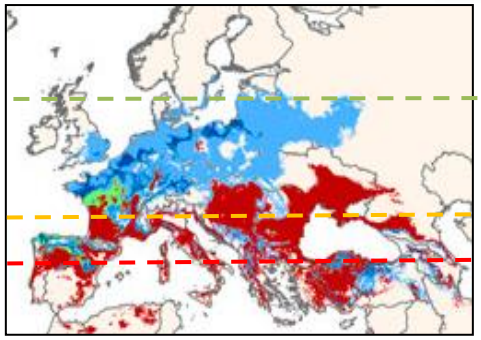
# Assessment of future climatic conditions in French vineyards. Consequences for defining adaptation strategies.

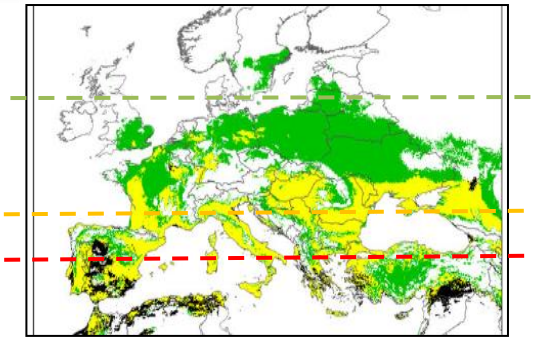
I. Garcia de Cortazar-Atauri, J. Caubel, H. Quenol, B. Bois, I. Chuine, E. Duchêne, R. Le Roux, A. K. Parker, C.Van Leeuwen, N. Ollat

# Context

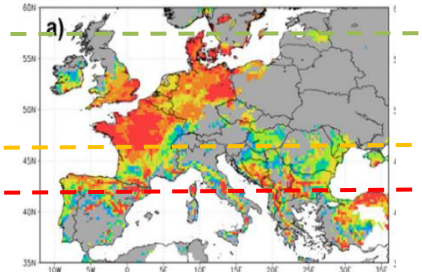
Several studies have provided maps about European vineyards situation in 2050



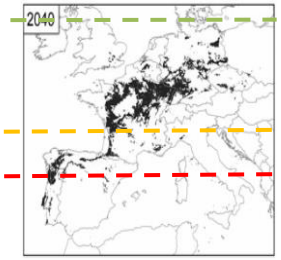
Hanna et al., 2013



Toth and Végvari 2015




Santos et al., 2013



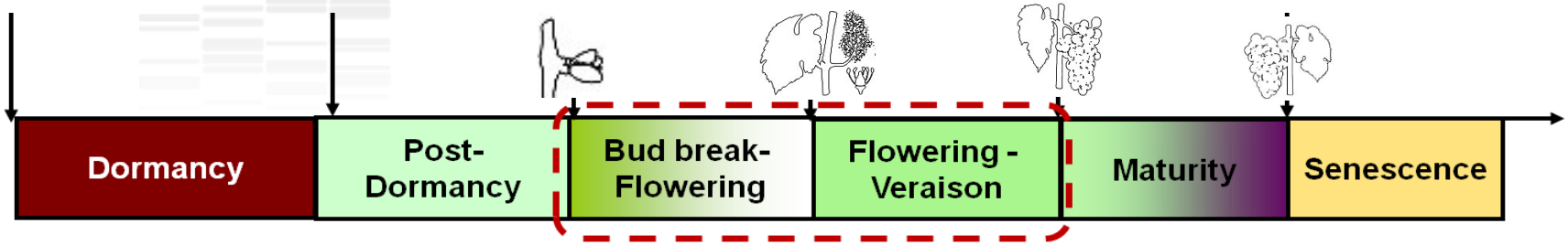

Moriondo et al., 2013

**Global analysis are useful** → they fail to define adaptation strategies at vineyard level

**Best tool**: **crop models** (see Fraga presentation using STICS) → however they consume too much data and resources (soil data, practices…)

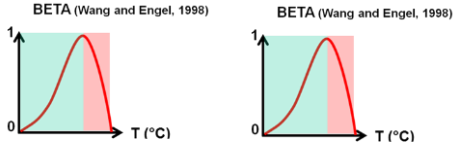
**Other strategies**: **ecoclimatic indicator analysis** → agroclimatic indicators calculated using phenology

# Methodology

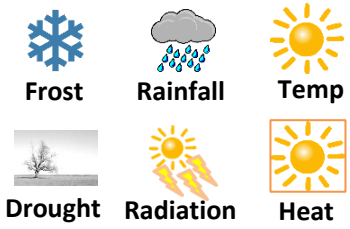


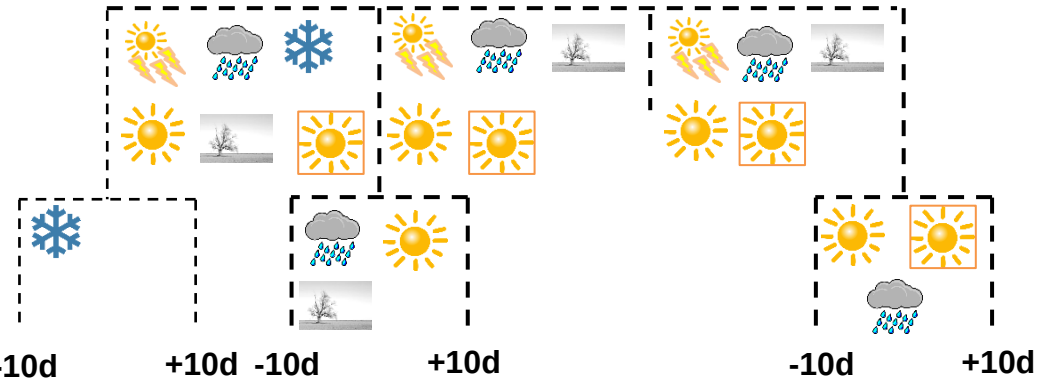

Cold Temp. — Hot Temperatures — Vendanges

**BRIN Model**
(Garcia de Cortazar et al., 2009)




**+ 35 d**




- CNRM – RCP 2.6, 4.5, 8.5
- 3 Périodes – [1970 – 2000], [2030-2060], [2070-2100]
- 199 Points (8km x 8km) – 19 vineyards
- 3 varieties: Chardonnay (early) – Syrah (medium) – Cabernet Sauvignon (late)
- 3 soils
- 60 indicators

# RESULTS

## some examples

# FRANCE

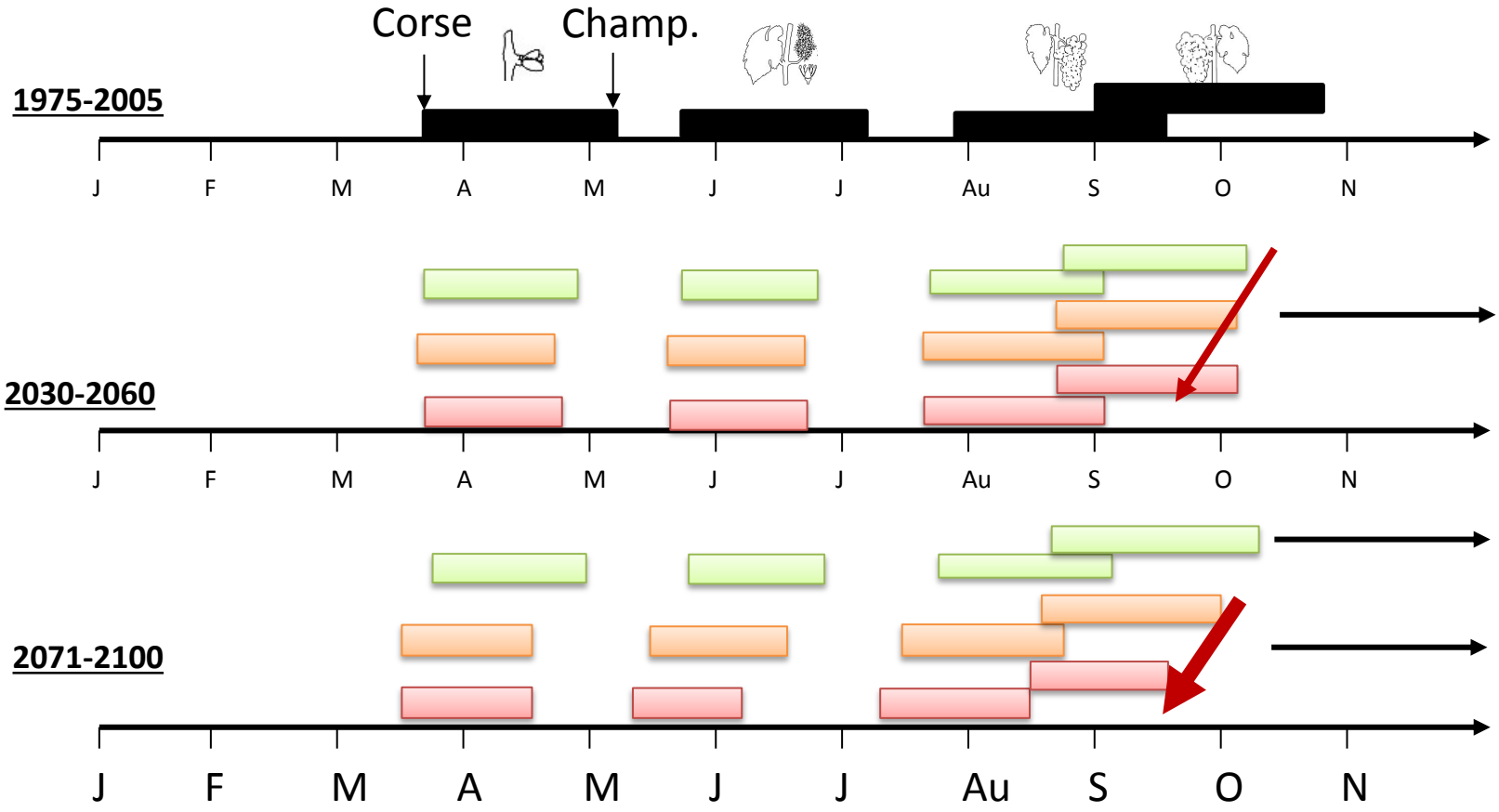
# Phenology

BB FL V H

# Methodology

Varieties: Chardonnay, Syrah, Cabernet Sauvignon
GCM: CNRM x 199p

Scenarios **2.6** **4.5** **8.5**




## Advance

-12 days N
-7 days S

-12 days N
-6 days S

-30 days N
-18 days S

# Champagne

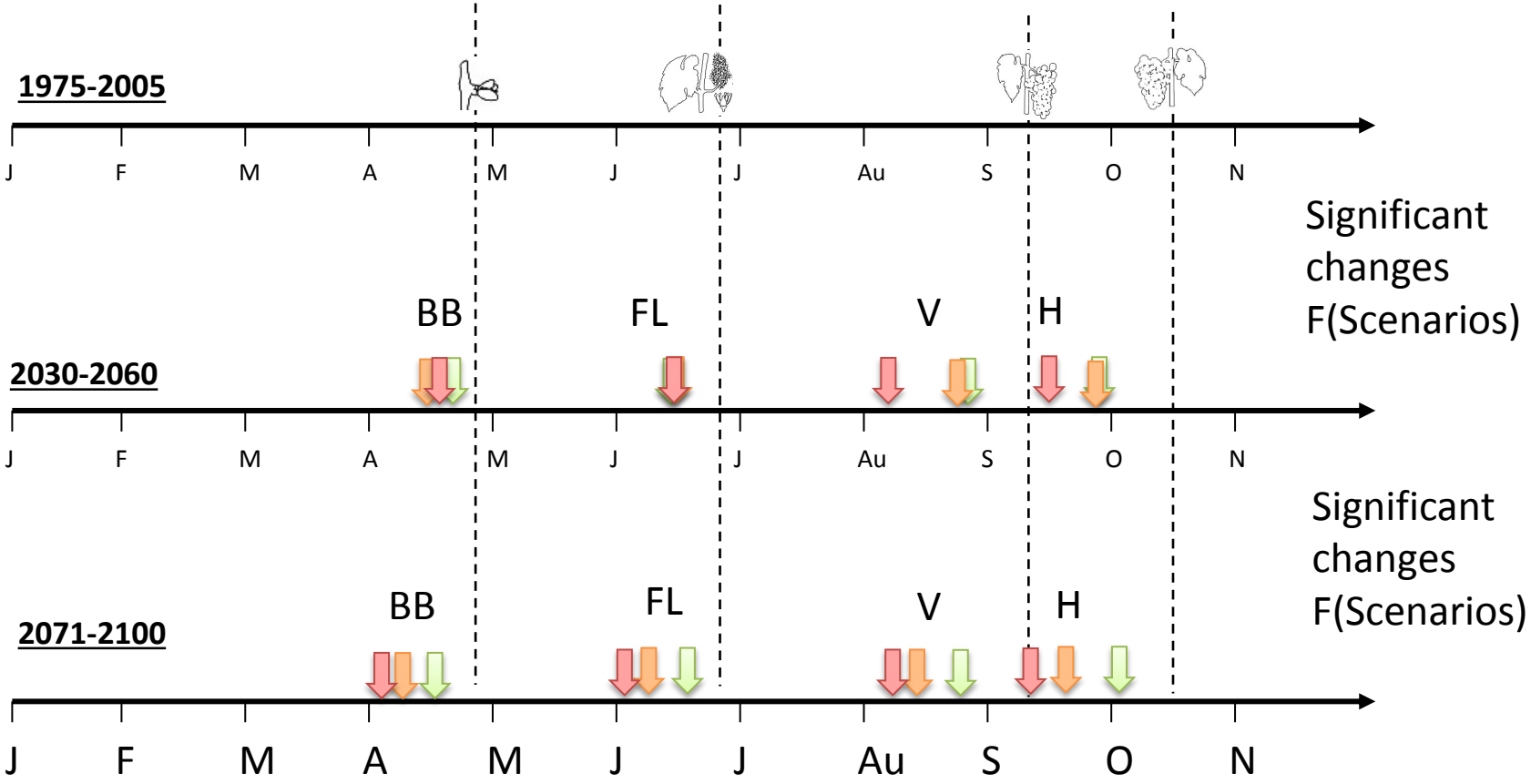
# Phenology

BB FL V H

# Methodology

Early Variety: Chardonnay
GCM: CNRM x 9p

Scenarios **2.6** **4.5** **8.5** **All**



## Bordeaux

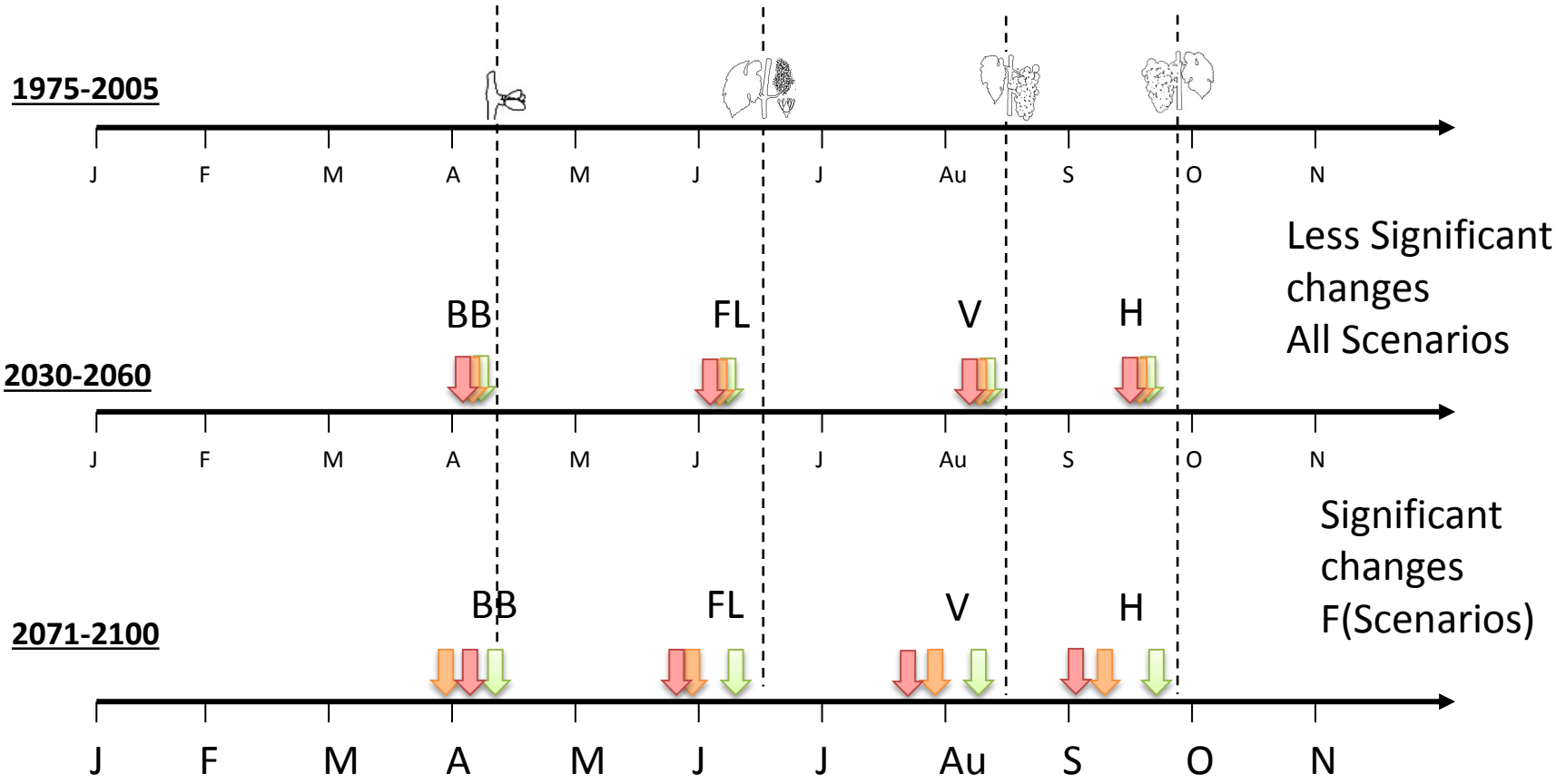
## Phenology

BB FL V H

## Methodology

Late Variety: Cabernet Sauvignon
GCM: CNRM x 25p

Scenarios **2.6** **4.5** **8.5** **All**



# Languedoc

# Phenology

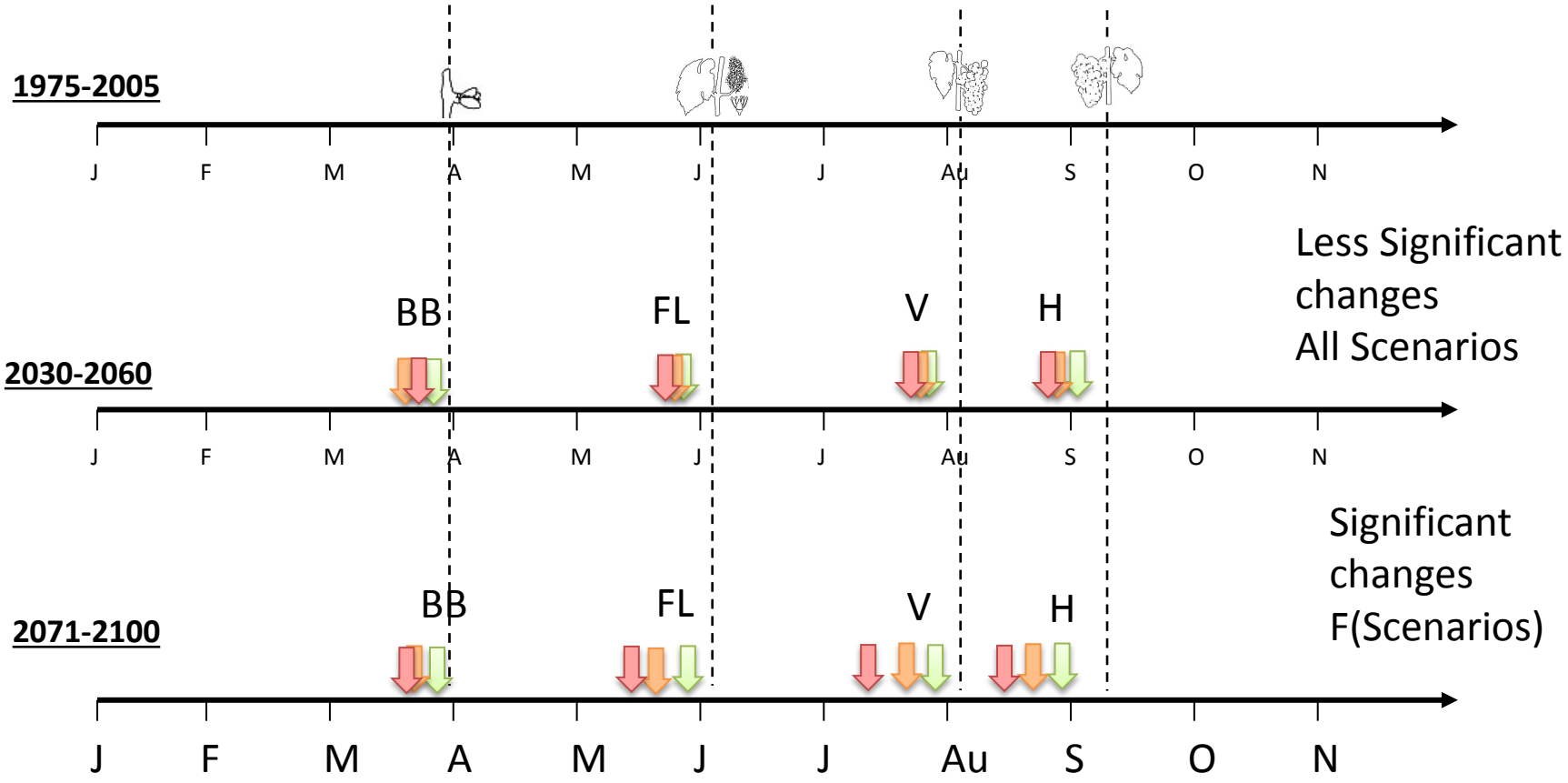
BB FL V H

# Methodology

Medium Variety: Syrah
GCM: CNRM x 26p

Scenarios **2.6** **4.5** **8.5** **All**

**Drought**



# Those changes in phenology…

# How can they impact agroclimatic conditions?

# Champagne

# Phenology

BB FL V H

# Methodology

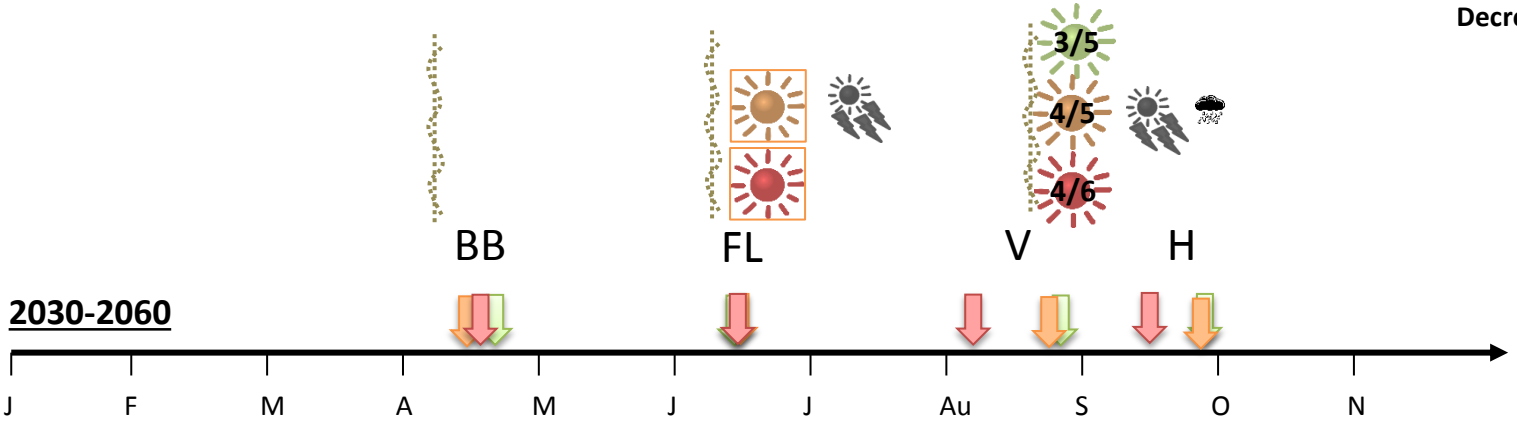
Early Variety: Chardonnay
GCM: CNRM x 9p

Scenarios **2.6** **4.5** **8.5** **All**

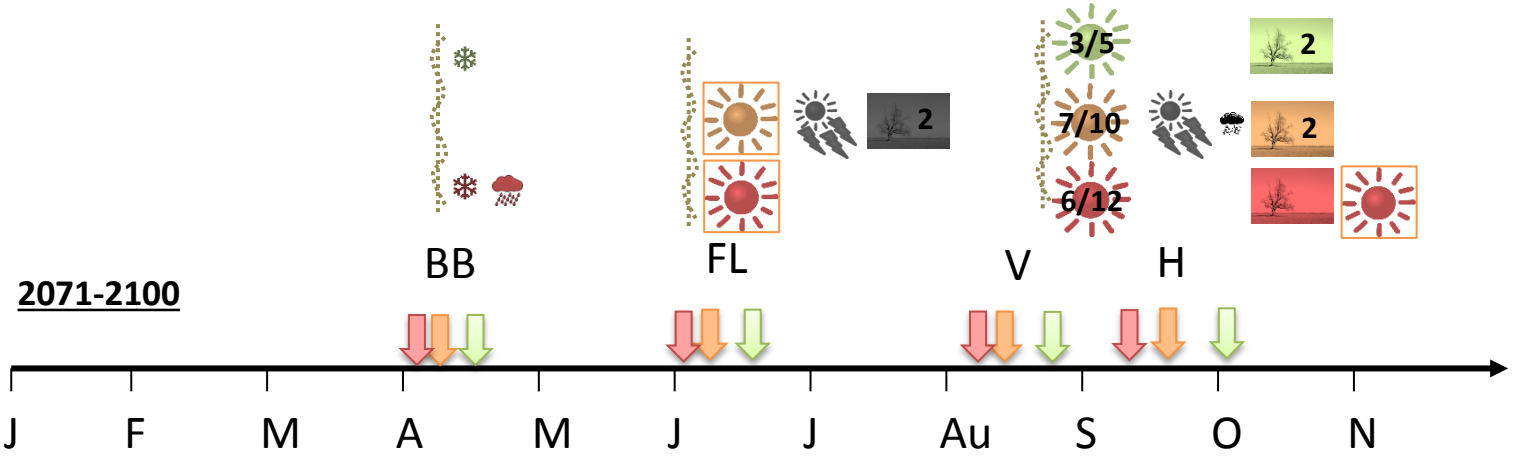
# Indicators

Frost Rainfall Temp
Drought Radiation Heat

**Trend**
Decrease ❄ Increase




Temperature




Temperature
Soil Water
Conditions
(soil dependent)

## Bordeaux

## Phenology

BB FL V H

## Methodology

Late Variety: Cabernet Sauvignon
GCM: CNRM x 25p

Scenarios **2.6** **4.5** **8.5** **All**

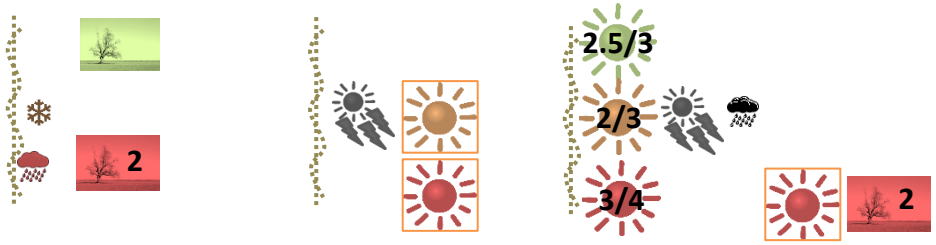
## Indicators

Frost Rainfall Temp

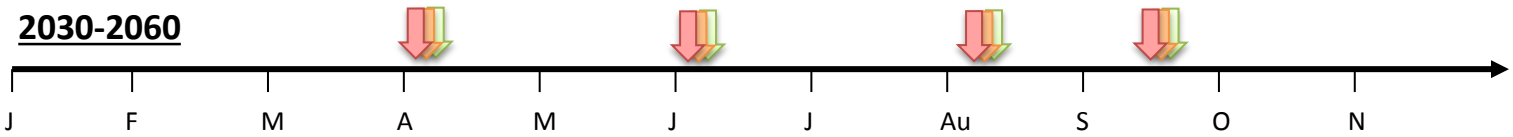
Drought Radiation Heat

**Trend**

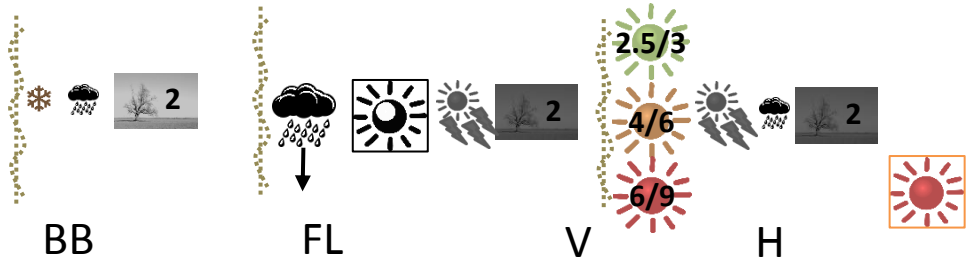
Decrease ❄ Increase



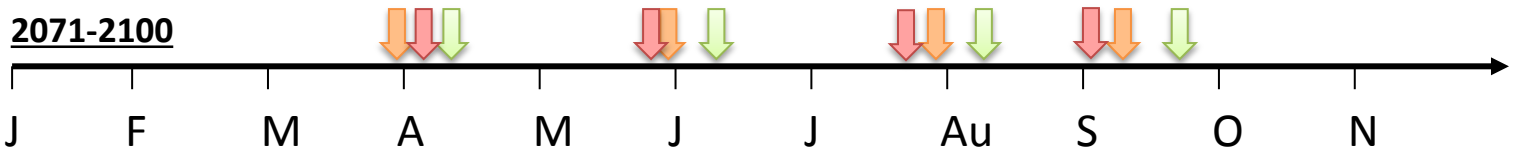

**2030-2060**




Temperature
Heat shock…
Dry conditions




**2071-2100**




Big changes
Temperature
Heat shock…
Dry conditions

# Languedoc

# Phenology

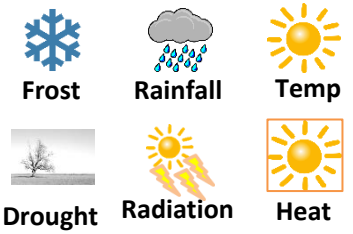
BB FL V H

# Methodology

Medium Variety: Syrah
GCM: CNRM x 26p

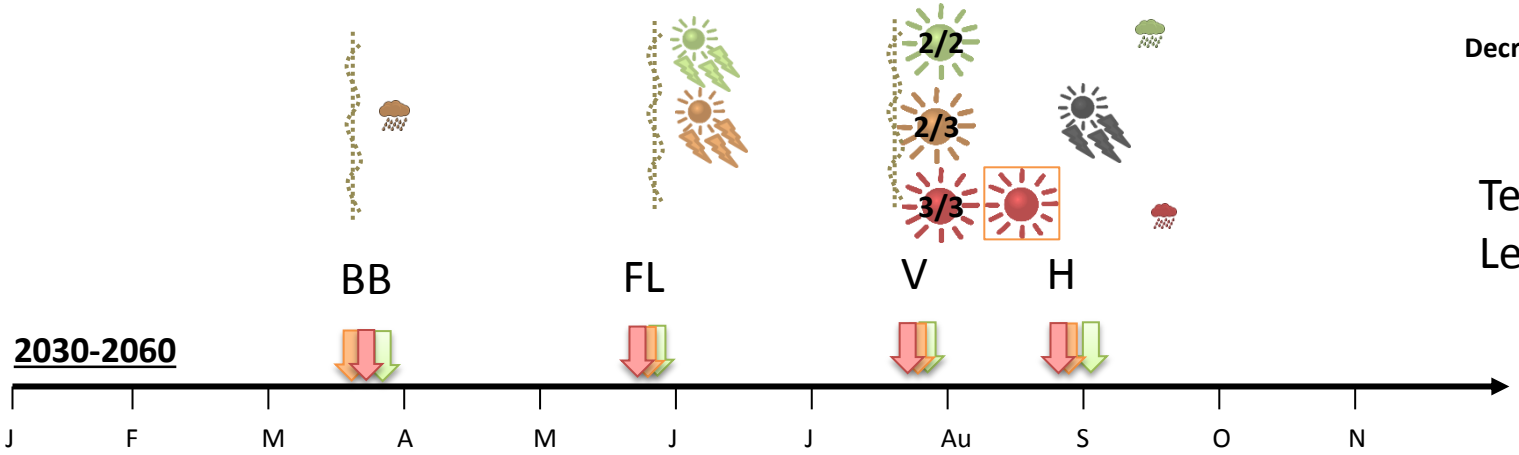
Scenarios **2.6** **4.5** **8.5** **All**

# Indicators

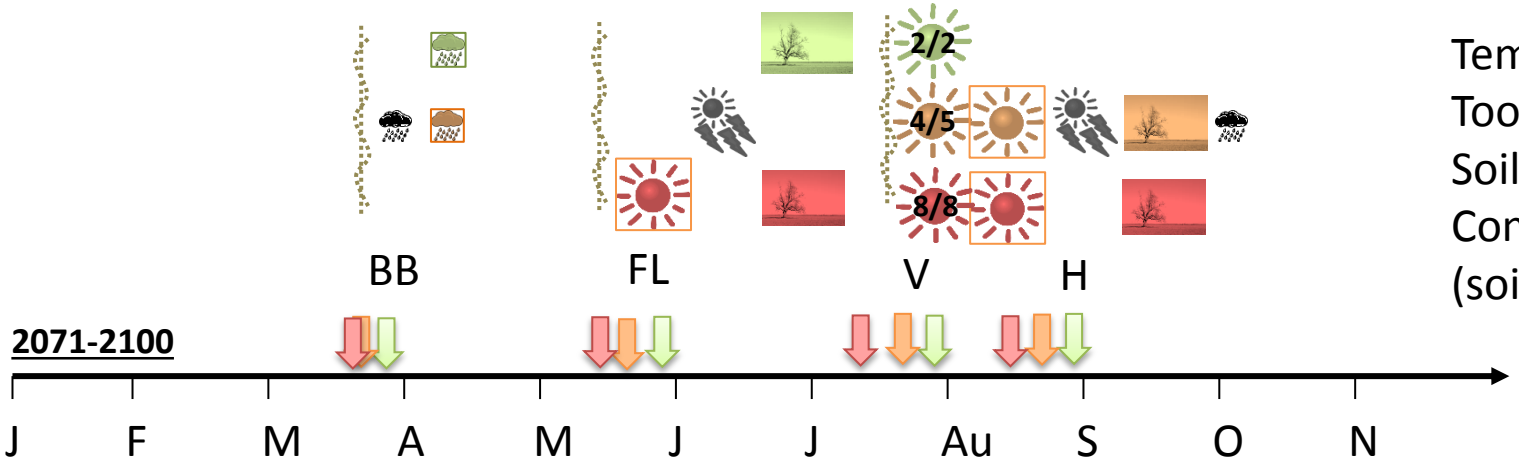



**Trend**

Decrease ❄ Increase




Temperature
Less rain in summer




Temperature
Too warm conditions
Soil Water
Conditions
(soil dependent)

# Conclusions

## Phenology

- Horizon 2050
  - All stages advance → more in Northern V than Southern V
  - No big difference between scenarios

- Horizon 2100
  - Scenario RCP 2.6 – no significant changes compared with 2050
  - RCP 4.5 et 8.5 are similar → significant changes

# Conclusions

## Climatic conditions

- Horizon 2050
  - Increase temperature maturity → 2°C – 5°C
  - Some Problems with Heat shock (days temperature > 37°C)
  - Some problems – Water deficit (no generalized)
  - Increase of radiation – efficiency??

- Horizon 2100
  - Big changes in many vineyards
  - Decrease frost risk / increase winter drought
  - Widespread problems at maturity:
    - Heat shock (days temperature > 37°C)
    - Water deficit → soil type
    - Temperature maturity → RCP4.5 /8.5 → +5-12°C
    - Increase of radiation – efficiency??

# Conclusions

## Adaptations (regional / local)

- Horizon 2050
    - High temperatures→ change to late varieties– i.e. Northern vineyards (Tmax decrease 2°C)
    - Water deficit → plot choice, rootstock – irrigation use not always clear
    - Training system can be optimized (soil burn!)

- Horizon 2100
    - Big changes if RCP 4.5 /8.5 scenarios happen
        - Phenology is not able to change everything
        - Training system can help to limit → heat / water problems
        - Better internal re-organization of vineyards
        - Irrigation in some situations can be necessary (water resource?)

# Thank you !