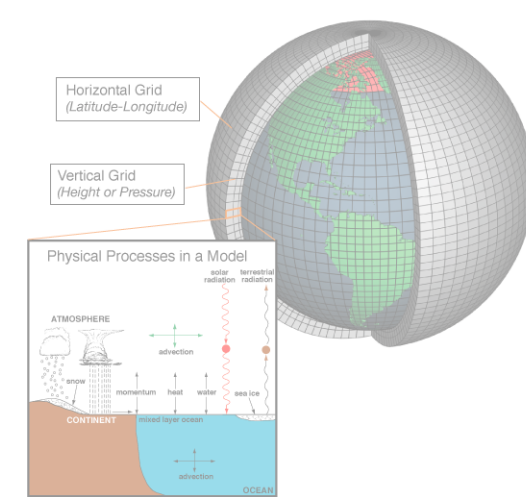



  
**Forum Météo & Viticulture Cognac**
  
*Maladies, ravageurs et modélisation*
  
**Lundi 26 janvier 2026 | 15h30**
  
 Espace Edmond & James Grégoire
   
 Grégoire Cognac, Châteaubernard



# Changement climatique dans le bassin de Cognac : gel, stress thermique et déficit hydrique

Sébastien ZITO – [sebastien.zito@inrae.fr](mailto:sebastien.zito@inrae.fr)

1

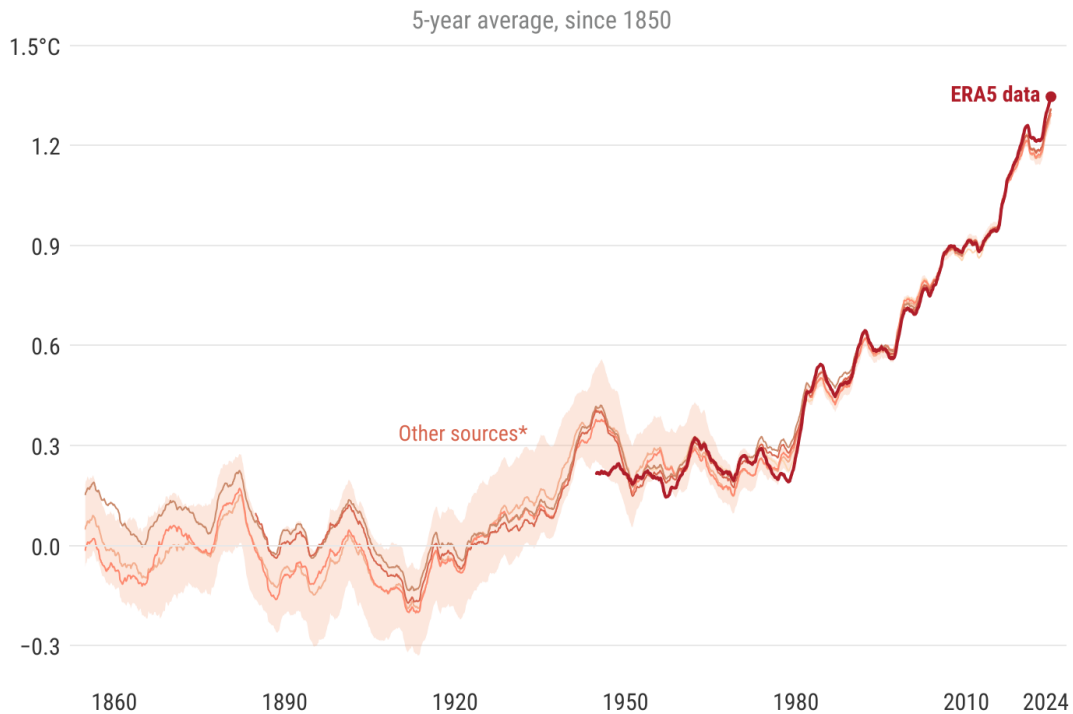


# Contexte du changement climatique - changements observés - Mondial



## Global surface temperature: increase above pre-industrial

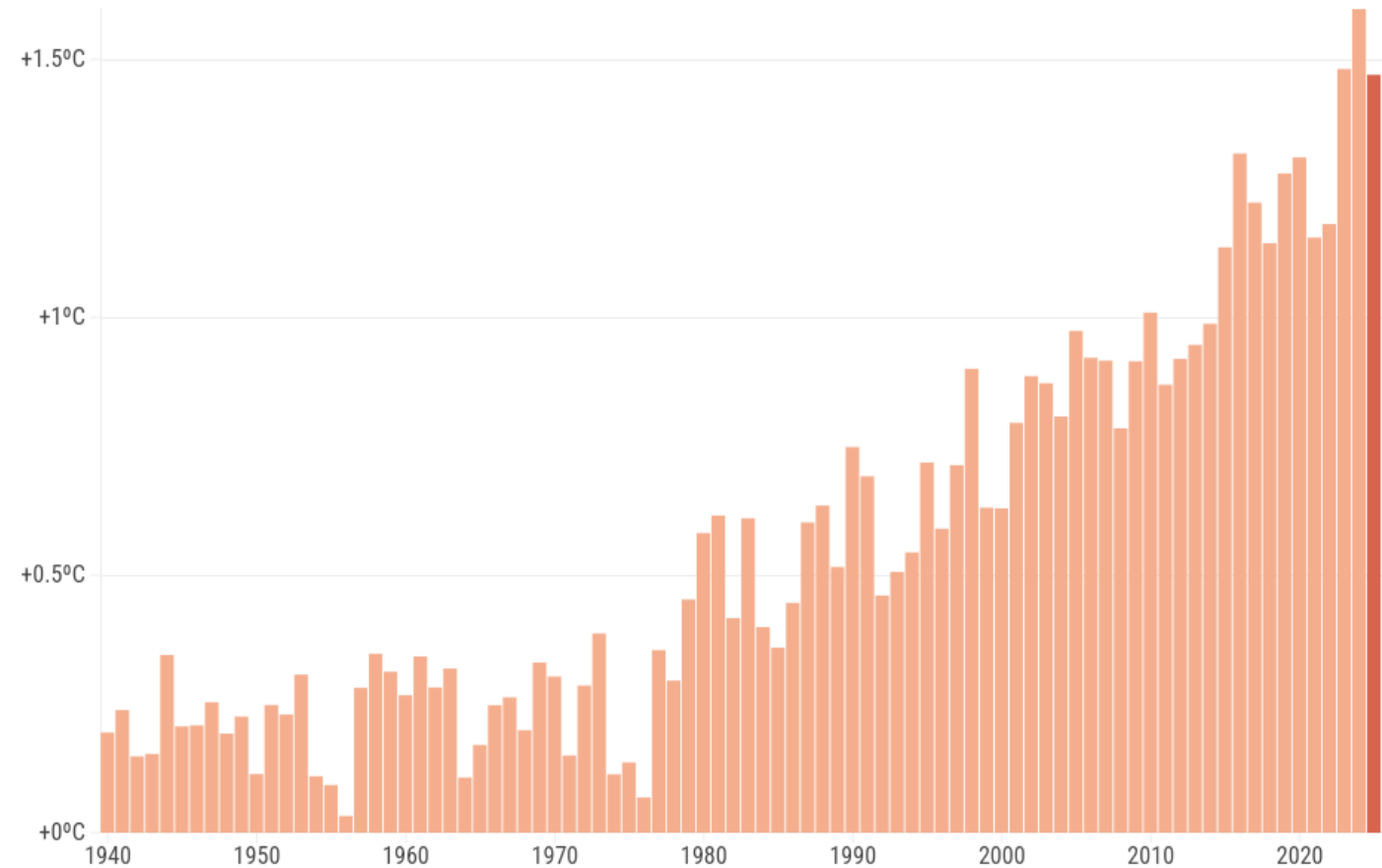
Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF



\*Other sources comprise JRA-3Q, GISTEMPv4, NOAA GlobalTempv6, Berkeley Earth and the HadCRUT5 ensemble mean. Shading shows the range of the HadCRUT5 ensemble.



## Global annual surface air temperature anomalies

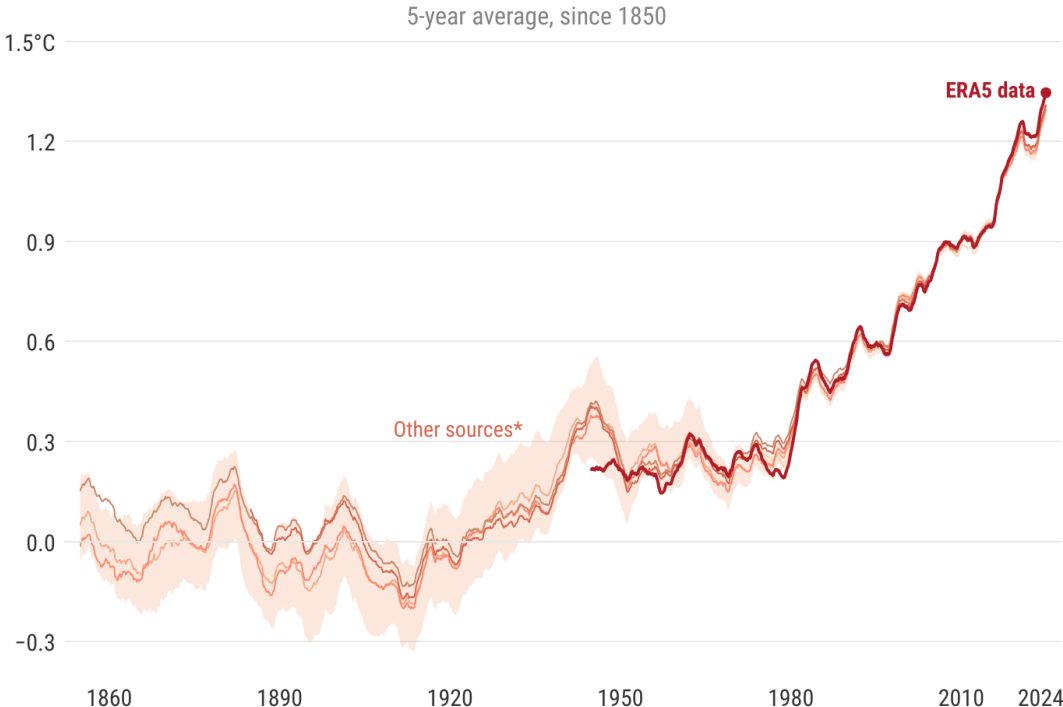


Data source: ERA5 • Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF

# Contexte du changement climatique - changements observés - Mondial

## Global surface temperature: increase above pre-industrial

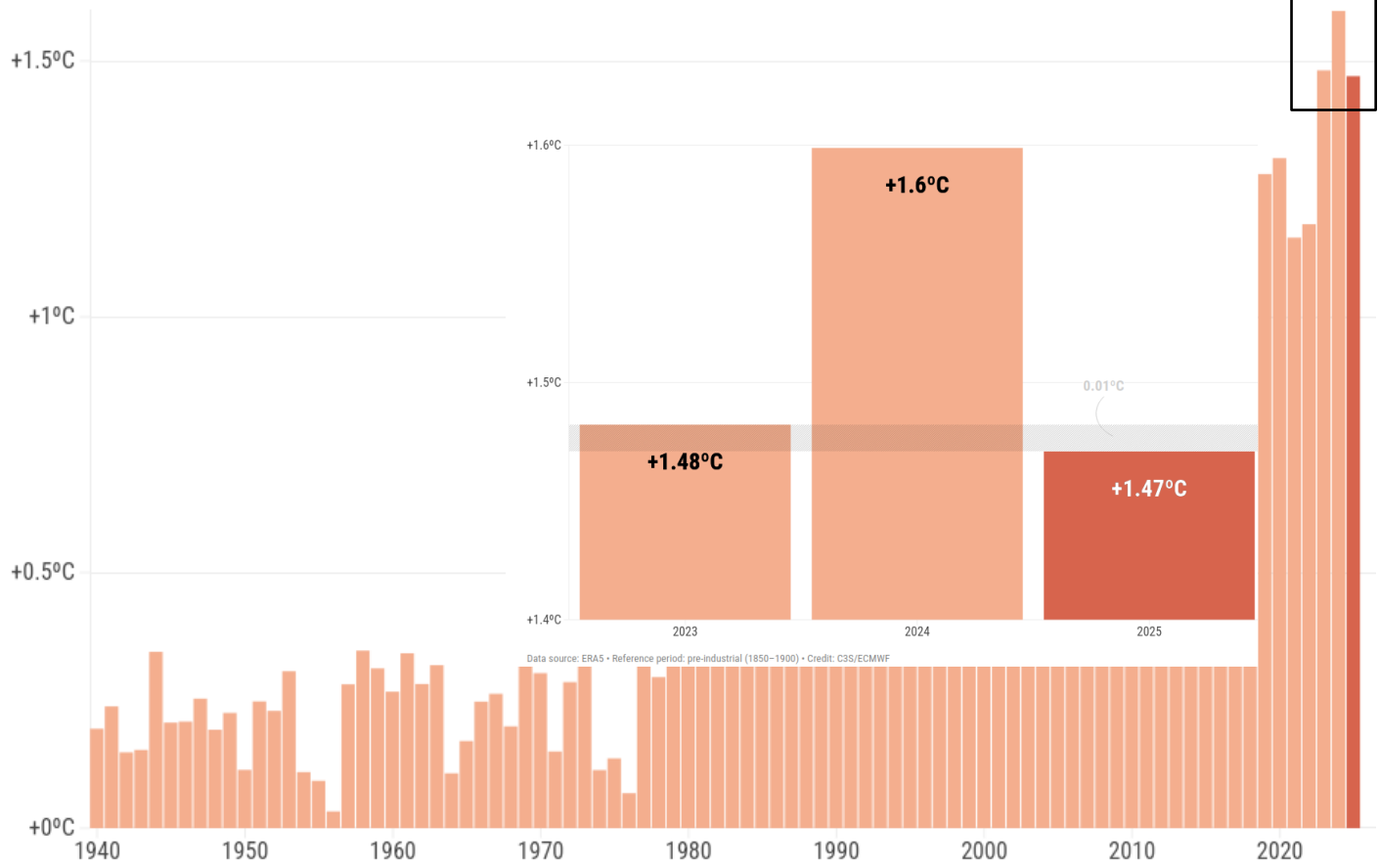
Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF



\*Other sources comprise JRA-3Q, GISTEMPv4, NOAA GlobalTempv6, Berkeley Earth and the HadCRUT5 ensemble mean. Shading shows the range of the HadCRUT5 ensemble.



## Global annual surface air temperature anomalies

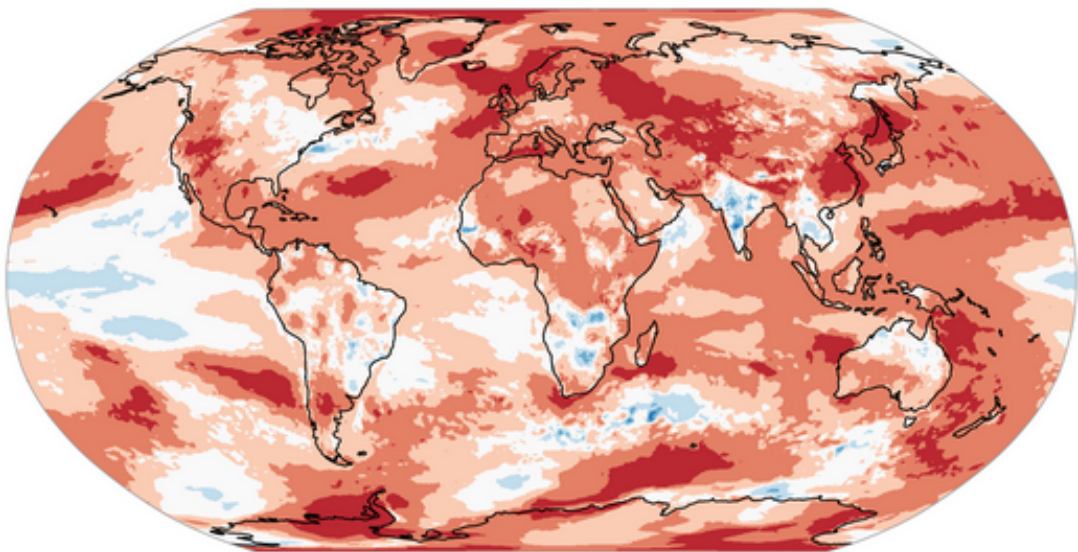


Data source: ERA5 • Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF

# Contexte du changement climatique - changements observés - Mondial

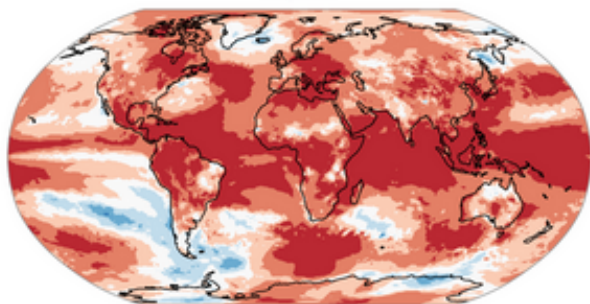
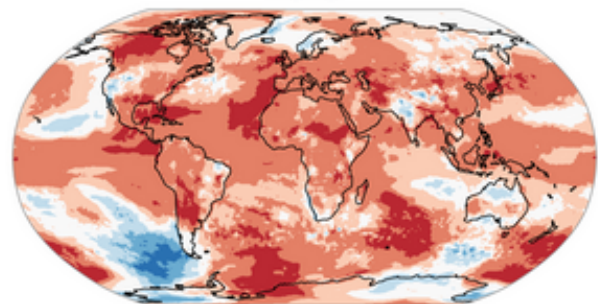
## Anomalies and extremes in surface air temperature

2025

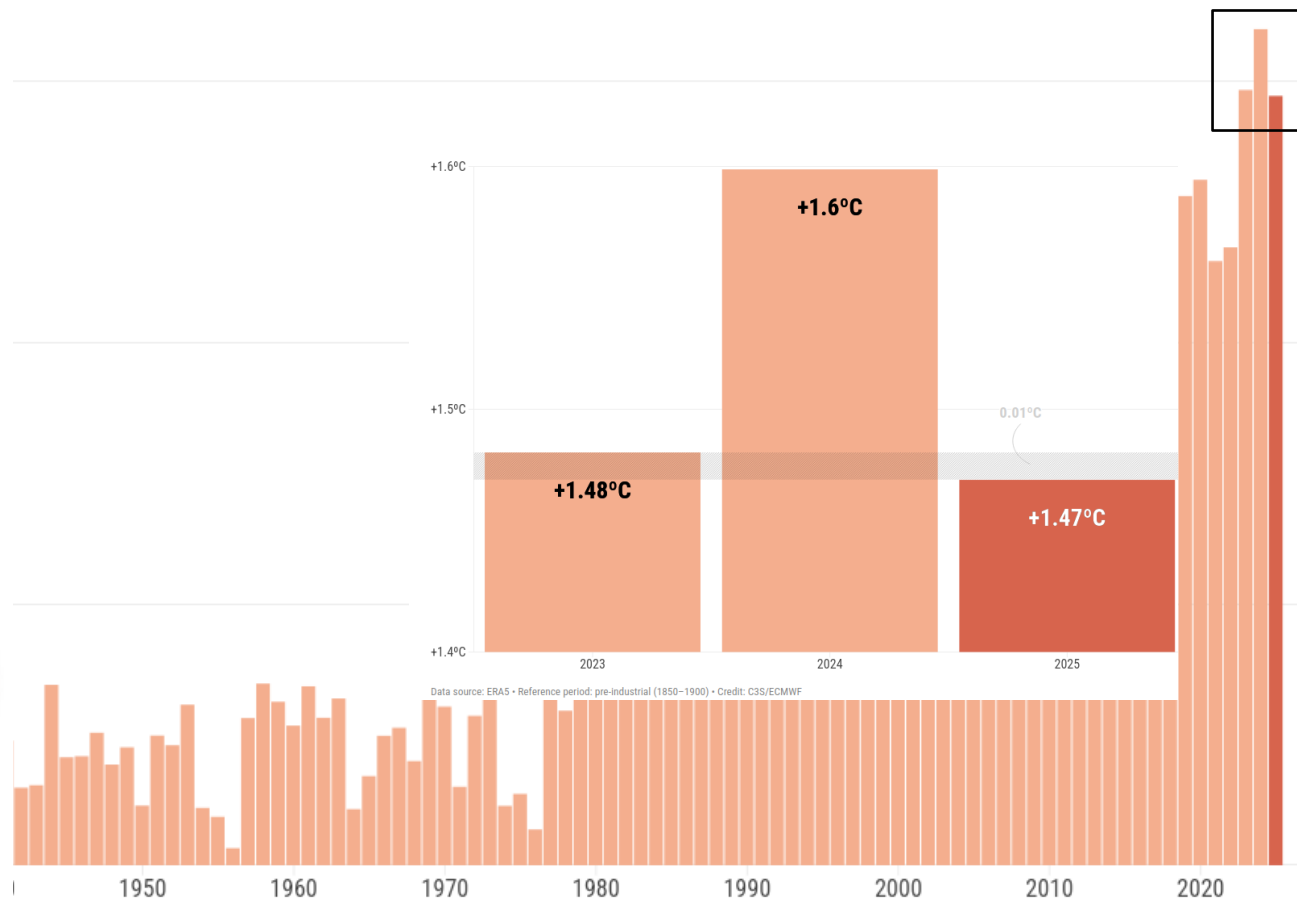


2023

2024



## Global annual surface air temperature anomalies



ERA5 • Reference period: pre-industrial (1850–1900) • Credit: C3S/ECMWF

Data: ERA5 1979–2025 • Reference period: 1991–2020 • Credit: C3S/ECMWF



PROGRAMME OF THE EUROPEAN UNION

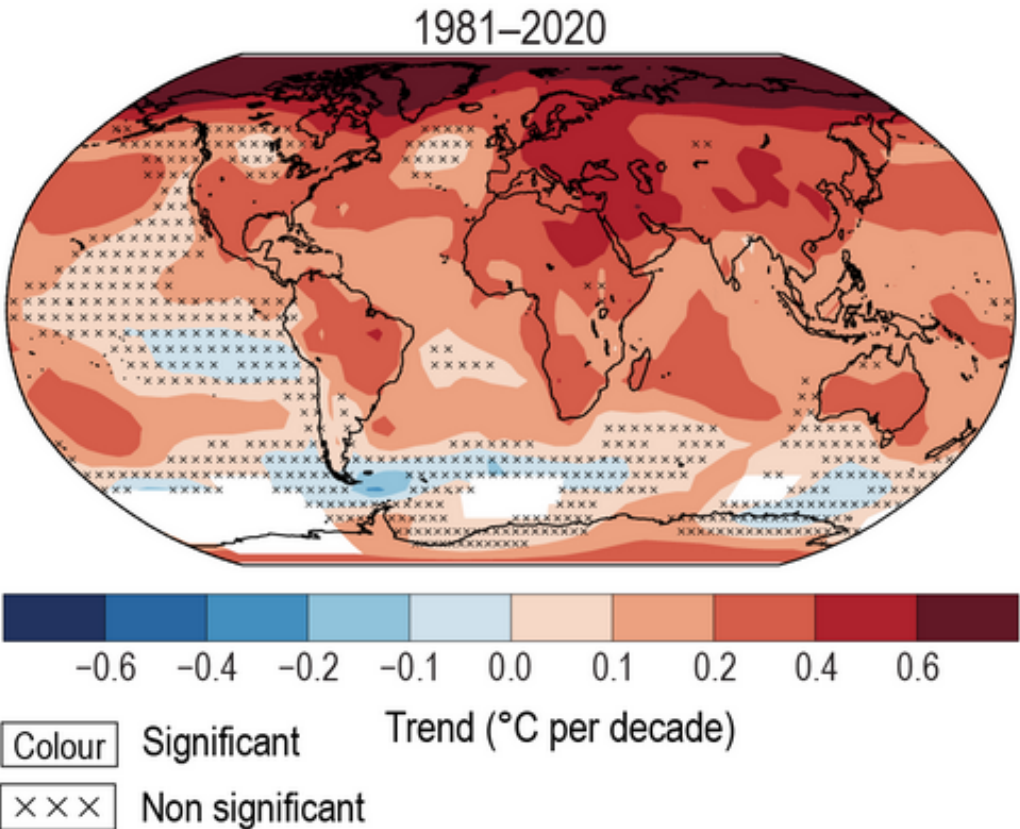


IMPLEMENTED BY



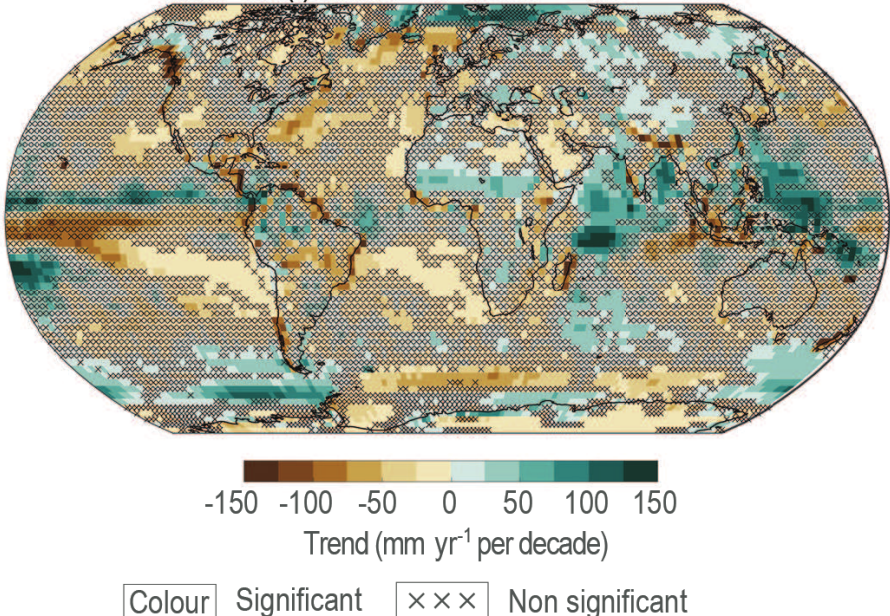
# Contexte du changement climatique - changements observés - Mondial

Distribution spatiale du changement de la température



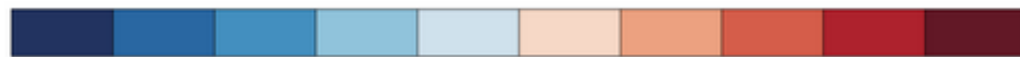
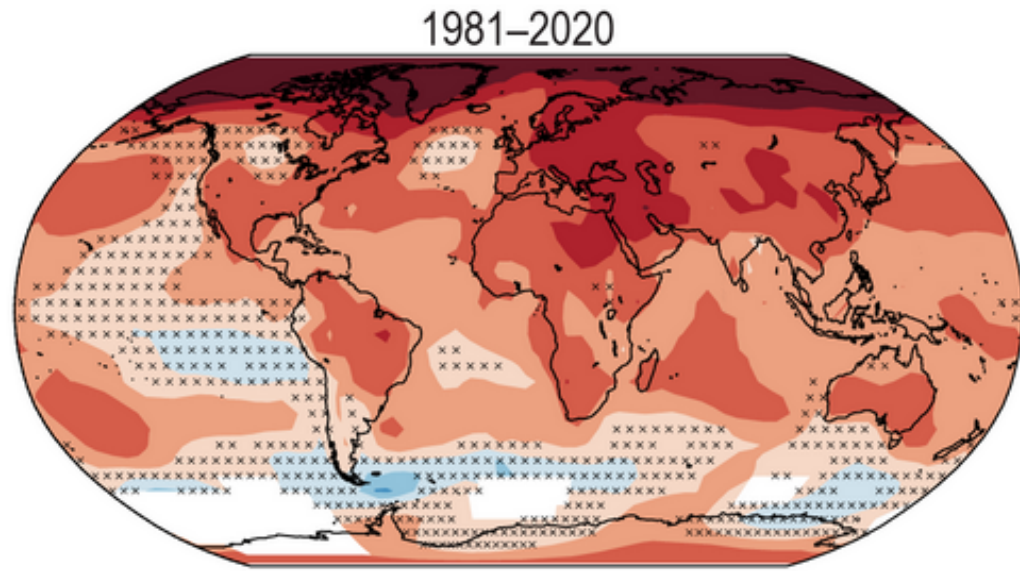
Distribution spatiale du changement de la pluviométrie

(f) GPCP V2.3 1980-2019



# Contexte du changement climatique - changements observés - Mondial

Distribution spatiale du changement de la température



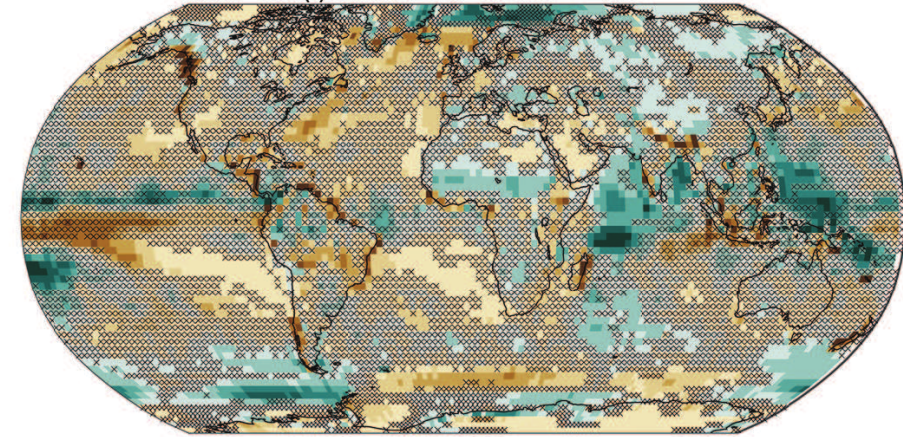
-0.6 -0.4 -0.2 -0.1 0.0 0.1 0.2 0.4 0.6

Colour Significant Trend (°C per decade)

××× Non significant

Distribution spatiale du changement de la pluviométrie

(f) GPCP V2.3 1980-2019



-150 -100 -50 0 50 100 150

Trend (mm yr<sup>-1</sup> per decade)

Colour Significant ××× Non significant

Augmentation des extrêmes



Chaleur extrême

Plus fréquente  
Plus intense

Fortes précipitations

Plus fréquentes  
Plus intenses

Sécheresse

Augmentation dans  
certaines régions

Conditions  
météorologiques  
propices aux  
incendies

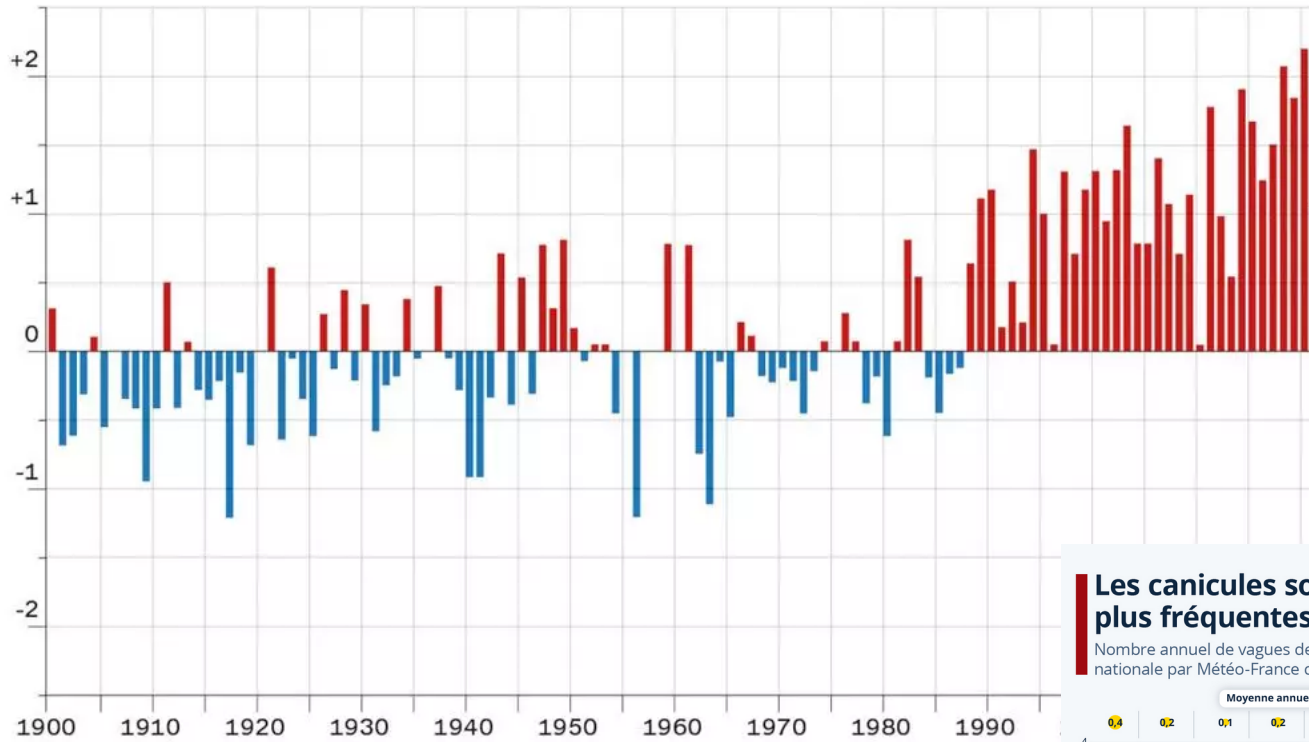
Plus fréquentes

Océan

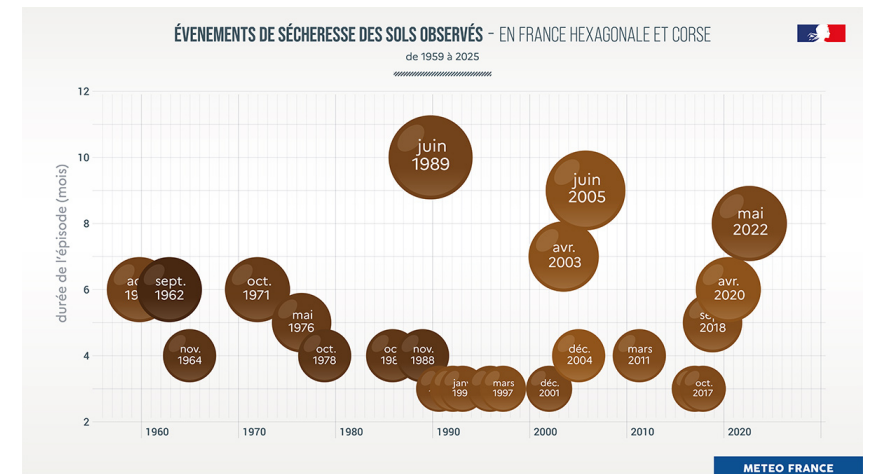
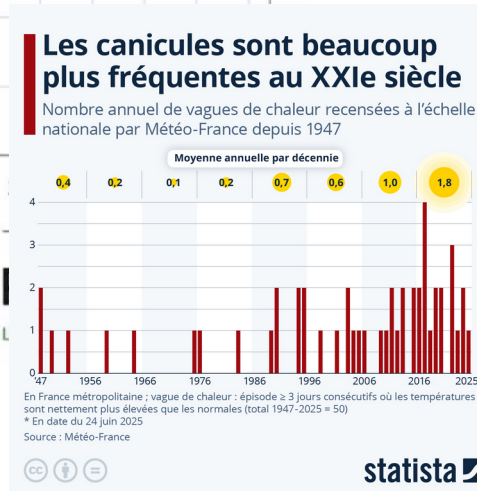
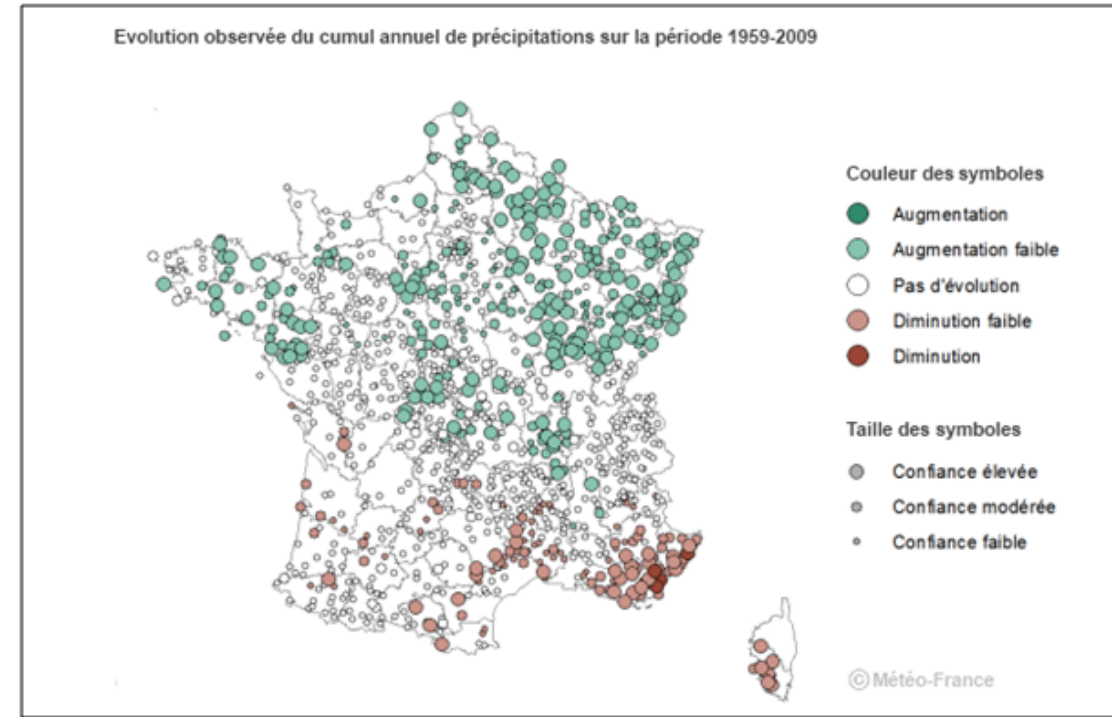
Réchauffement  
Acidification  
Perte d'oxygène  
Montée des mers

# Contexte du changement climatique - changements observés - France

Evolution de la température moyenne annuelle en France (normales 1961-1990)

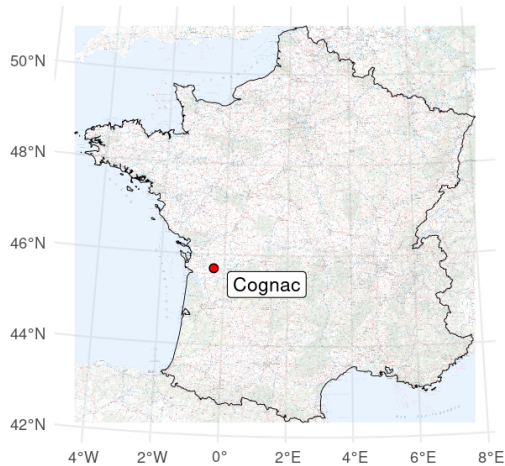


Source : ministère de la Transition écologique et de la Cohésion des territoires  
<https://www.ecologie.gouv.fr/impacts-du-changement-climatique-atmosphere-temperatures-et-precipitations>



# Contexte du changement climatique - changements observés - Cognac

Données issues de la station Météo-France de Cognac (1955-2025)

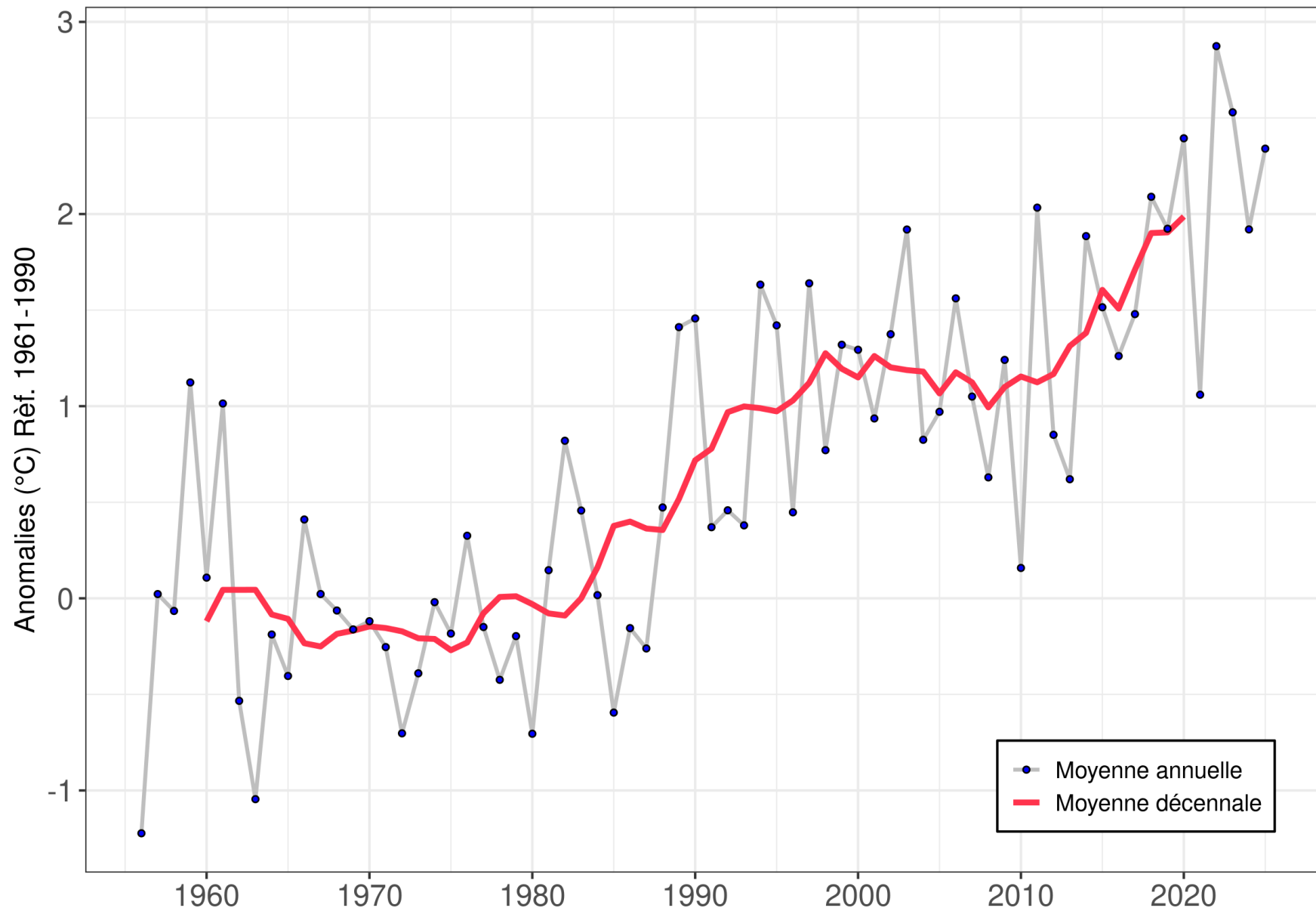


Augmentation significative de la température annuelle

**+0,36°C/10 ans**

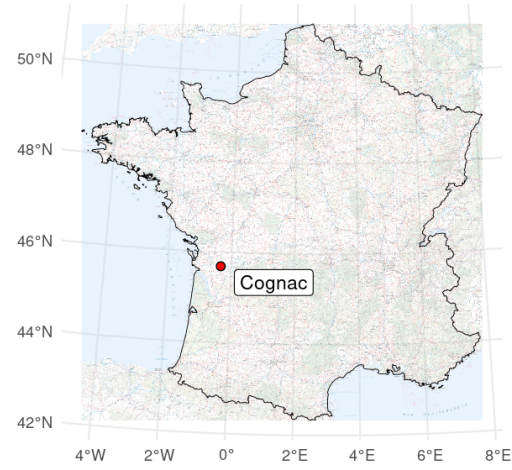
VS

**+0,17°C/10 ans (échelle globale)**

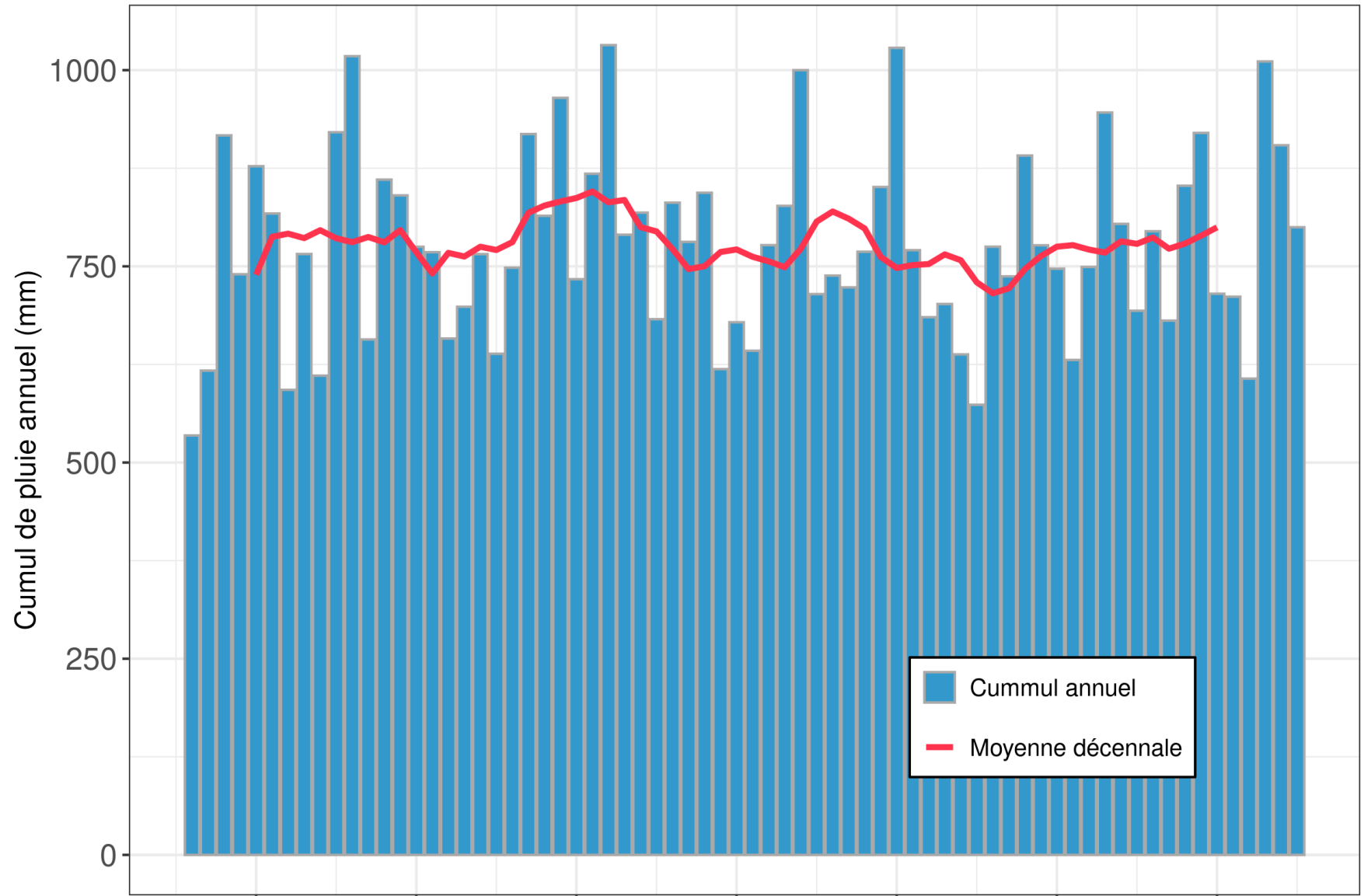


# Contexte du changement climatique - changements observés - Cognac

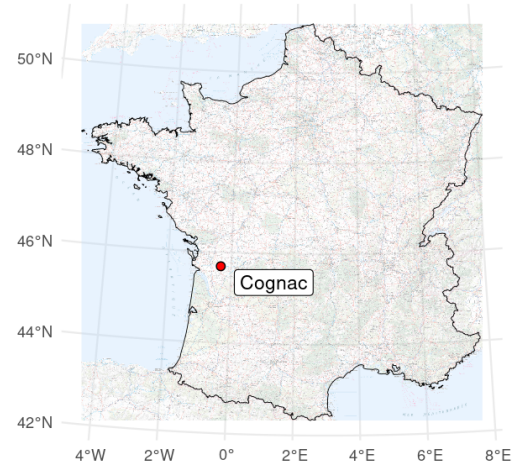
Données issues de la station Météo-France de Cognac (1955-2025)



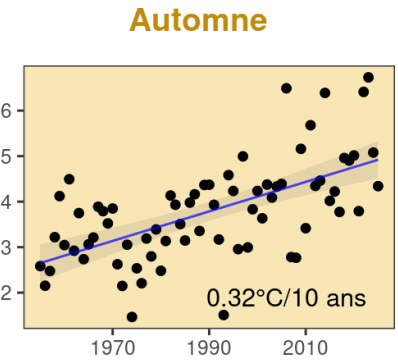
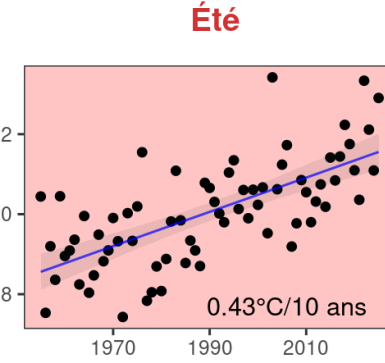
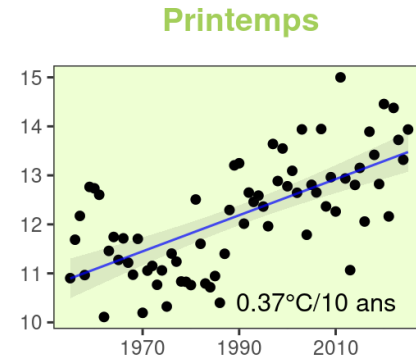
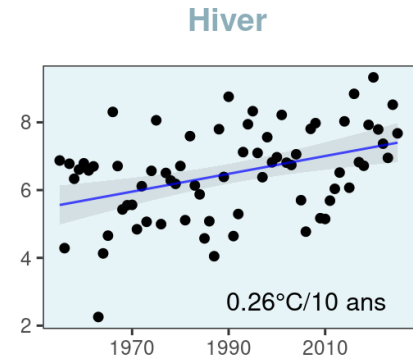
Pas d'évolution significative du cumul de pluie annuel



# Contexte du changement climatique - changements observés - Cognac

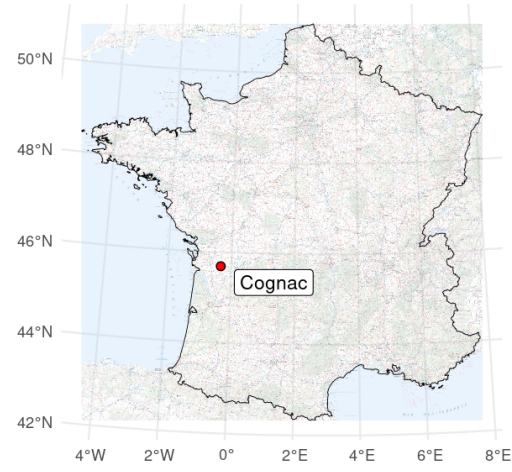


Température  
moyenne



I

# Contexte du changement climatique - changements observés - Cognac



Température moyenne

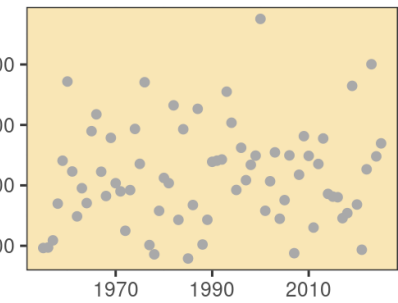
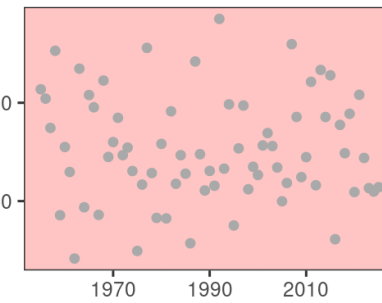
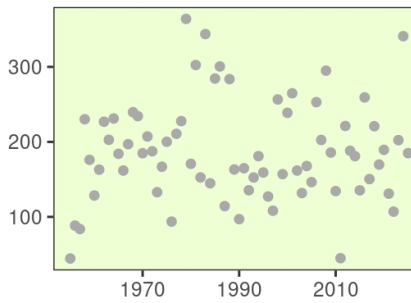
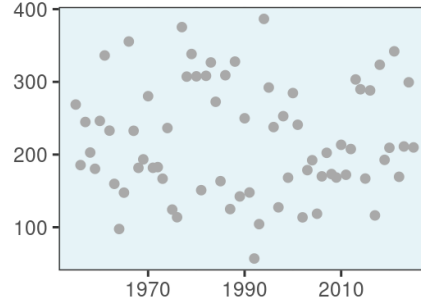
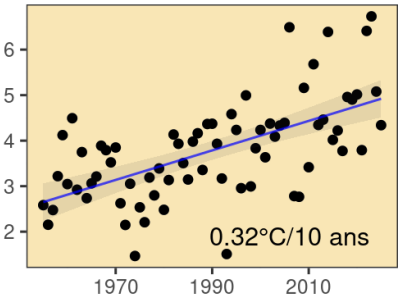
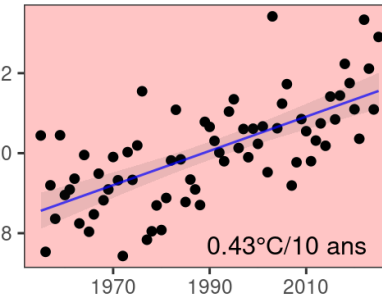
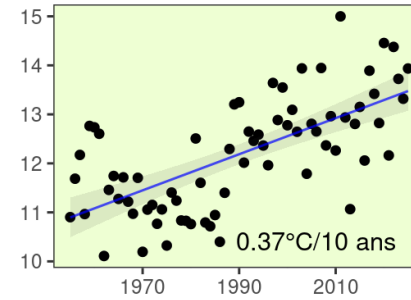
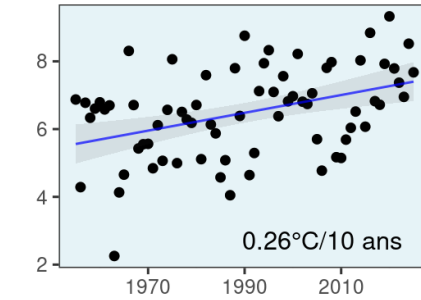
Cumul de pluie

Hiver

Printemps

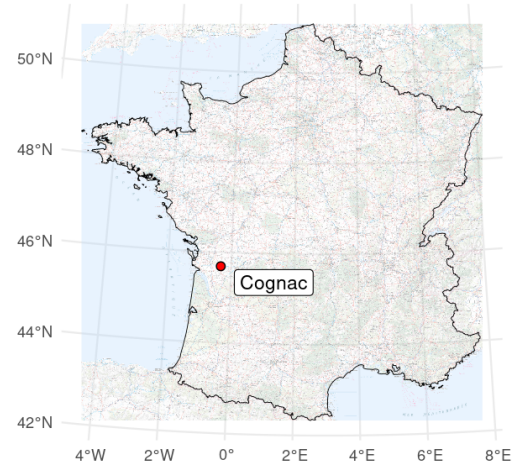
Été

Automne



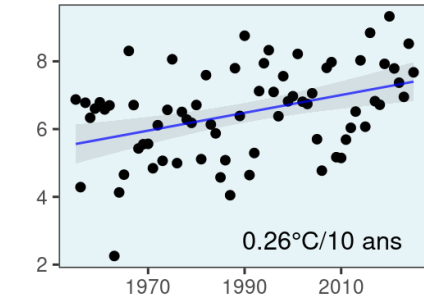
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# Contexte du changement climatique - changements observés - Cognac

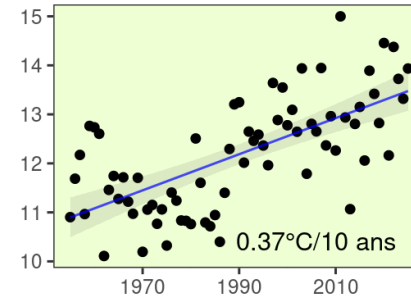


Température moyenne

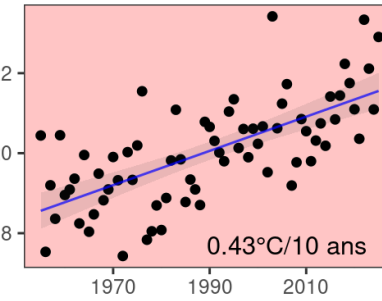
Hiver



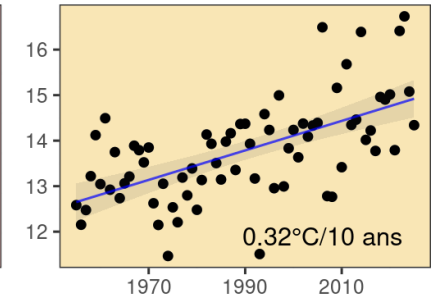
Printemps



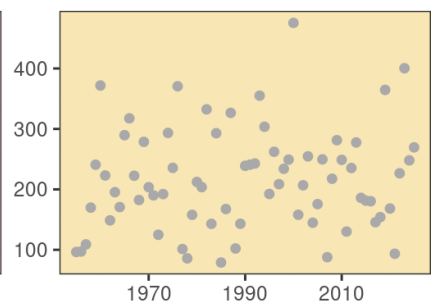
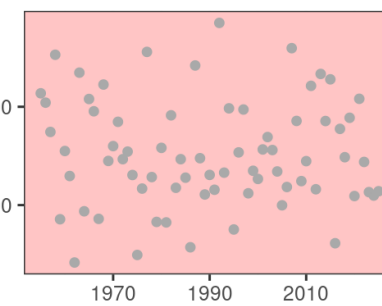
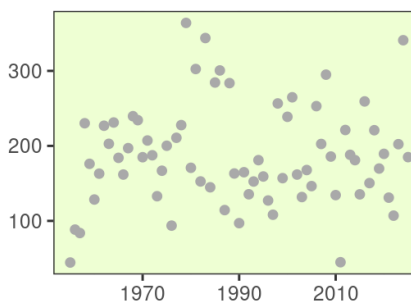
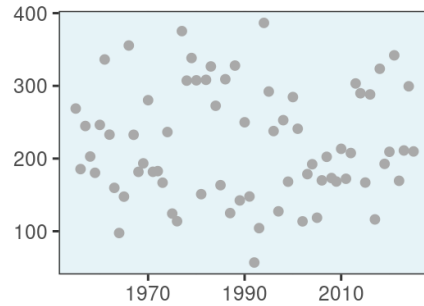
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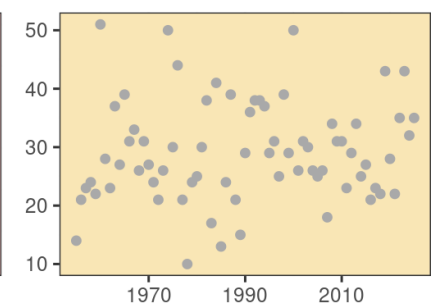
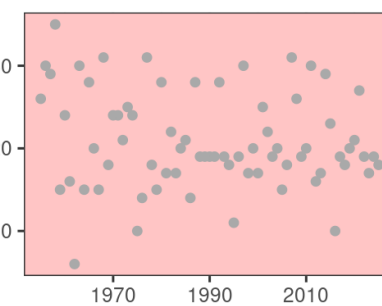
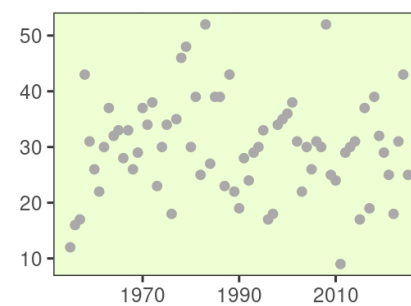
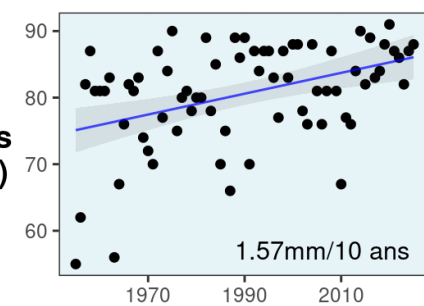
Automne



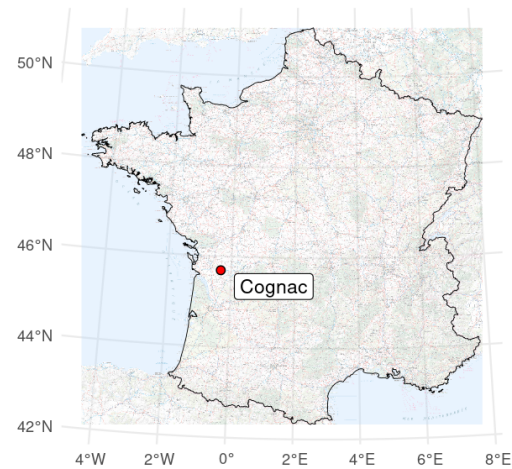
Cumul de pluie



Nombre de jours de pluie (>1mm)



# Contexte du changement climatique - changements observés - Cognac



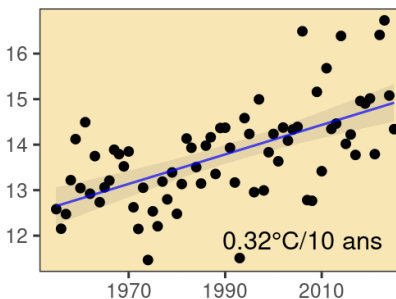
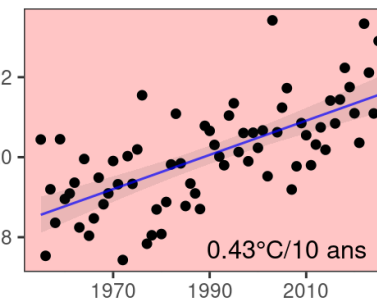
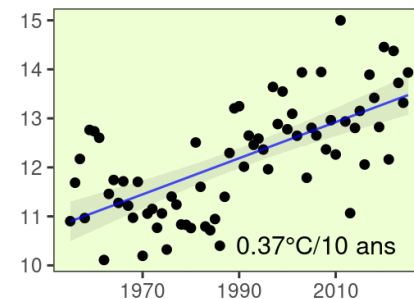
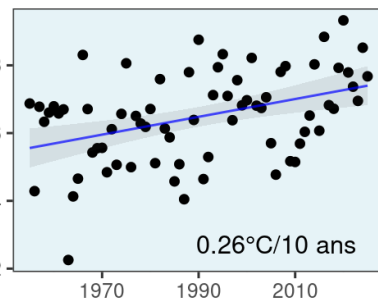
**Température moyenne**

Hiver

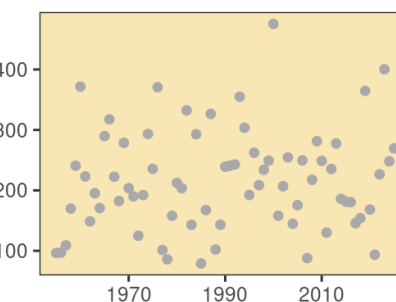
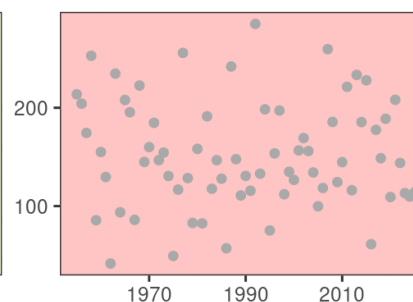
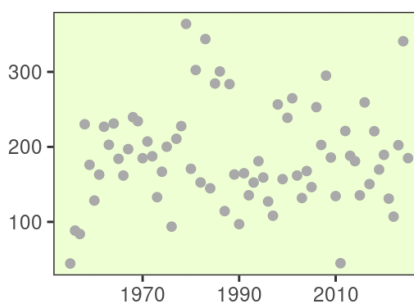
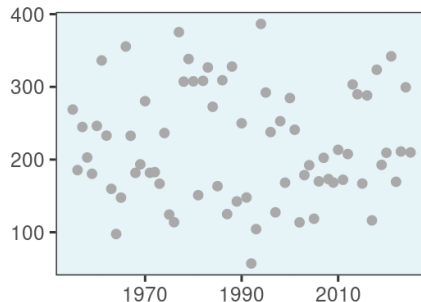
Printemps

Été

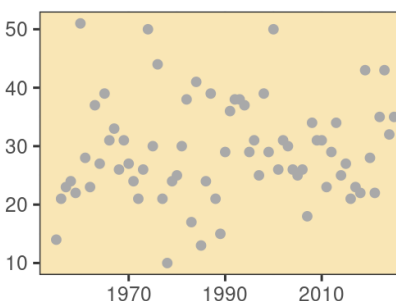
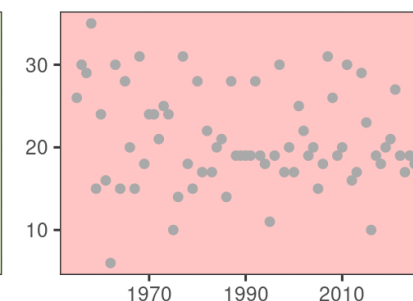
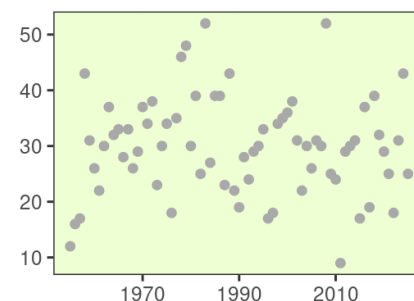
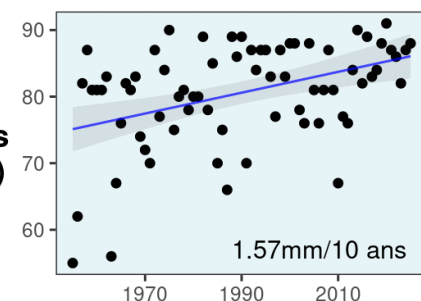
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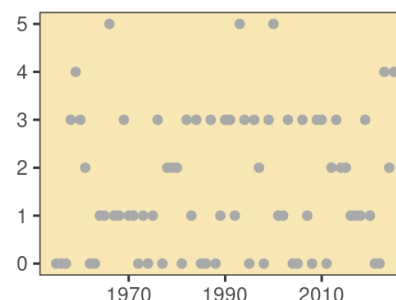
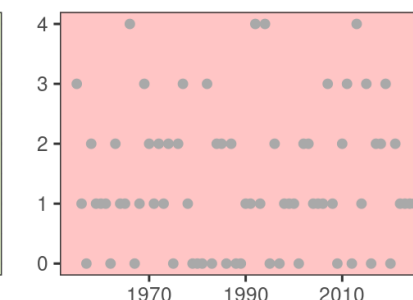
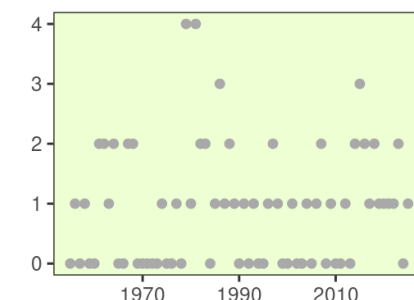
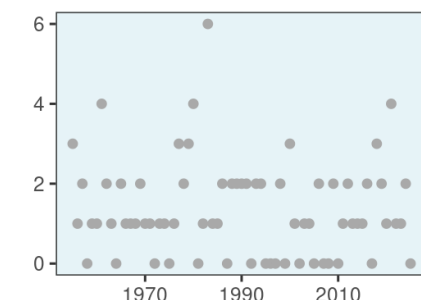
**Cumul de pluie**



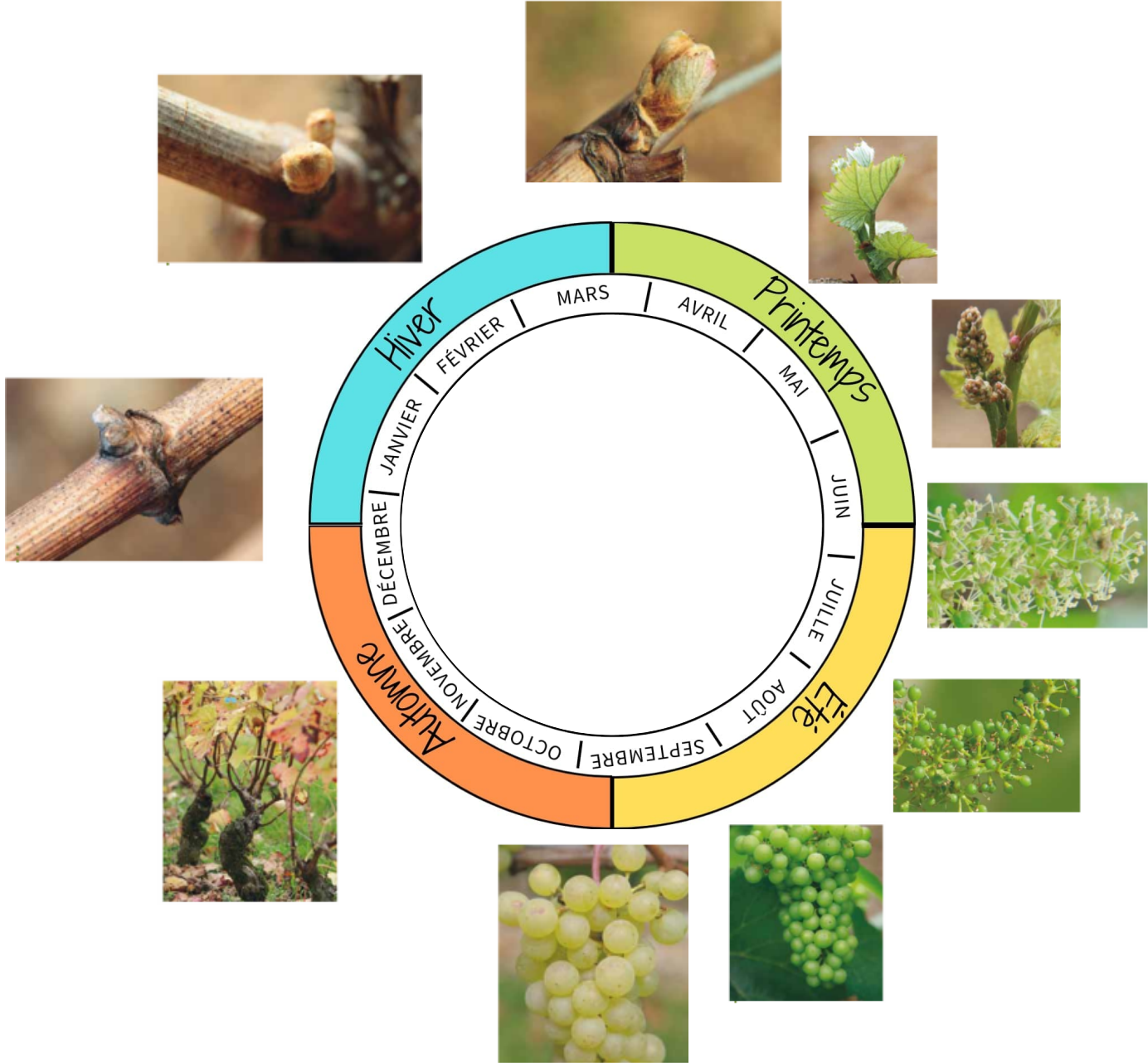
**Nombre de jours de pluie (>1mm)**



**Nombre de jours de forte pluie (>20mm)**



# Conséquence sur le cycle annuel de la vigne

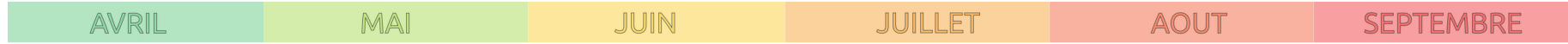


# Conséquence sur le cycle annuel de la vigne et risques/avantages associés

Zito, et al. 2023



Simulation du cycle végétatif de l'Ugni blanc sur la région de Cognac



20 avril

BBCH 07



1961-1992

12 avril

BBCH 07



1992-2021

+1.35°C



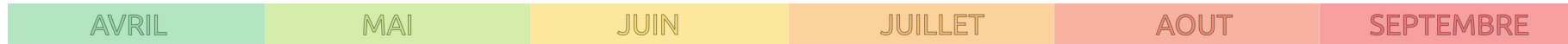
Gel de printemps

# Conséquence sur le cycle annuel de la vigne et risques/avantages associés

Zito, et al. 2023



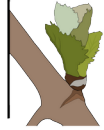
Simulation du cycle végétatif de l'Ugni blanc sur la région de Cognac



1961-1992

20 avril

BBCH 07



21 juin

BBCH 65



1992-2021

+1.35°C

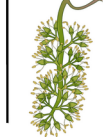
12 avril

BBCH 07

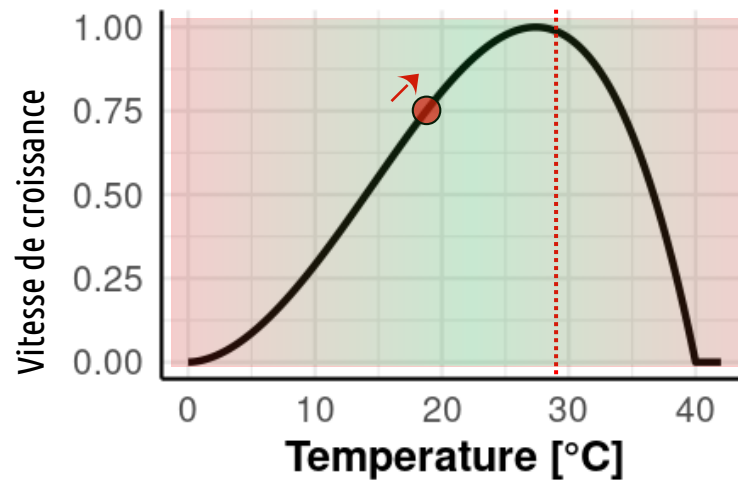


12 juin

BBCH 65



Gel de printemps



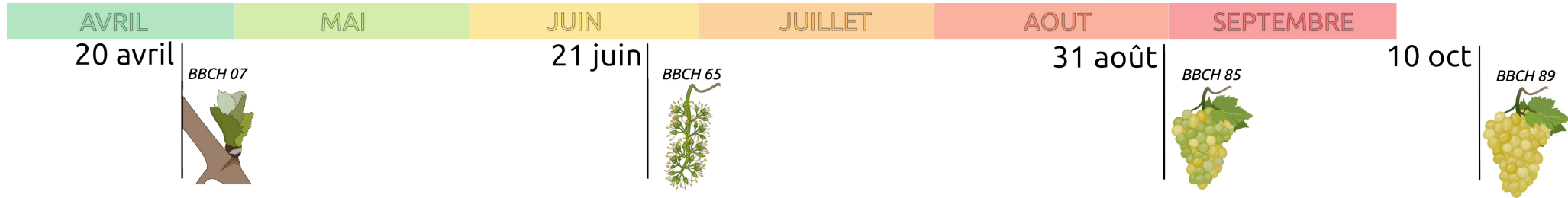
# Conséquence sur le cycle annuel de la vigne et risques/avantages associés

Zito, et al. 2023



Simulation du cycle végétatif de l'Ugni blanc sur la région de Cognac

1961-1992

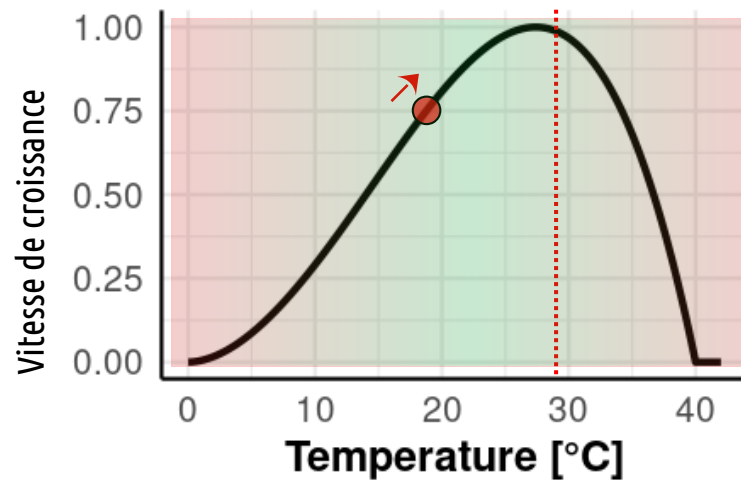


1992-2021

+1.35°C



Gel de printemps

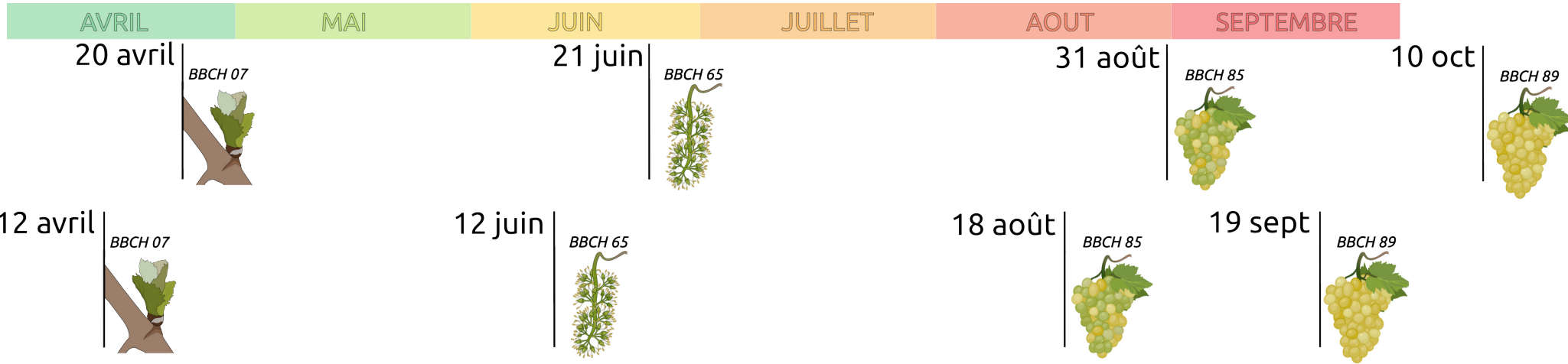


# Conséquence sur le cycle annuel de la vigne et risques/avantages associés

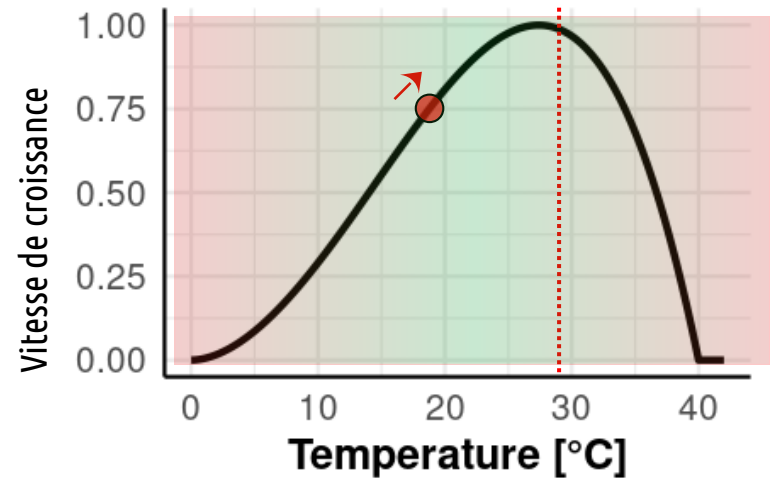
Zito, et al. 2023



Simulation du cycle végétatif de l'Ugni blanc sur la région de Cognac



Gel de printemps



## Stress thermique



Gouot©

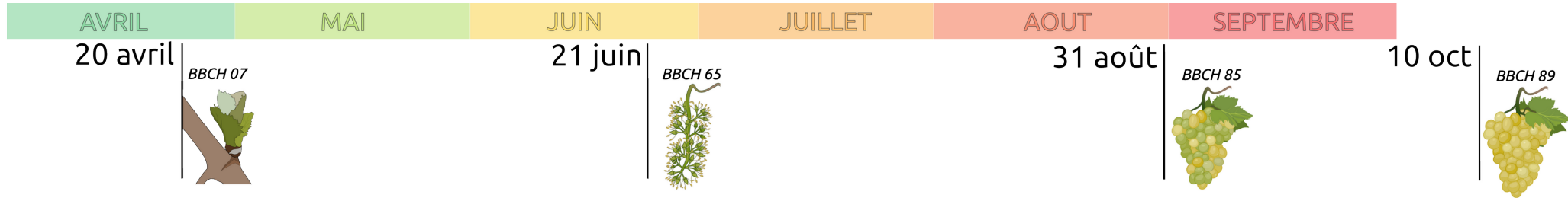
# Conséquence sur le cycle annuel de la vigne et risques/avantages associés

Zito, et al. 2023



Simulation du cycle végétatif de l'Ugni blanc sur la région de Cognac

1961-1992

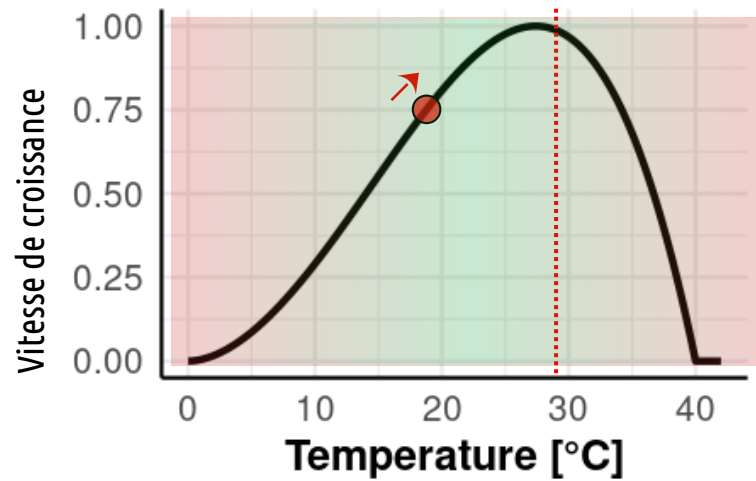


1992-2021

+1.35°C



Gel de printemps



Stress thermique



Gouot©



Gouot©

Stress hydrique

# Conséquence sur le cycle annuel de la vigne et risques/avantages associés

Zito, et al. 2023

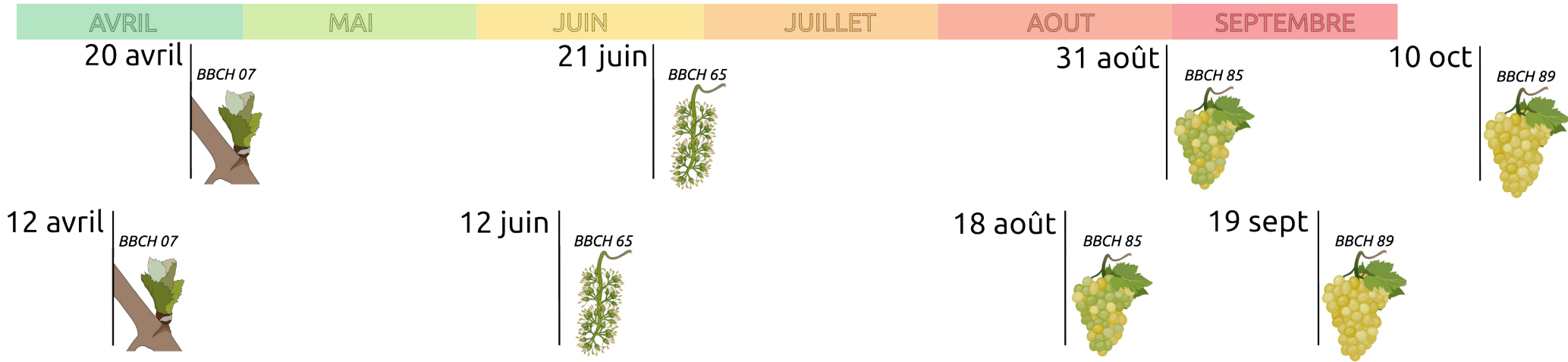


Simulation du cycle végétatif de l'Ugni blanc sur la région de Cognac

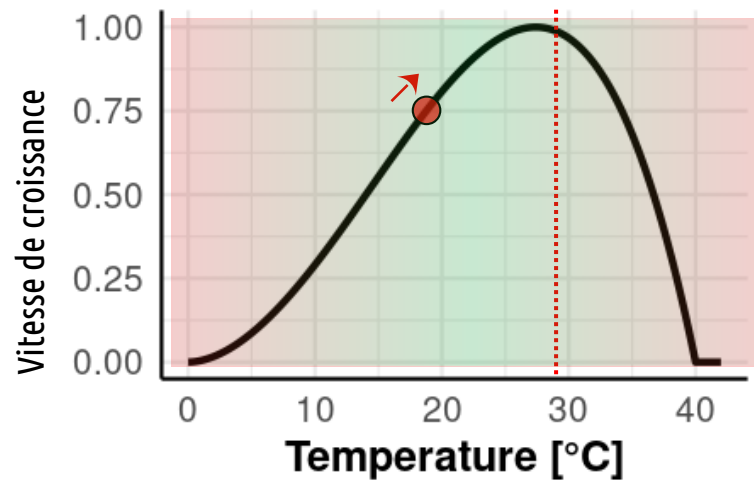
1961-1992

1992-2021

+1.35°C



Gel de printemps



Stress thermique



Gouot®

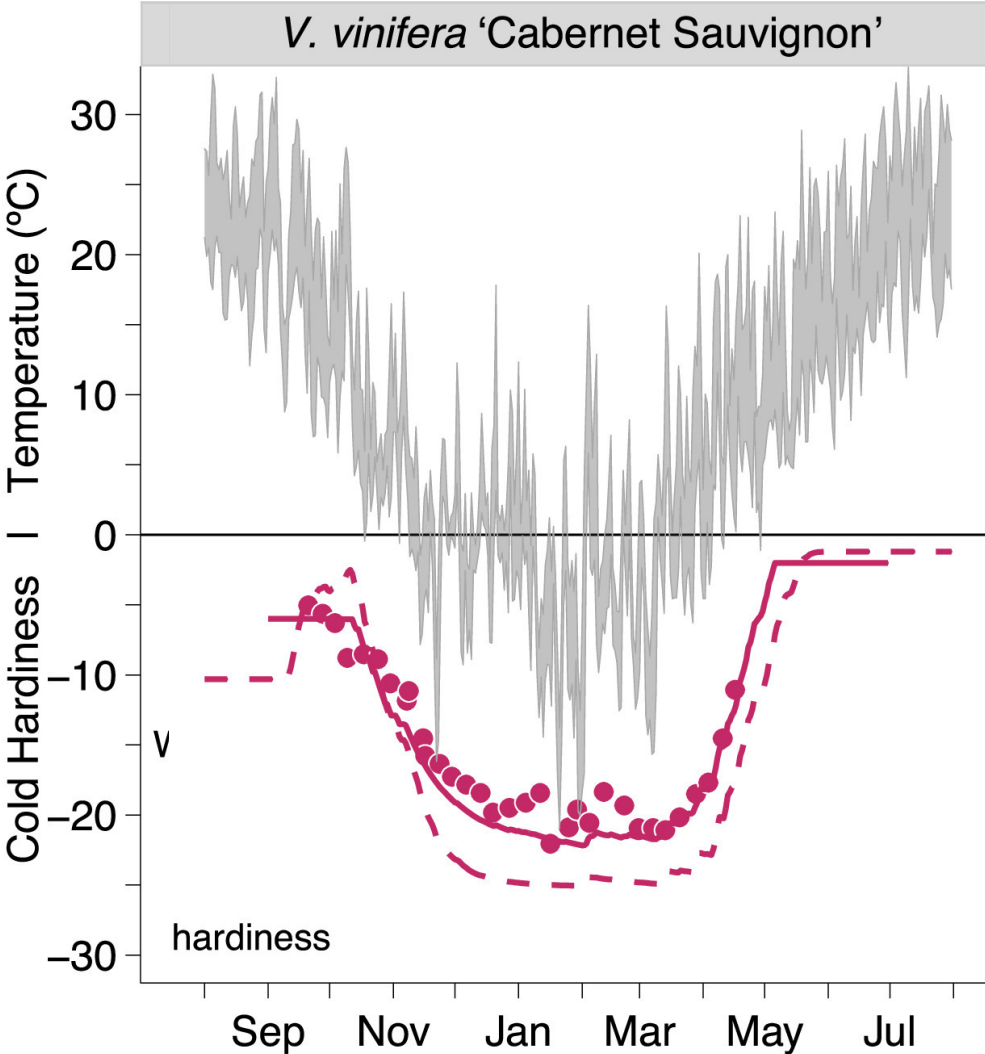


Gouot®

Stress hydrique

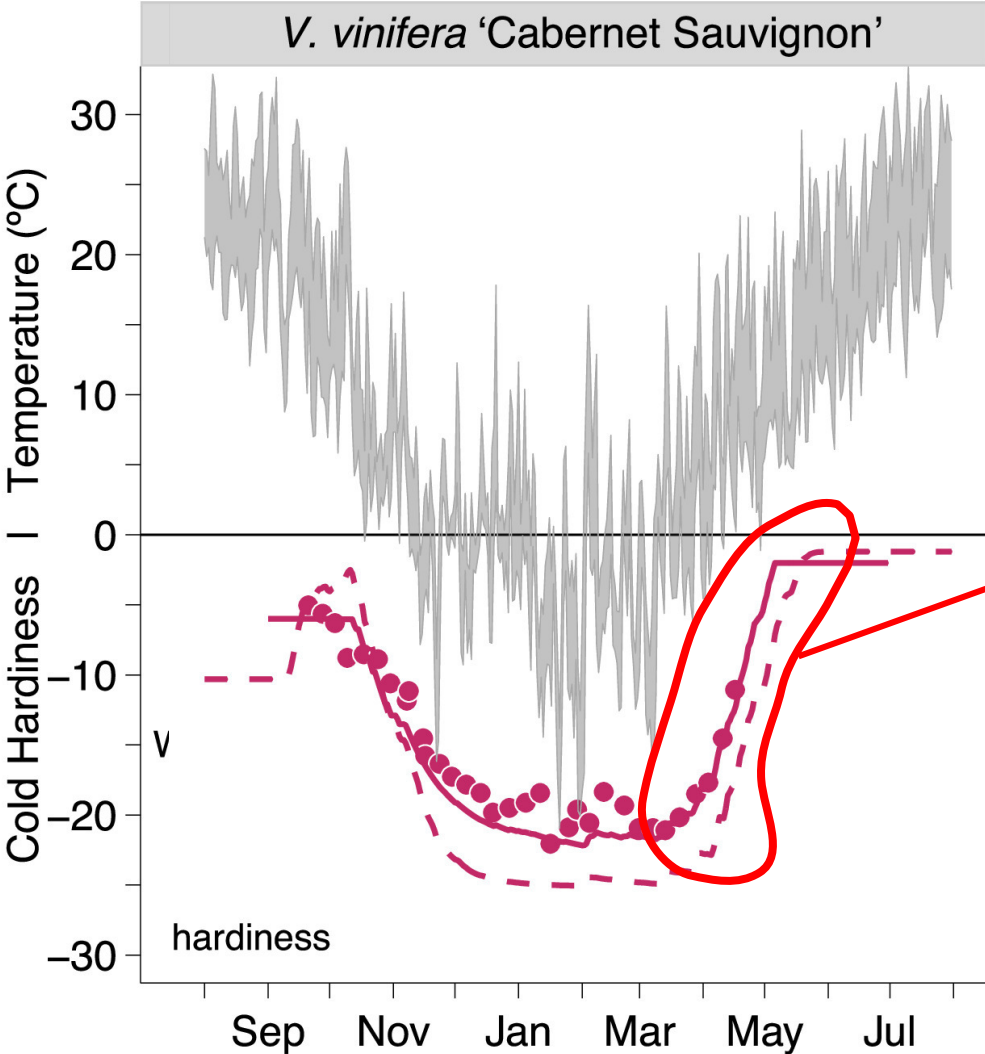
# Evolution du risque de gel de printemps

Sensibilité de la vigne au froid dynamique

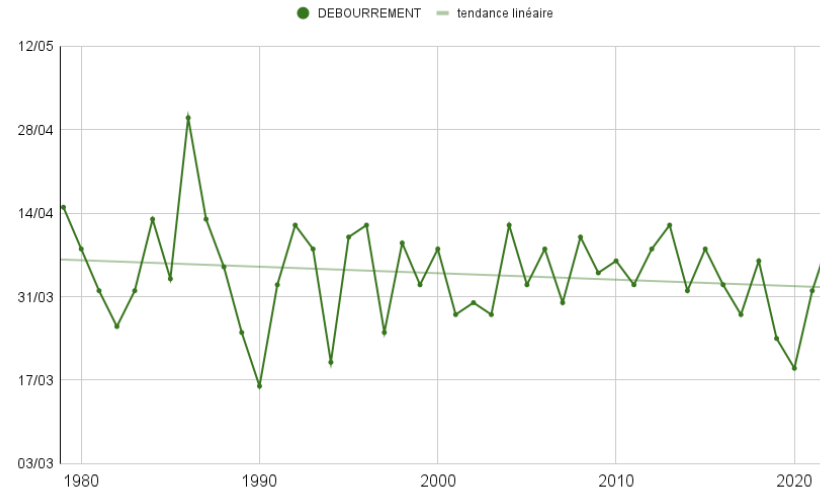


# Evolution du risque de gel de printemps

Sensibilité de la vigne au froid dynamique

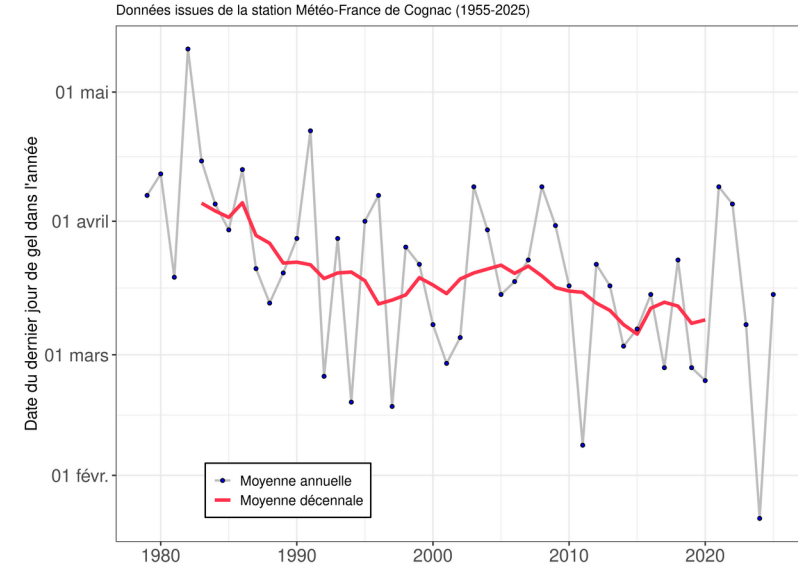


# Evolution du risque de gel de printemps



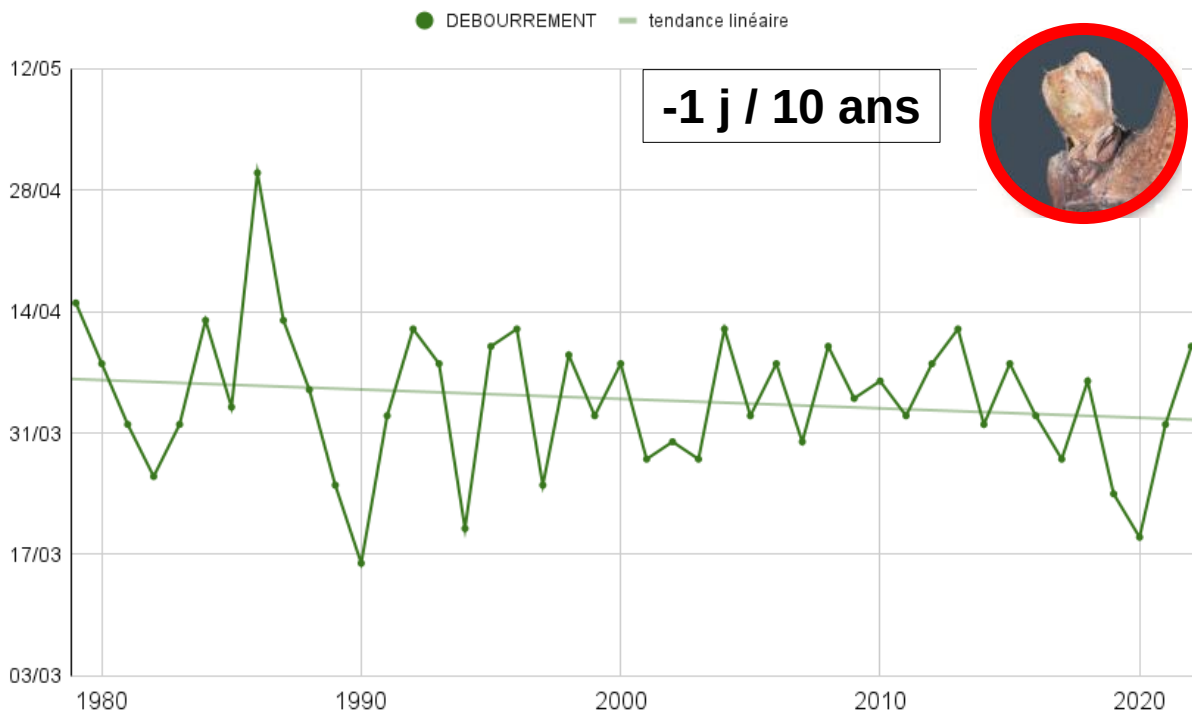
Avancée du débourrement

vs

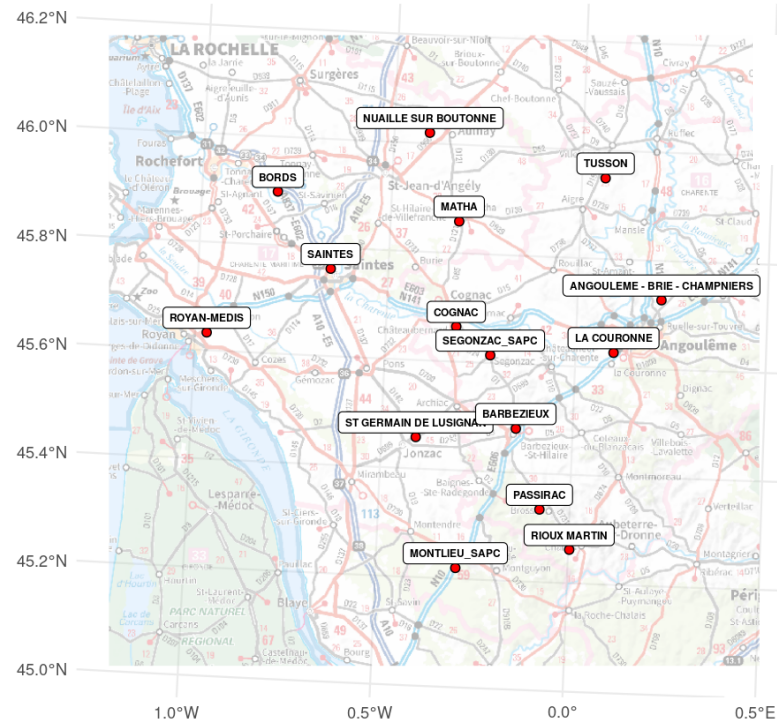


Avancée du dernier jour de gel dans l'année

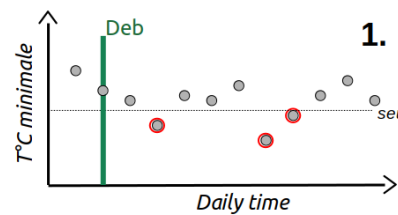
# Evolution du risque de gel de printemps



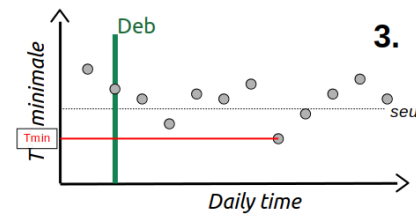
Source BNIC



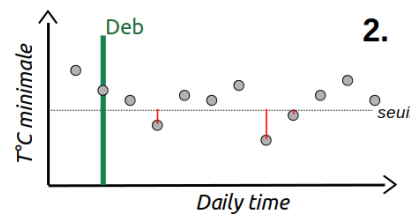
1. Nbre de jours de froid ( $T_{min} < \text{seuil}$  après le débournement)



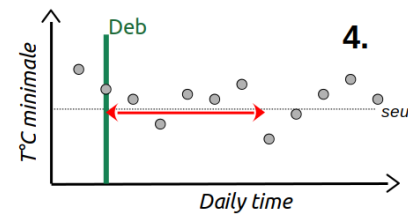
3. Minimale des  $T_{min}$  après le débournement



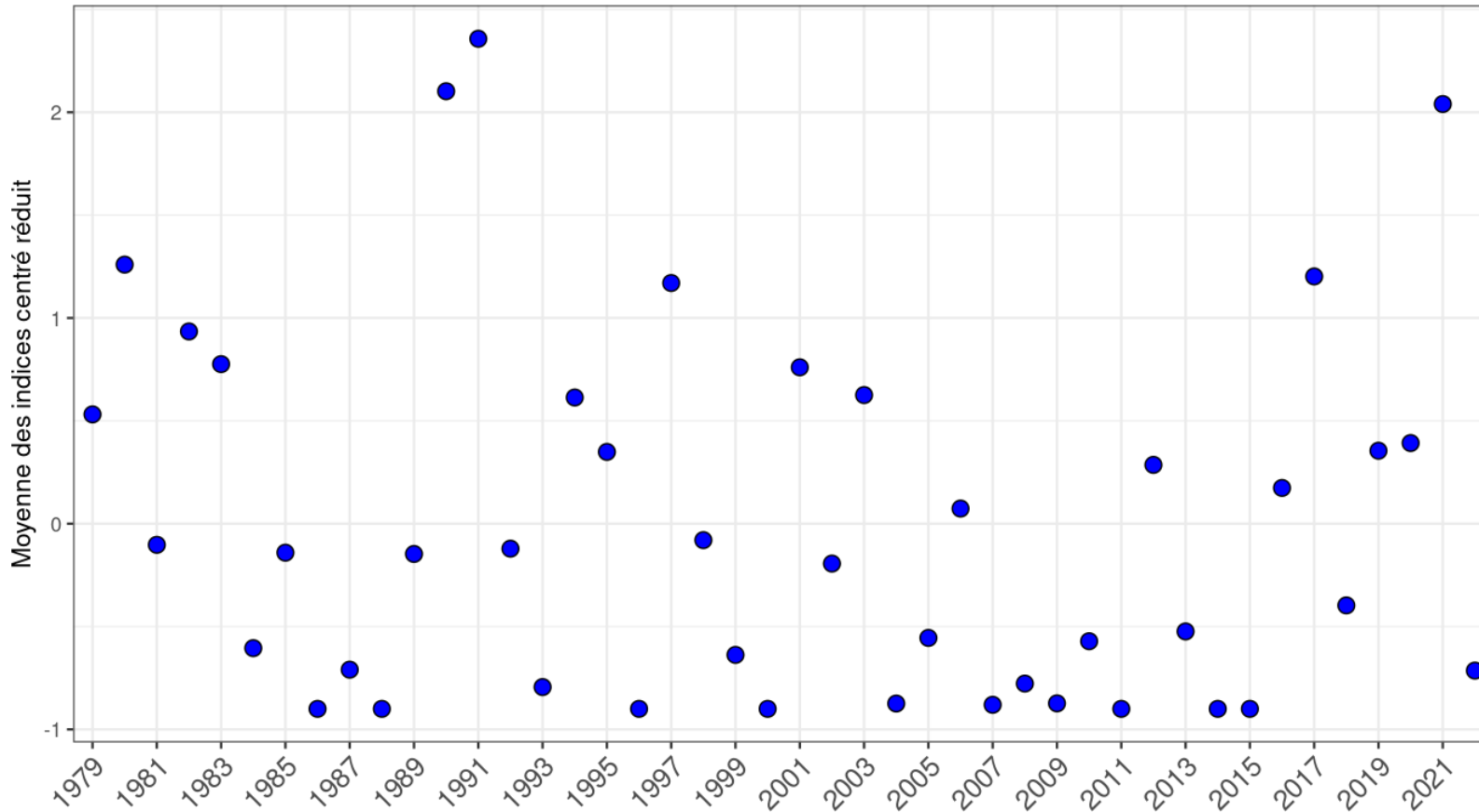
2. Cumul de froid (par rapport à un seuil après débournement)



4. Nombre maximum de jours ou  $T_{min} < \text{seuil}$



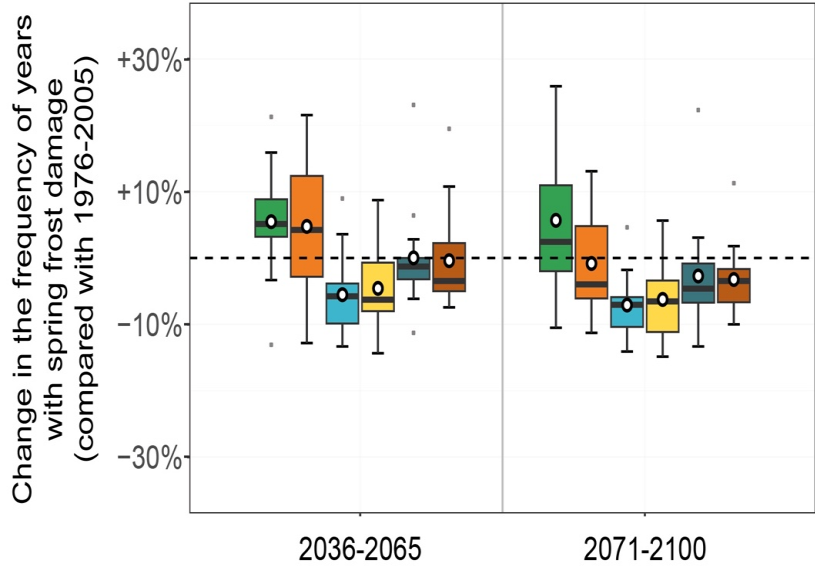
# Evolution du risque de gel de printemps



**Aucune évolution significative du risque de gel de printemps, basé sur les indicateurs définis sur la période 1979-2022 en lien avec l'augmentation des températures et l'avancée du stade de débourrement**

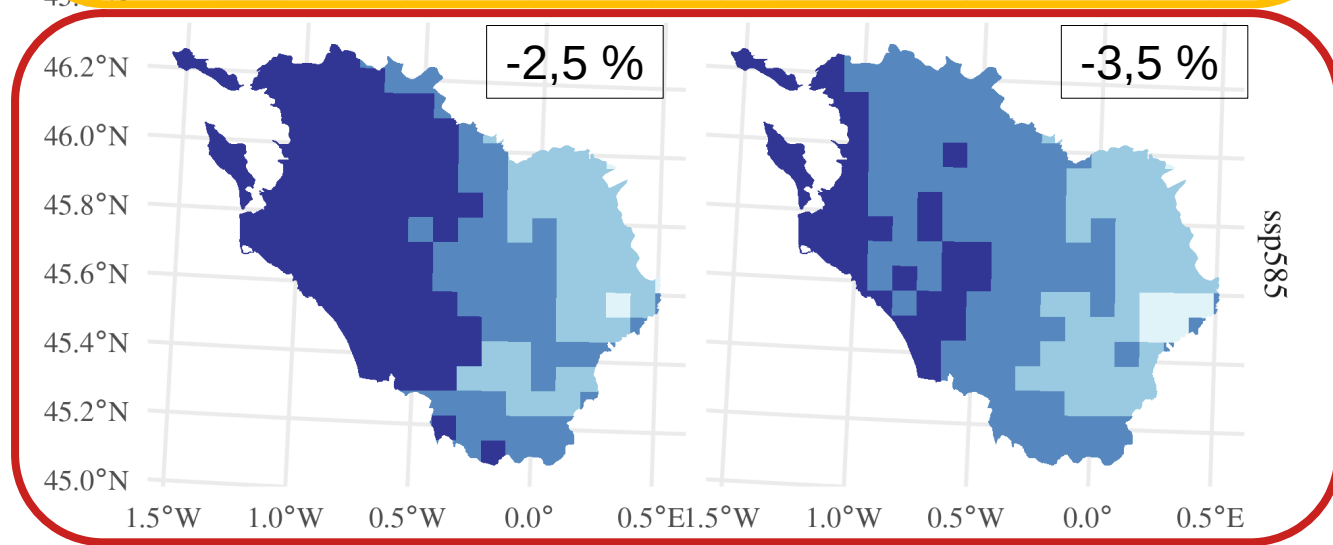
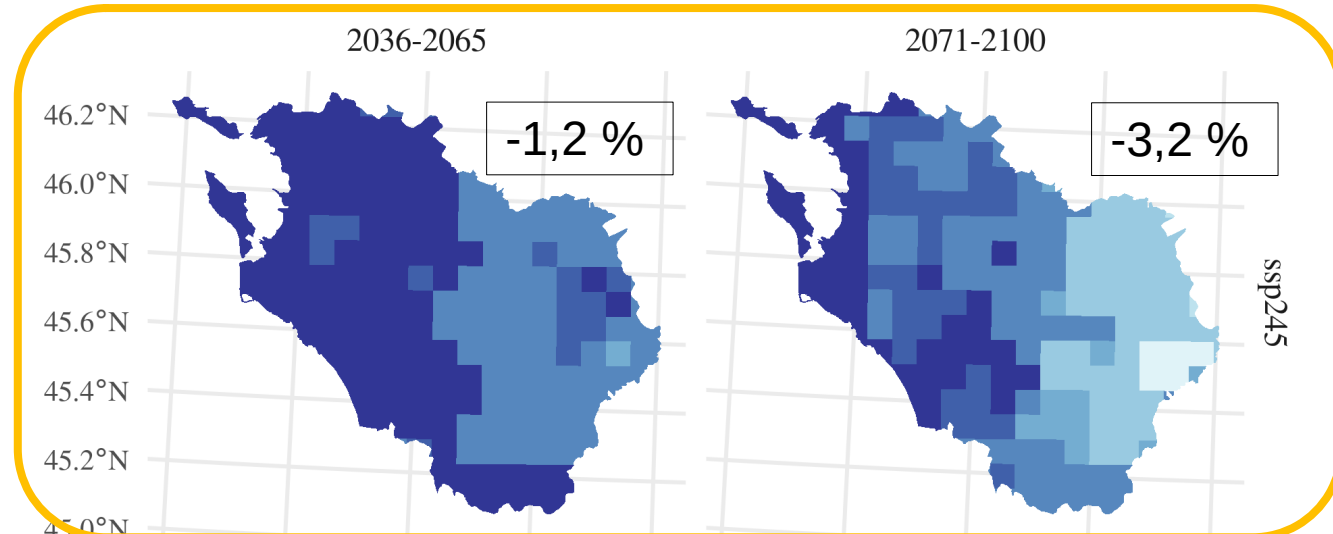
	Nbr jour de froid	Cummul de froid	Température minimale	Tardivité
2022	0.8	-0.8	0	0
2021	6.2	-8.8	-2	25.7
2020	3.5	-3.1	-0.7	12.8
2019	3	-2.7	0.1	28.3
2018	0.7	-0.3	0	17.3
2017	3.7	-5.2	-1.2	31.3
2016	3.7	-2.4	0.2	18.7
2015	0	0	0	0
2014	0	0	0	0
2013	1	-0.7	0.2	11
2012	2	-2.8	-1	13.8
2011	0	0	0	0
2010	0.3	-0.1	0	12.7
2009	0.2	0	0	0
2008	0.5	-0.3	0	1.2
2007	0.5	-0.1	0.2	0.5
2006	2.2	-3.4	-0.8	3.3
2005	1.2	-0.6	0.2	8.8
2004	0.3	-0.2	0.1	0
2003	3.8	-4.6	-0.8	13.3
2002	2	-1.6	0	12.8
2001	2.7	-3.7	-1.2	24
2000	0	0	0	0
1999	1	-0.4	0.3	8.7
1998	1.7	-2.9	-0.6	4.7
1997	5	-4.8	-0.6	33
1996	0	0	0	0
1995	2	-2.1	-0.6	26
1994	3.2	-2.9	-0.5	28.7
1993	0.3	0	0	3
1992	2.2	-2.6	-0.4	4.2
1991	5.7	-9.2	-3.3	21.3
1990	6	-8.9	-2	29.3
1989	1.7	-0.9	0.2	23
1988	0	0	0	0
1987	0.7	-0.3	0.3	7.7
1986	0	0	0	0
1985	1	-1	0	24
1984	1	-0.7	0.2	7.3
1983	4.5	-4.5	-0.9	14.8
1982	4.5	-3.1	-0.1	40.7
1981	2	-1.6	0.1	18.5
1980	5.2	-6.4	-1.4	16.3
1979	3.8	-4	-0.2	21

# Evolution du risque de gel de printemps – quel projections ?

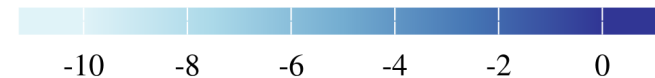


Bois et al., 2023

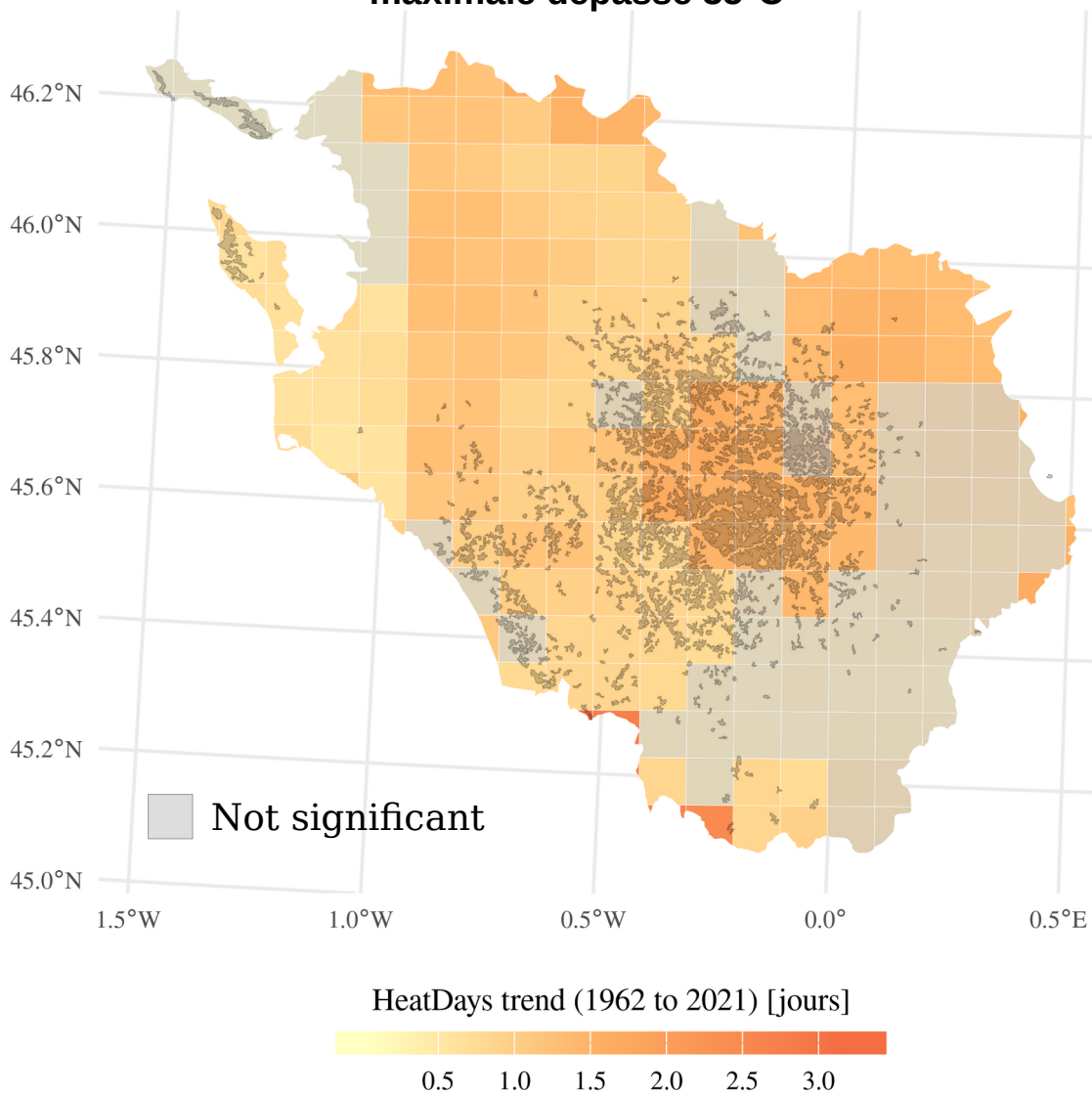
**Incertitude élevée lié à la simulation du débourrement !**



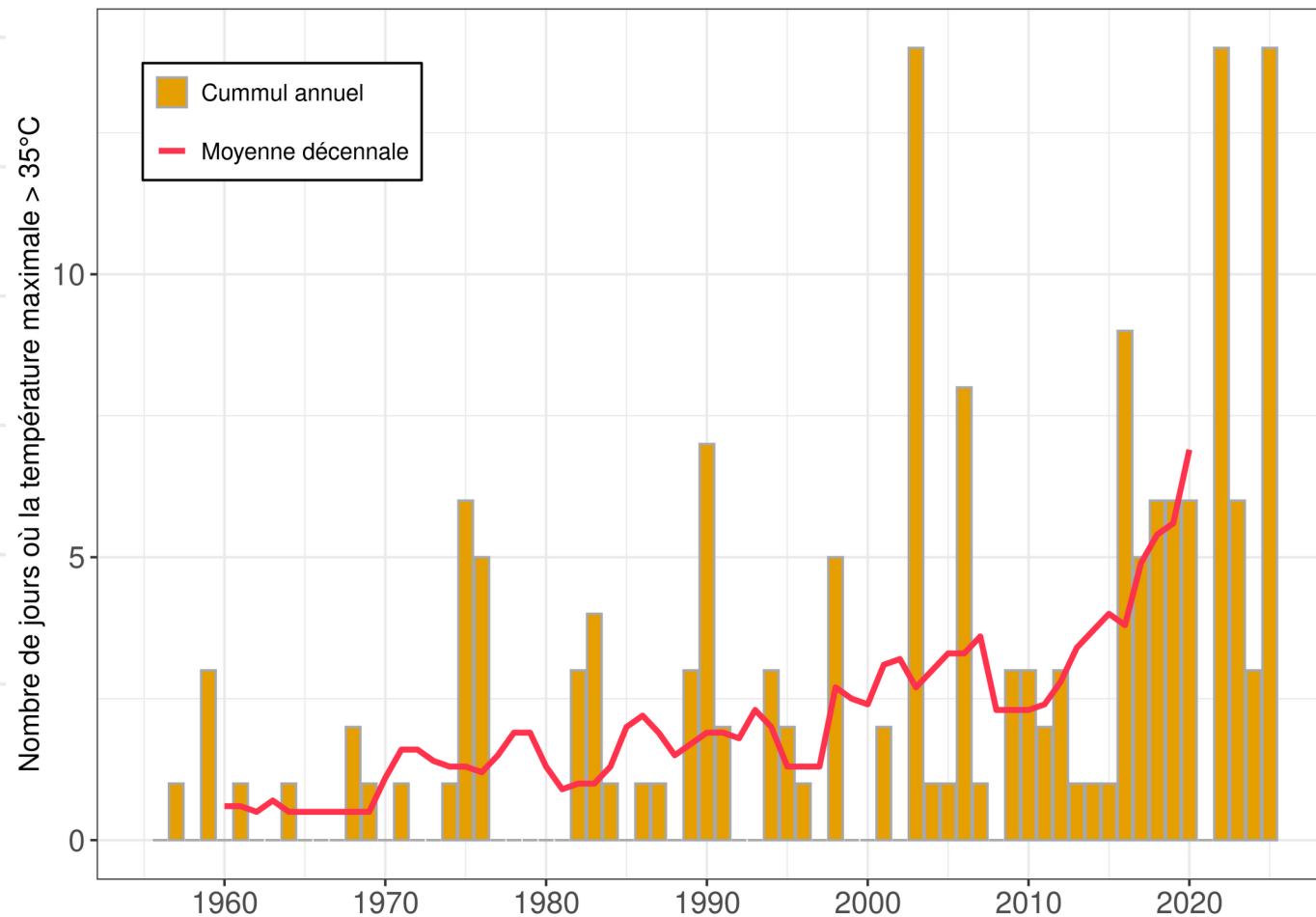
Evolution de la fréquence d'année gélives [%]



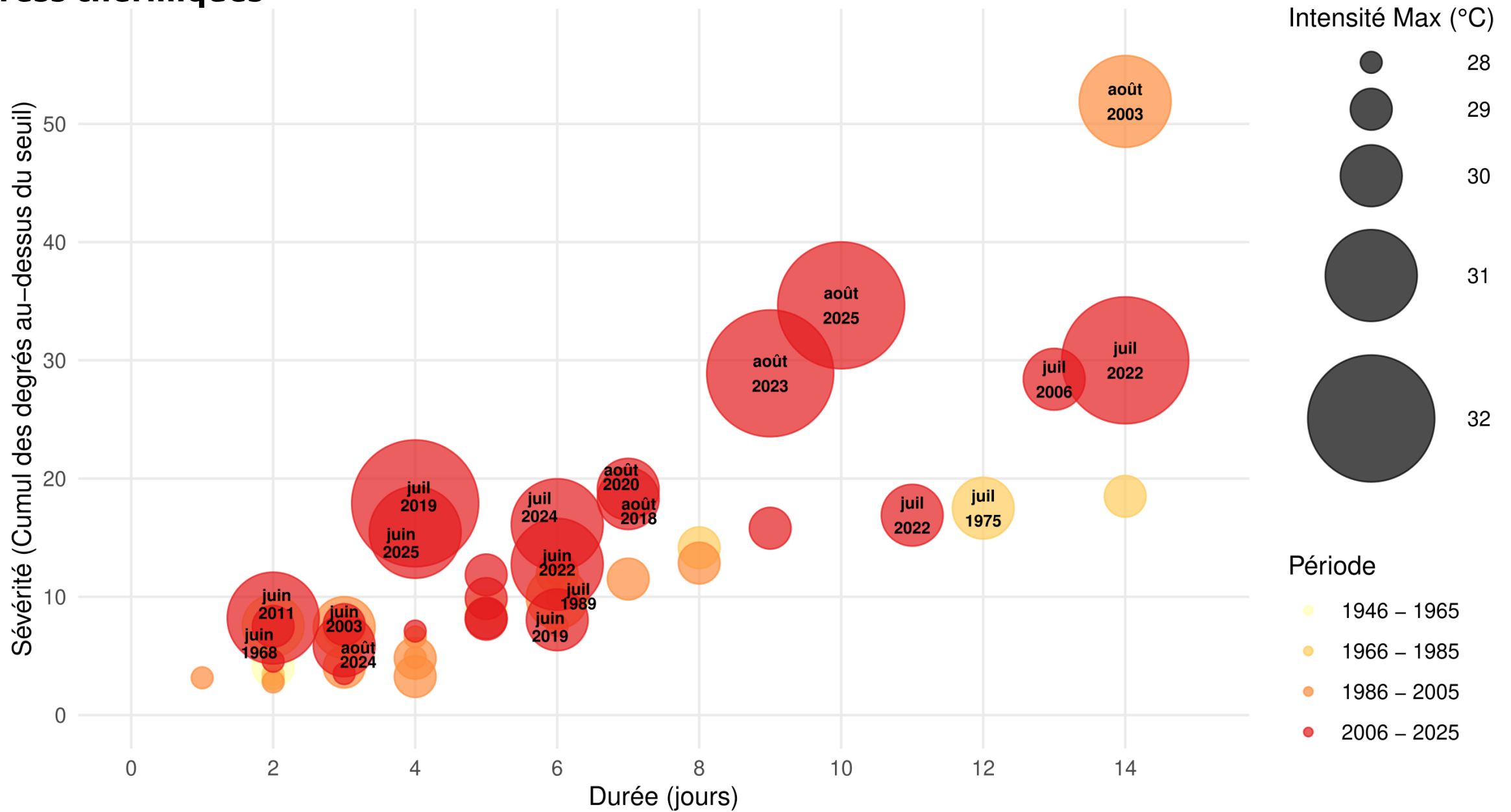
## Evolution du nombre de jours où la température maximale dépasse 35°C



Données issues de la station Météo-France de Cognac (1955-2025)



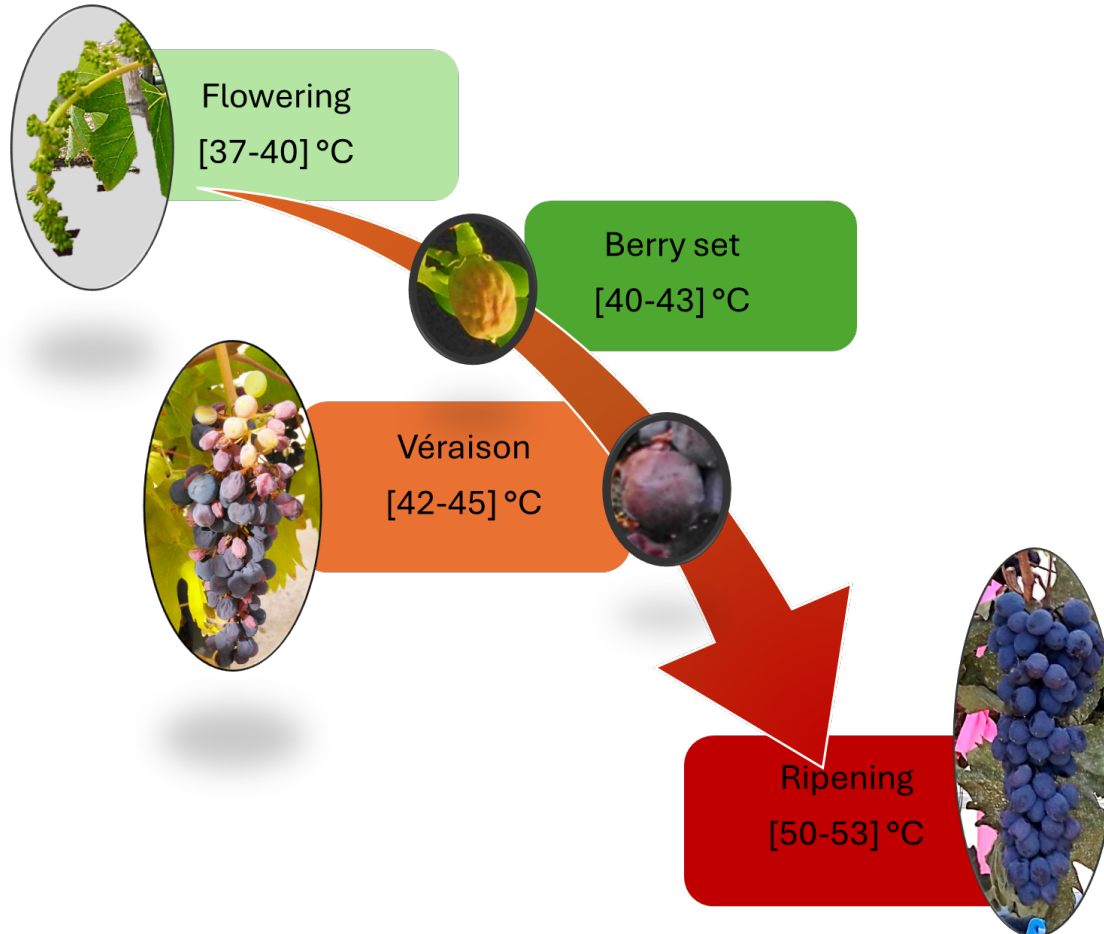
# Stress thermiques



Source : Données Météo-France, station de Cognac (1955–2025).  
Méthodologie : Identification des vagues de chaleur selon le protocole TRACC ; normales (1991–2020)

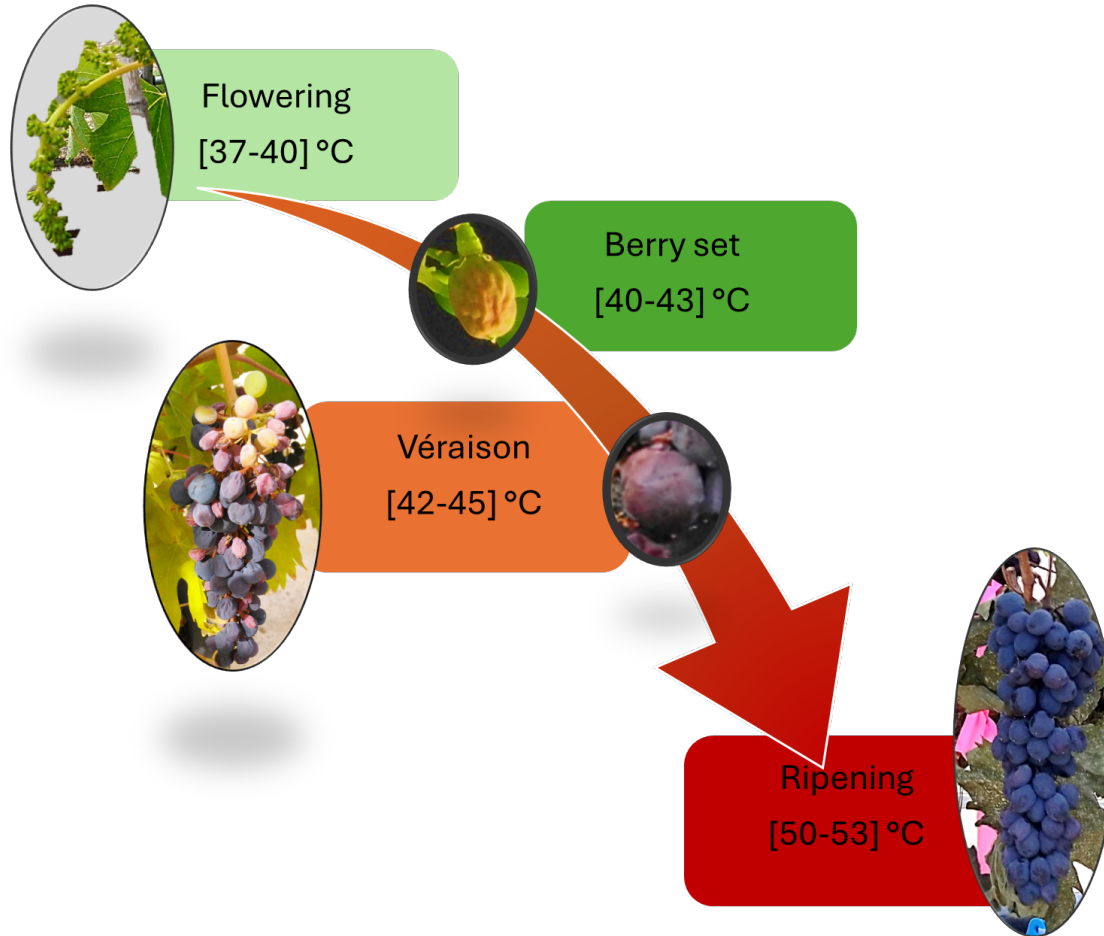
# Stress thermiques

Sensibilité de la vigne aux fortes températures  
(seuil correspondant aux températures de surface)

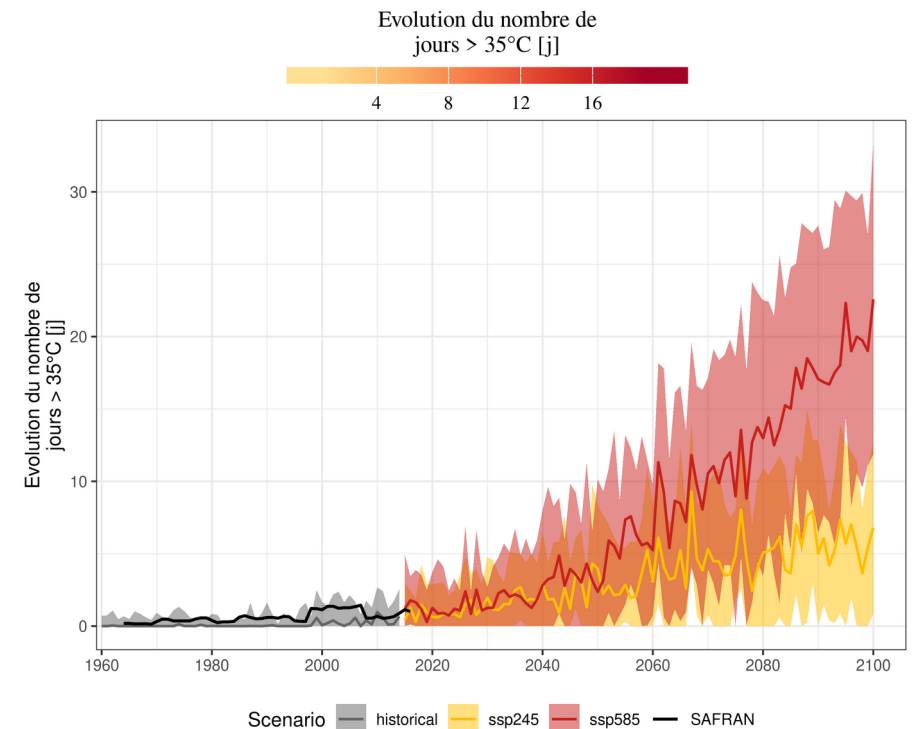
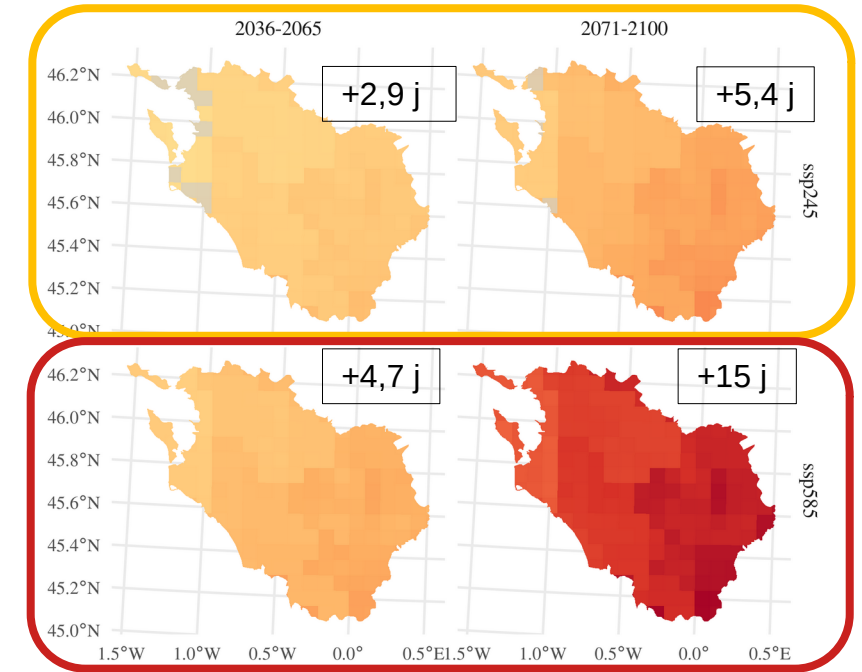


# Stress thermiques

Sensibilité de la vigne aux fortes températures  
(seuil correspondant aux températures de surface)

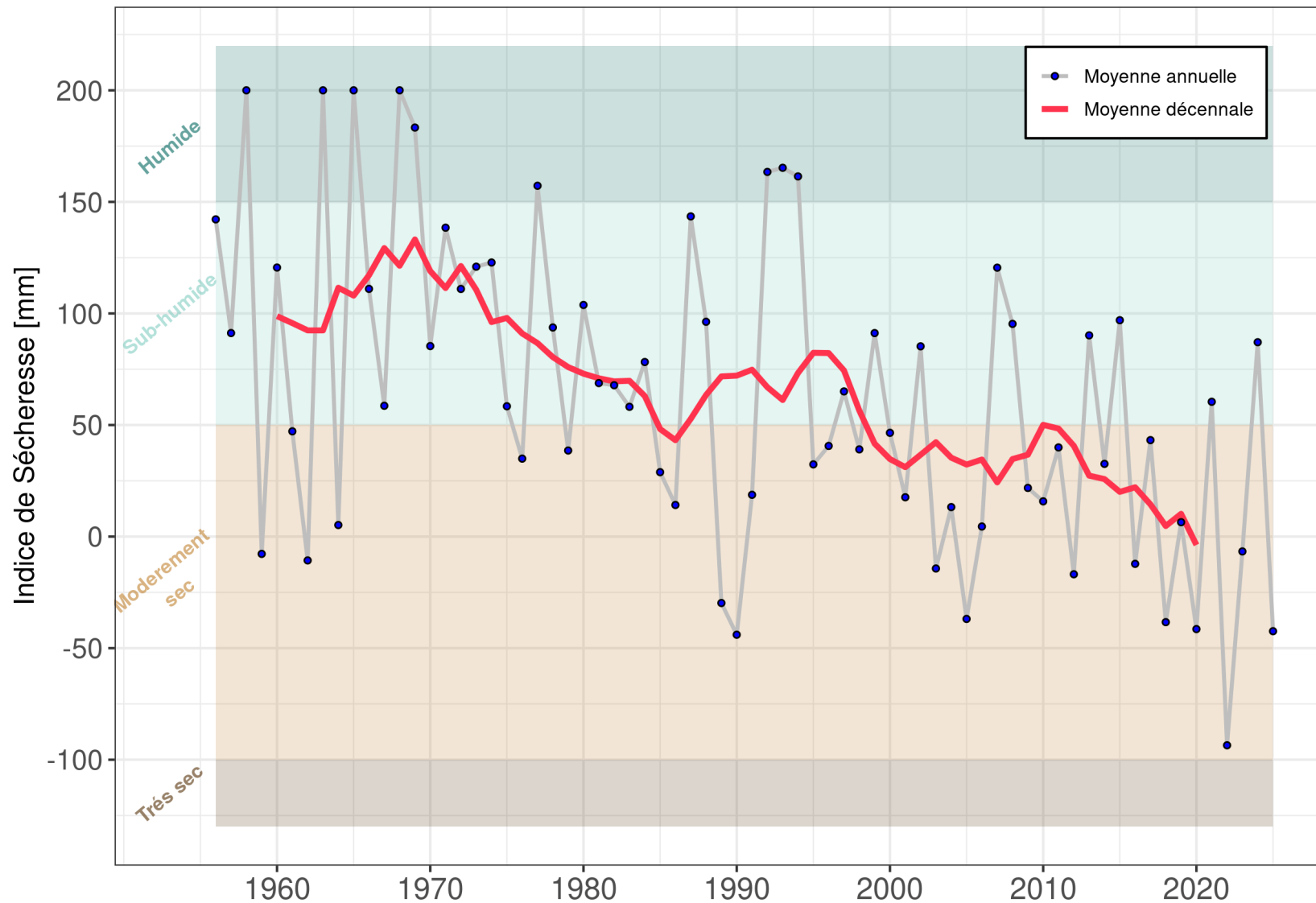


Gouot et al., 2026



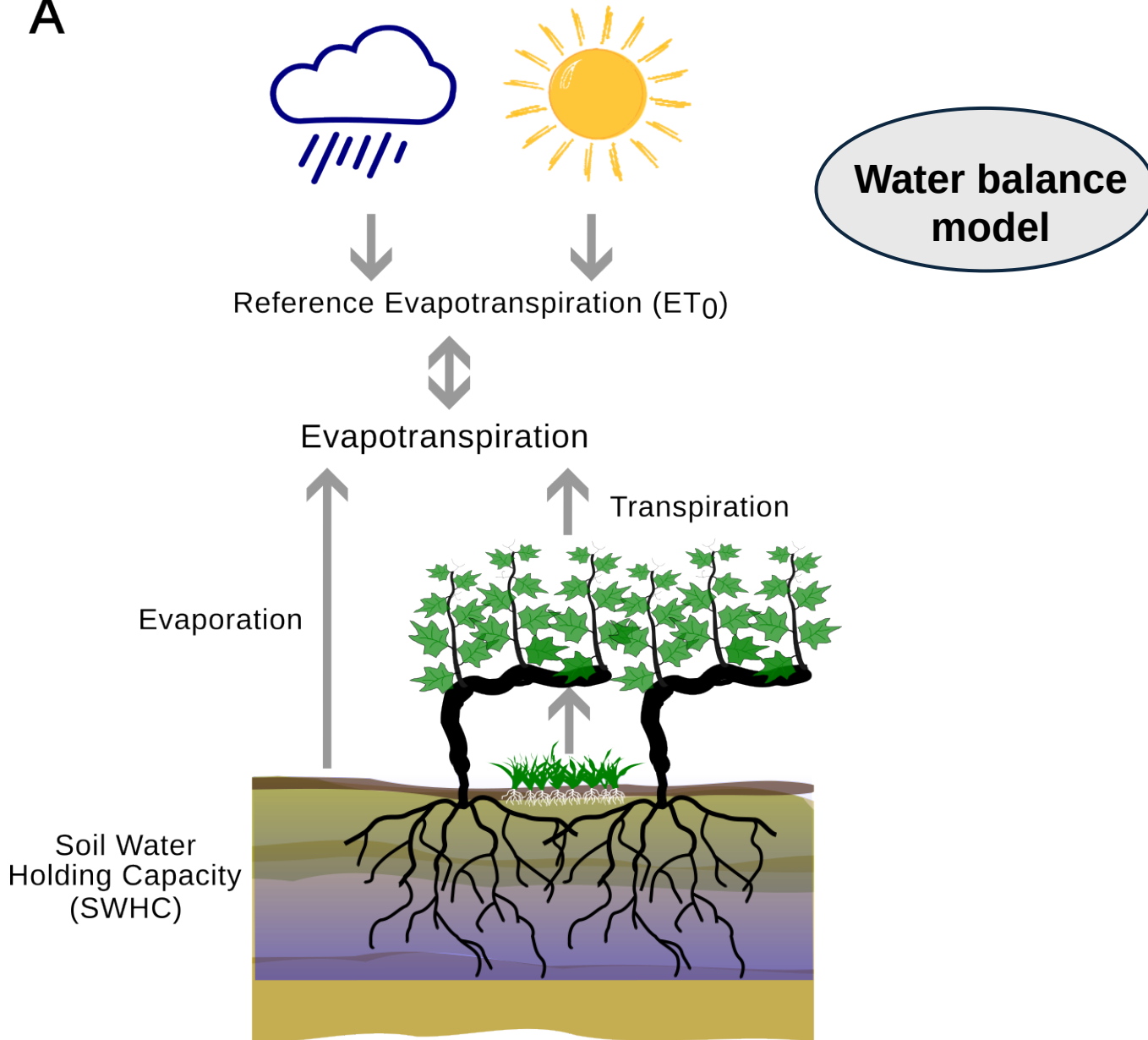
# Evolution de l'indice de sécheresse (avril-septembre)

Données issues de la station Météo-France de Cognac (1955-2025)



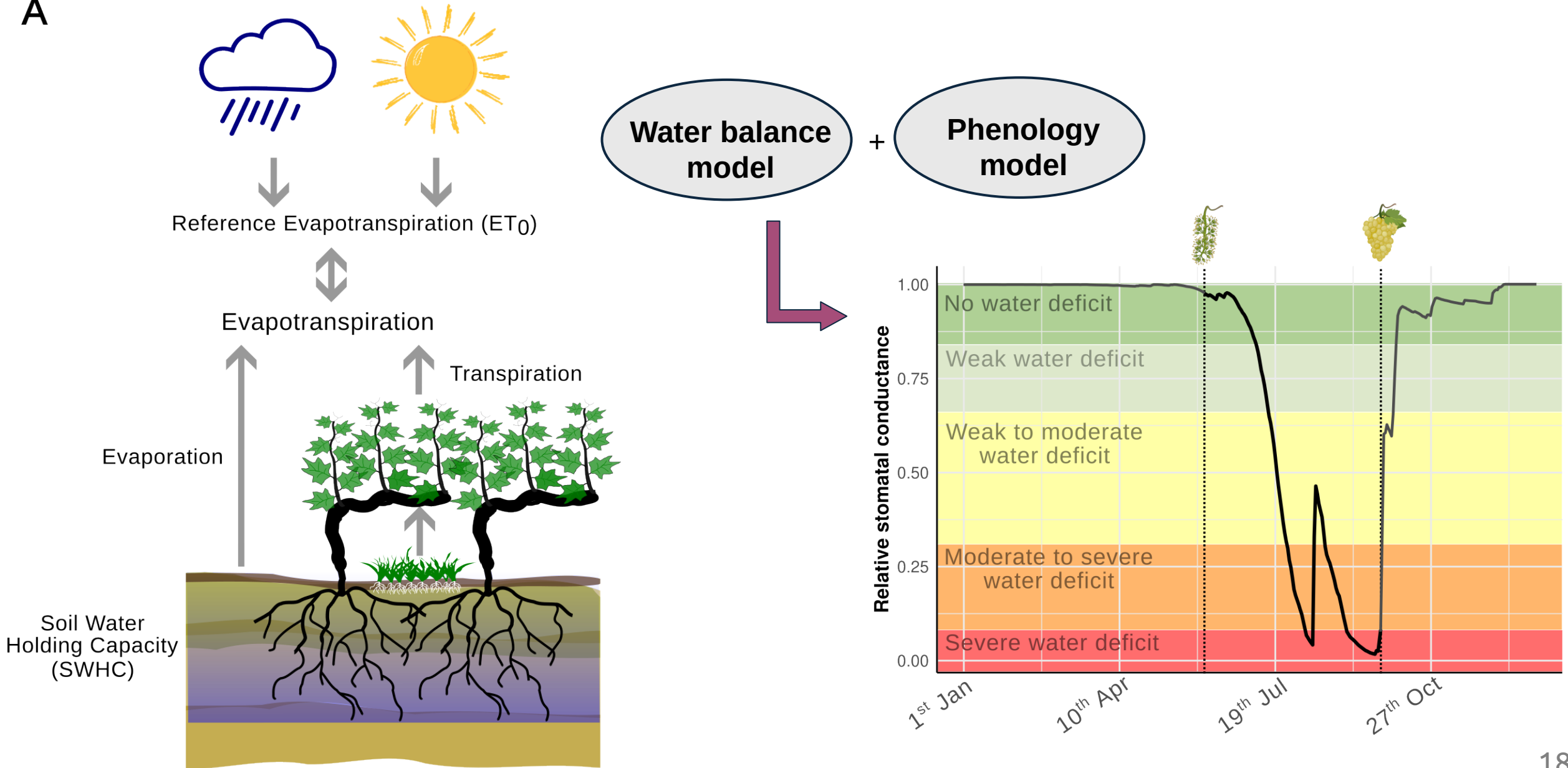
# Modélisation du bilan hydrique de la vigne

A

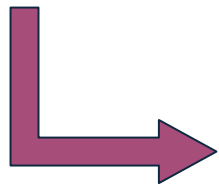
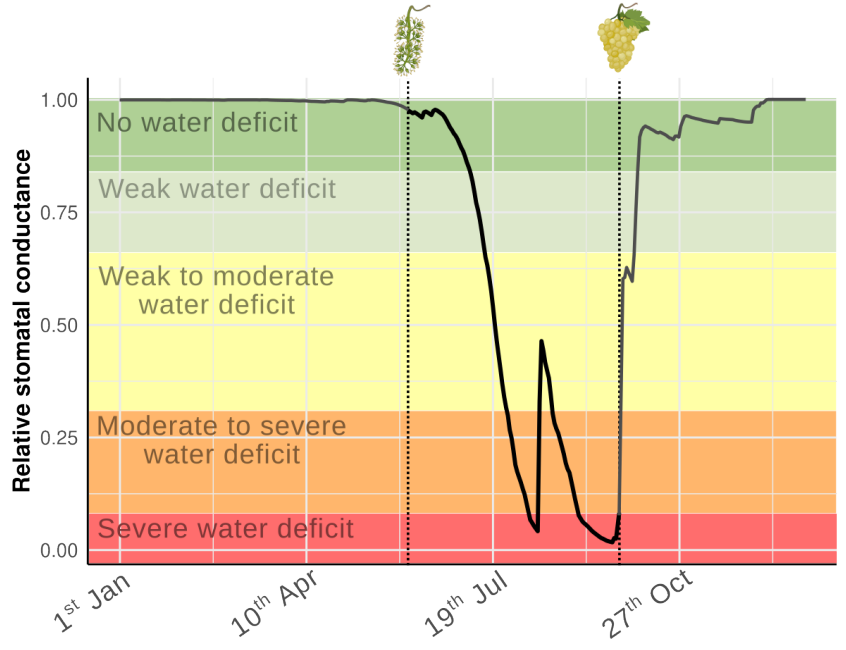


# Modélisation du bilan hydrique de la vigne

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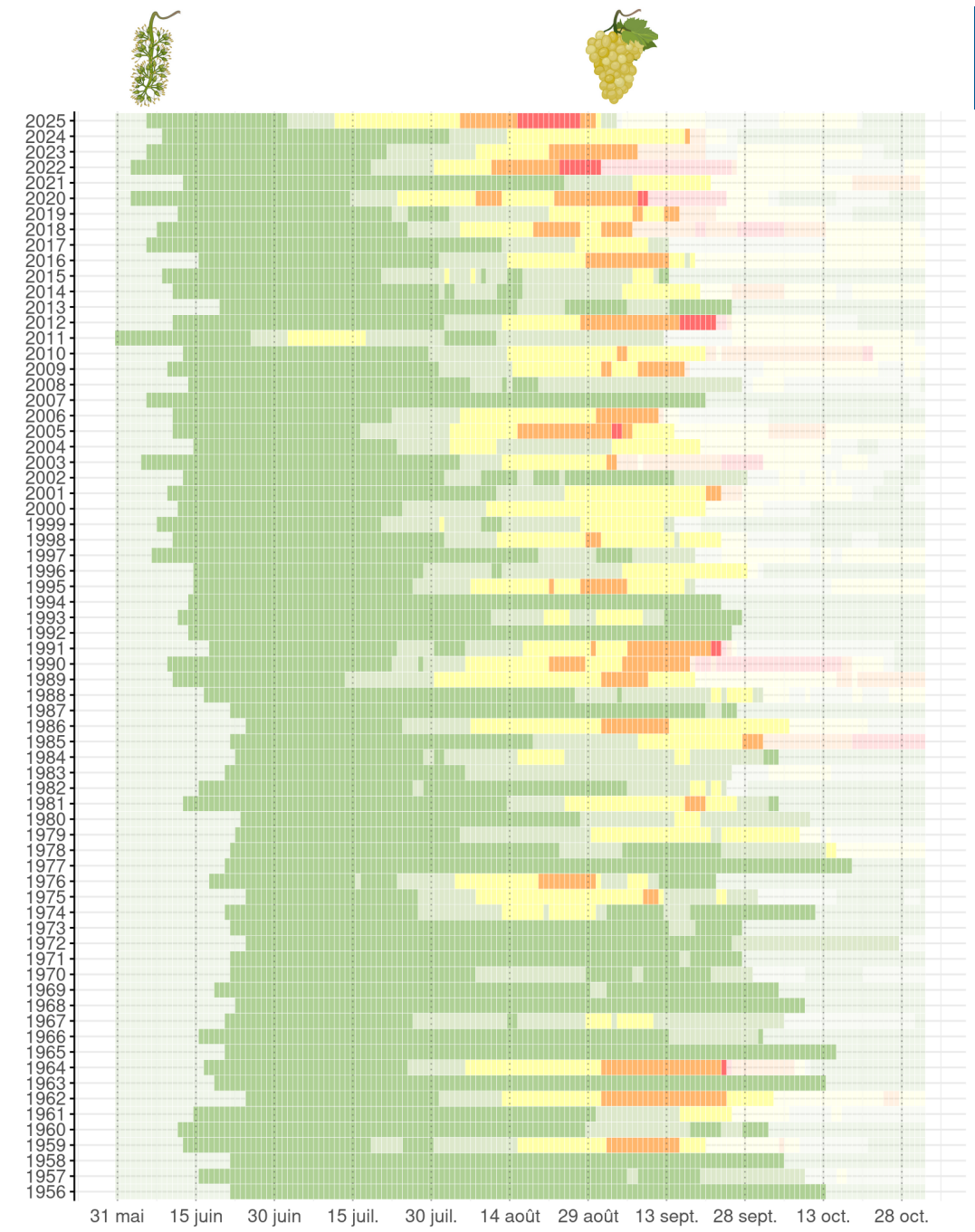


# Modélisation du bilan hydrique de la vigne



Water deficit indices

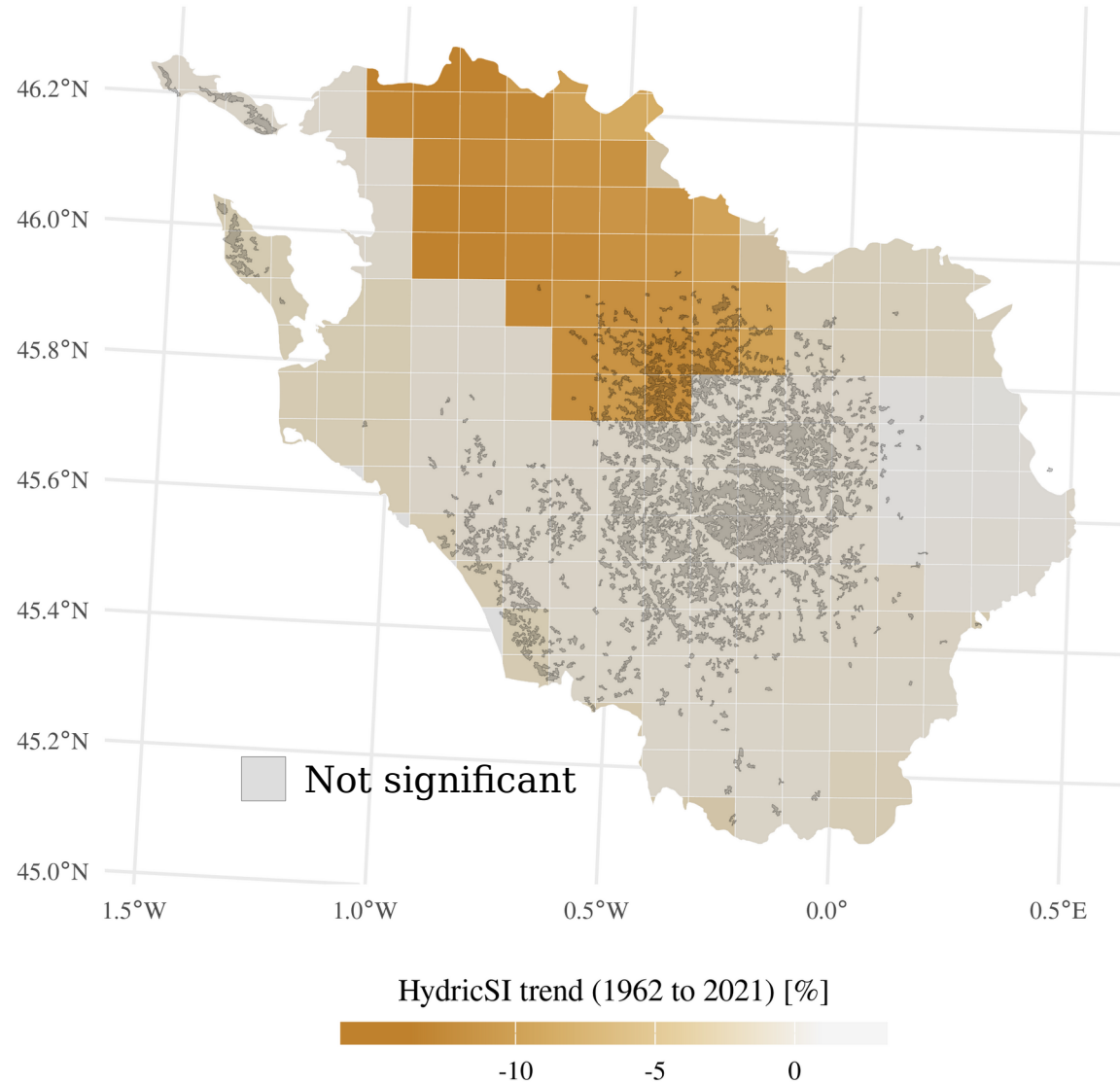
Station Météo-France de Cognac de 1956 à 2025



Déficit hydrique Sévère Modéré à sévère Faible à modéré Faible Absent

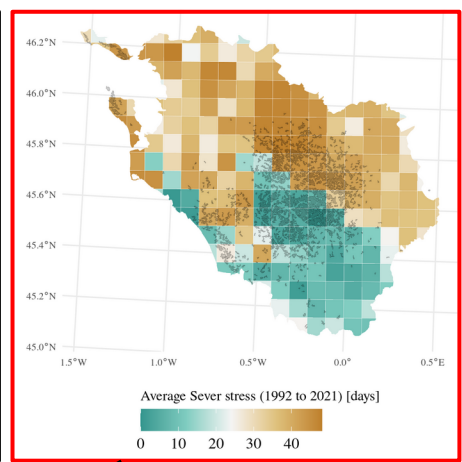
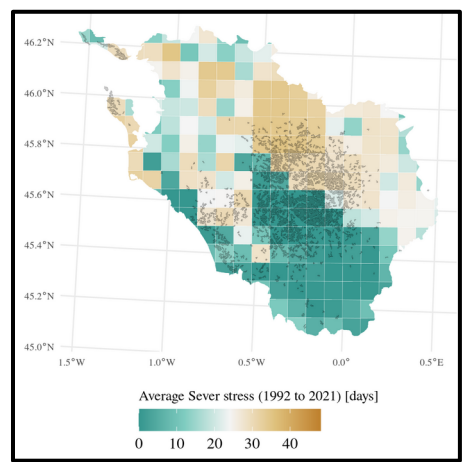
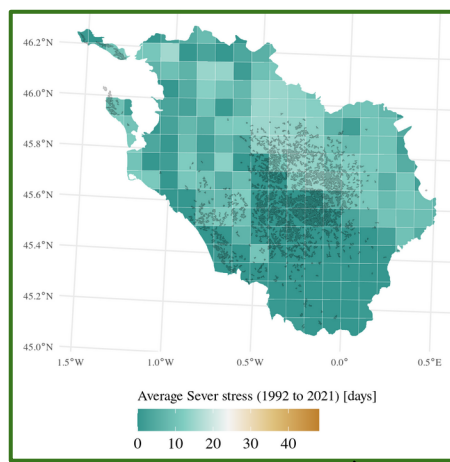
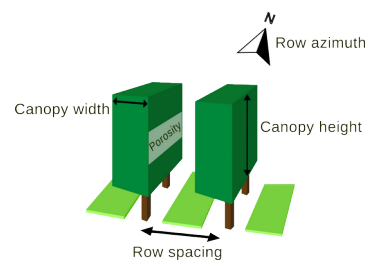
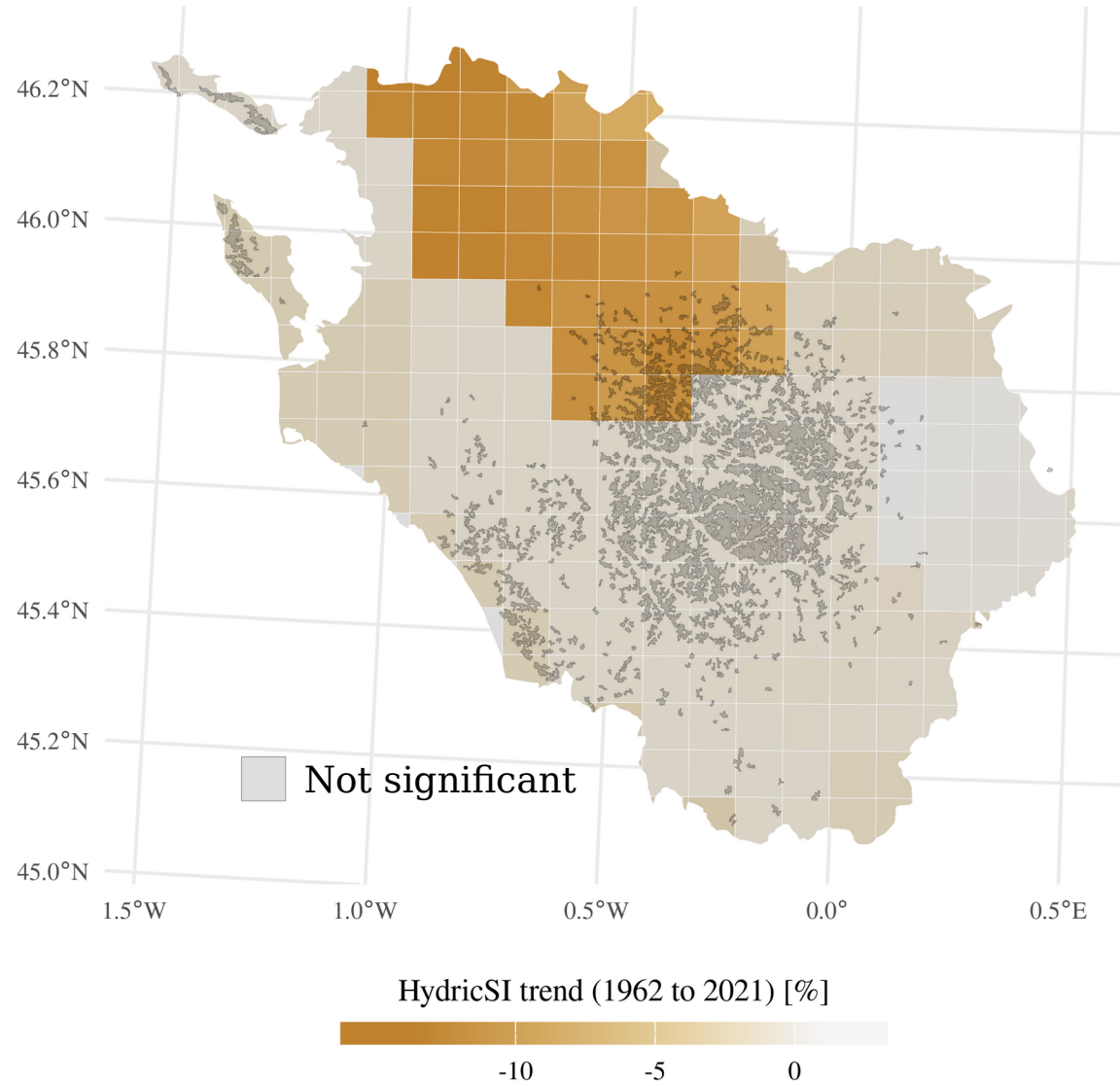
# Modélisation du bilan hydrique de la vigne – effet du mode de conduite

Evolution du déficit hydrique simulé  
entre floraison et maturité



# Modélisation du bilan hydrique de la vigne – effet du mode de conduite

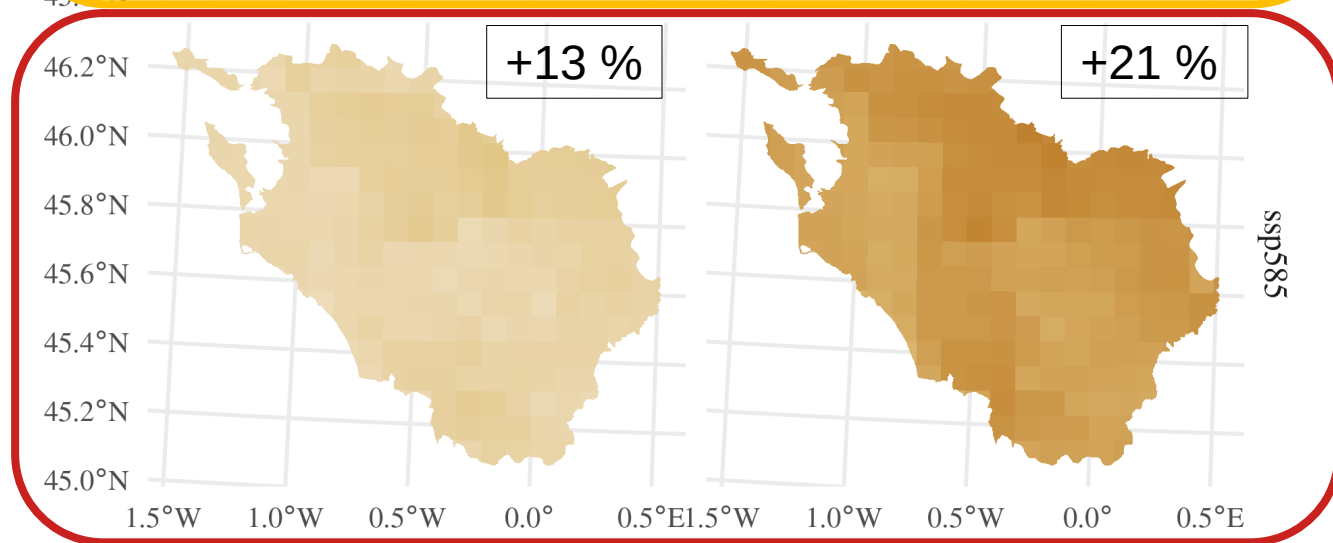
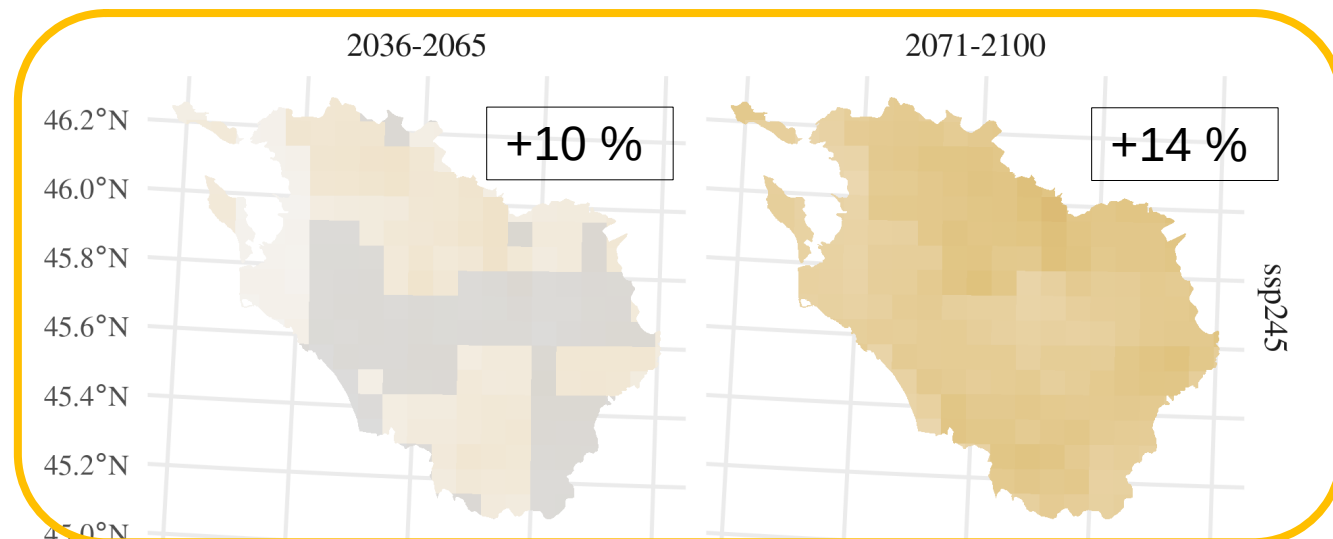
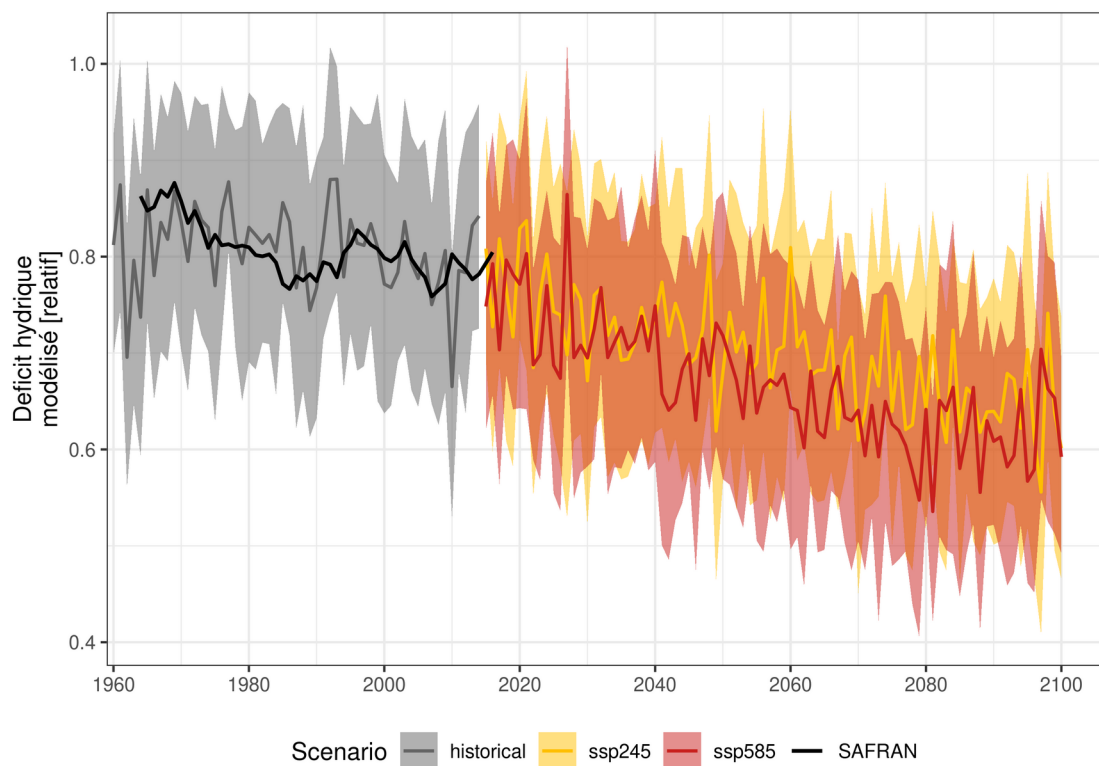
Evolution du déficit hydrique simulé entre floraison et maturité



-12 days

+11 days

# Modélisation du bilan hydrique de la vigne – projections futures

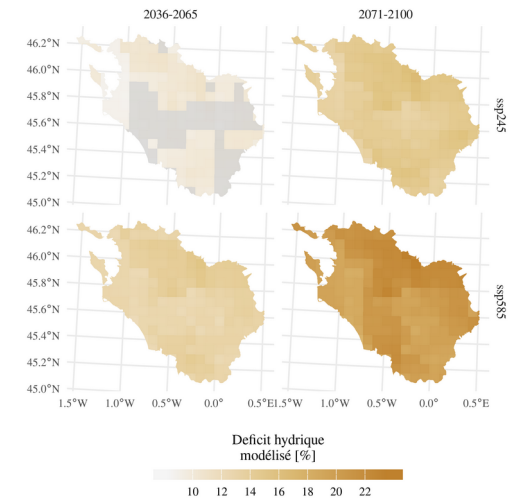
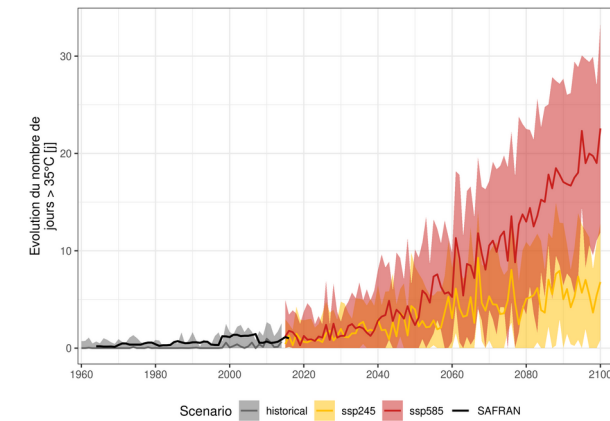
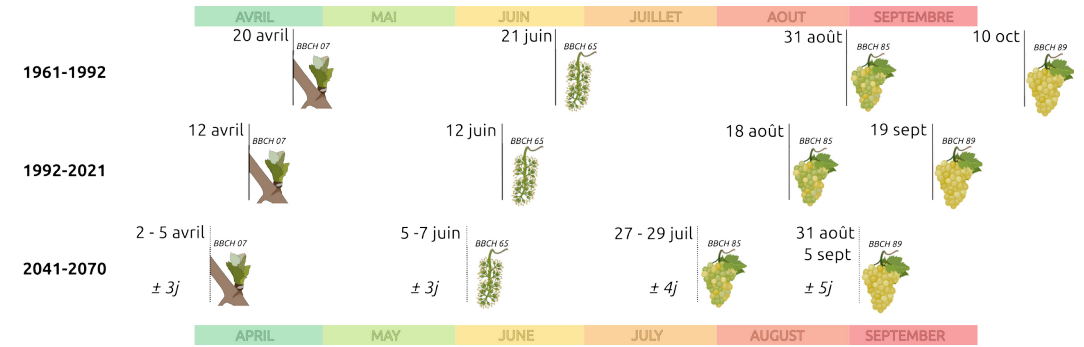


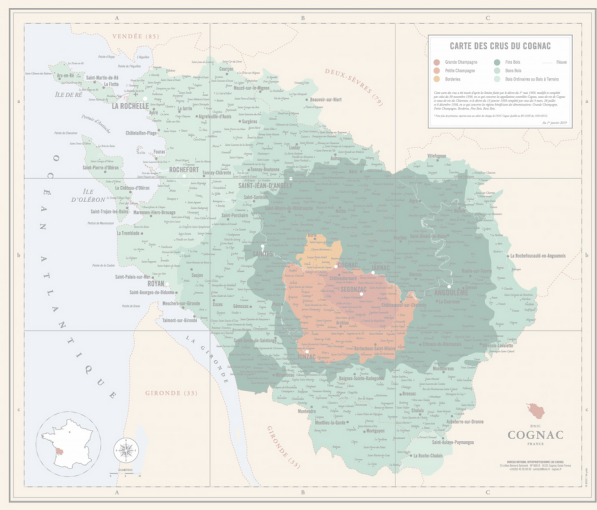
Deficit hydrique modélisé [%]



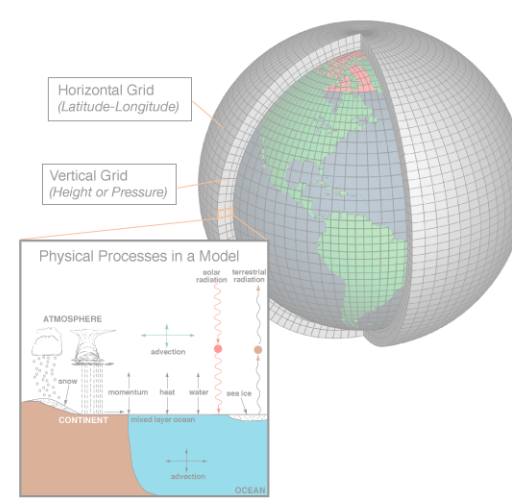
# Conclusion

- Phénologie : cycle de la vigne plus court et précoce sous l'effet de la hausse des températures.
- Risque Gel : Débourrement précoce maintenant un risque de gel printanier constant, malgré des hivers plus doux.
- Risque Échaudage : Augmentation marquée due au décalage de la maturation vers le cœur de l'été ; une menace croissante avec les projections futures.
- Stress Hydrique : Apparition de déficits hydriques, partiellement compensés par un cycle plus court. L'évolution future dépendra des trajectoires d'émissions de GES.






  
**Forum Météo & Viticulture Cognac**
  
*Maladies, ravageurs et modélisation*
  
**Lundi 26 janvier 2026 | 15h30**
  
 Espace Edmond & James Grégoire
   
 Grégoire Cognac, Châteaubernard



**Merci pour votre attention**

Sébastien ZITO – [sebastien.zito@inrae.fr](mailto:sebastien.zito@inrae.fr)

