

Low winter chill + reduction of fog

Tree temperature \approx Air temperature



**Chill calculations
Management**

Tree temperature $>$ Air temperature



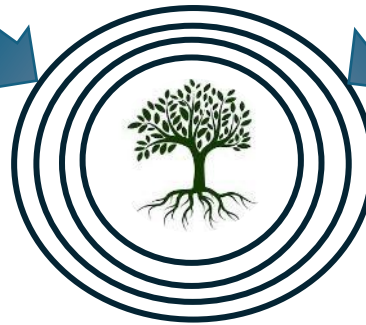
Objectives and hypotheses

FUNDAMENTAL

Improve the accuracy of chill estimation calculations

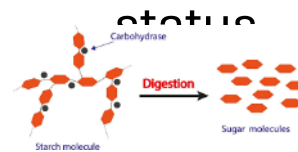
Meteorological approach

Physiological approach



Tree temperature as predictor of chill accumulation

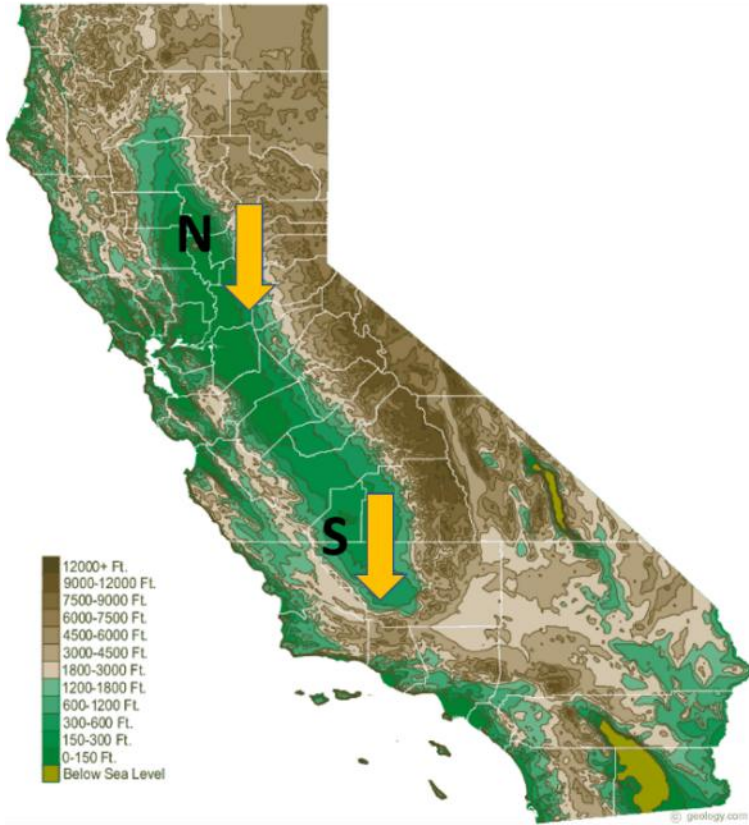
Non-structural carbohydrates as biomarkers of dormancy status



MANAGEMENT

Improve climate change mitigation strategies

Methods



Historical chill portion (CP)
accumulation: 70 (S) – 80 (N)

3 orchards, 3 years



Tree bark temperature



Orchard micro-climate



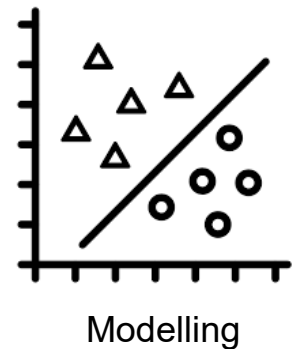
Macro-climate



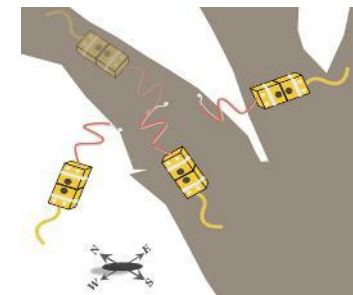
Phenology



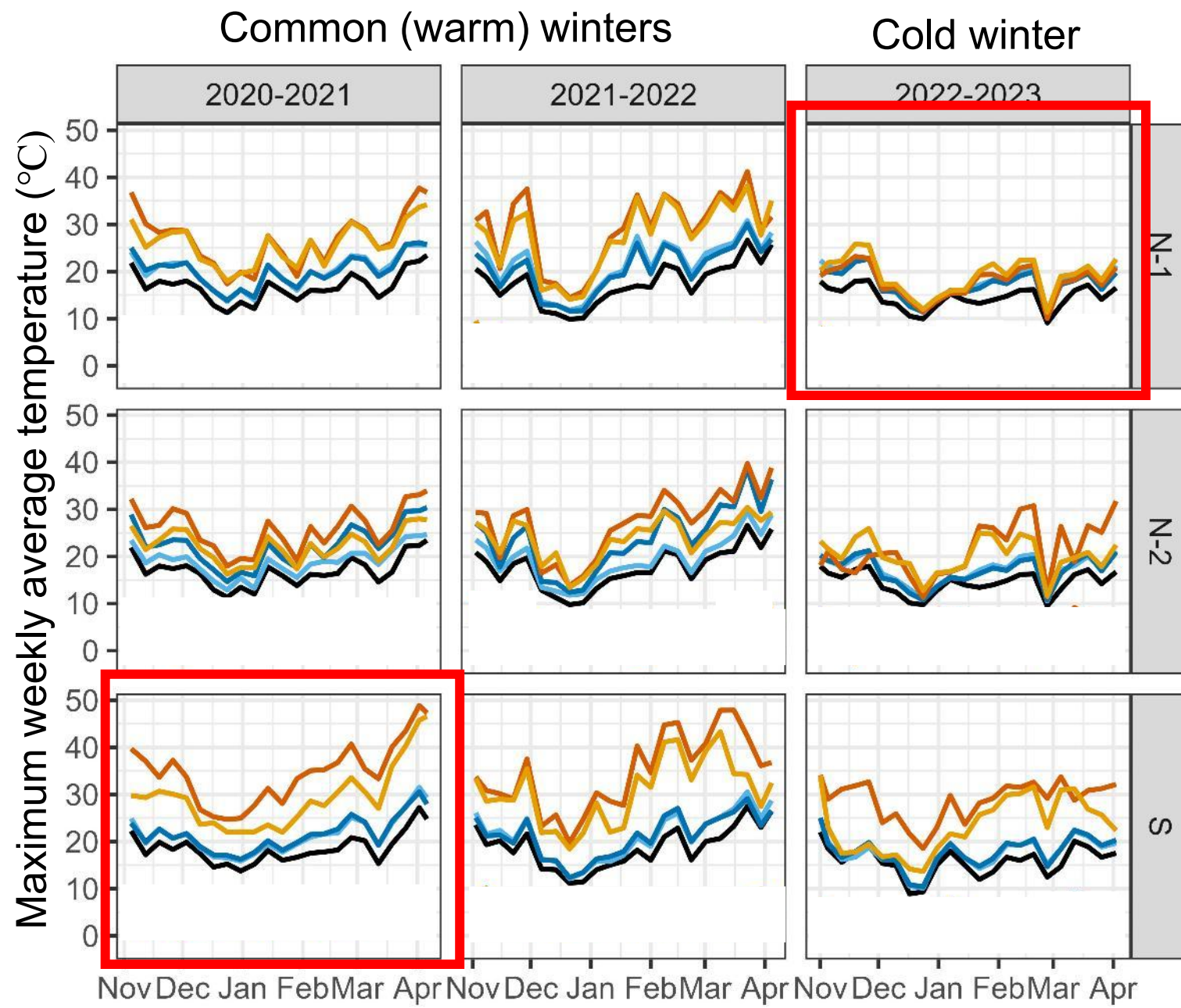
NSC sampling

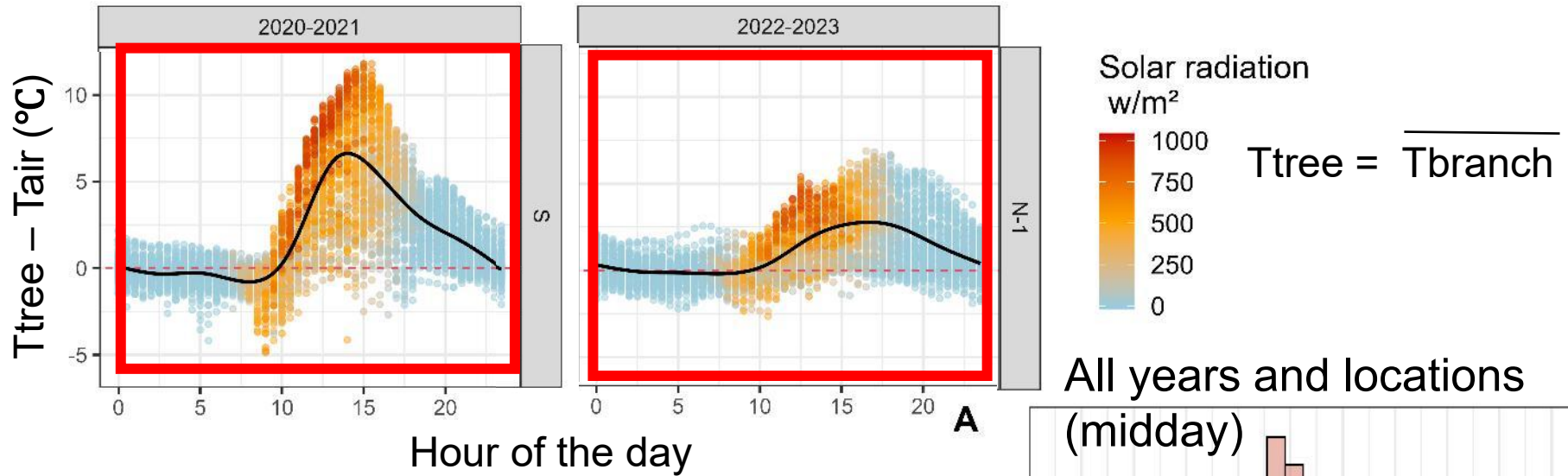


Results

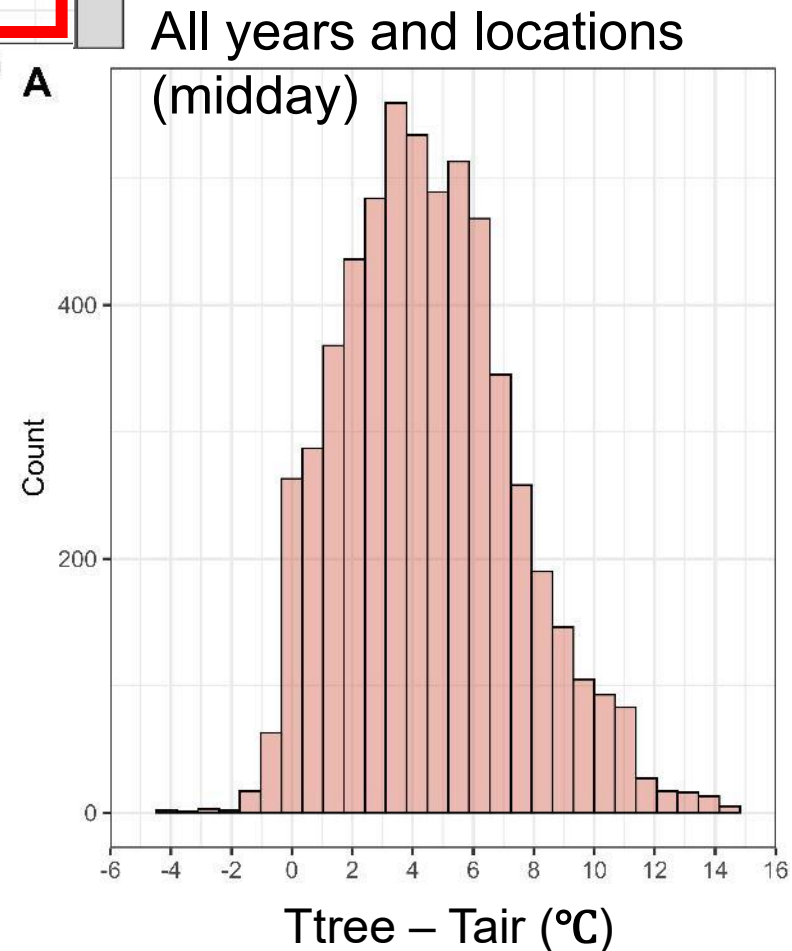


T branch





- ‘Tree temperature’ is affected by various weather variables, including solar radiation
- **‘Tree temperature’** is, on average, **3-7 °C higher** than ‘Air temperature’

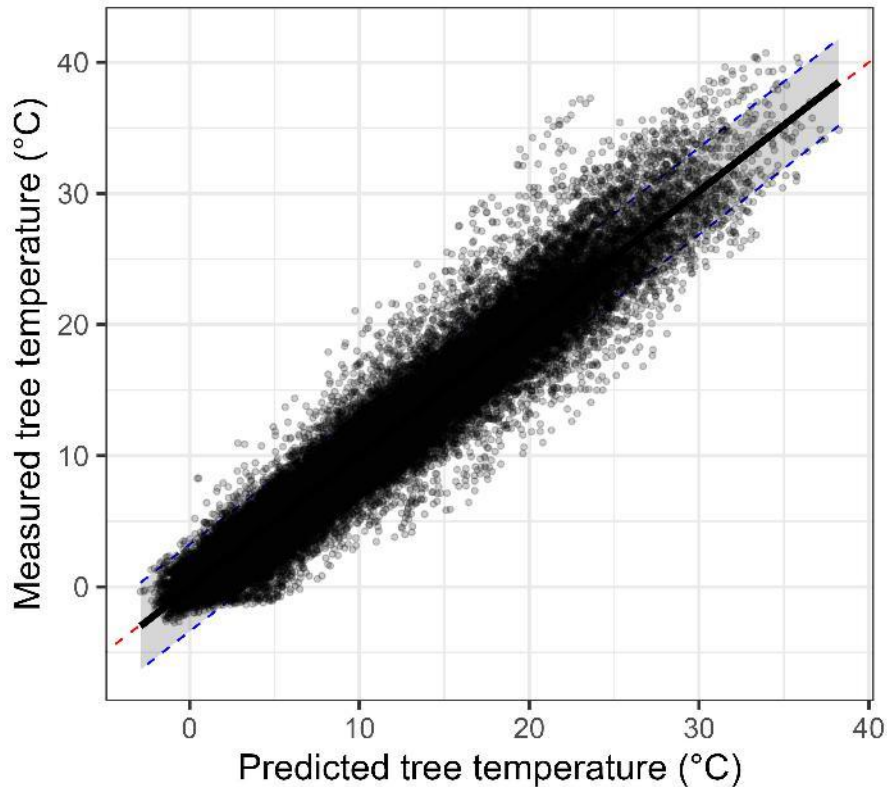


The *TreeChill* model

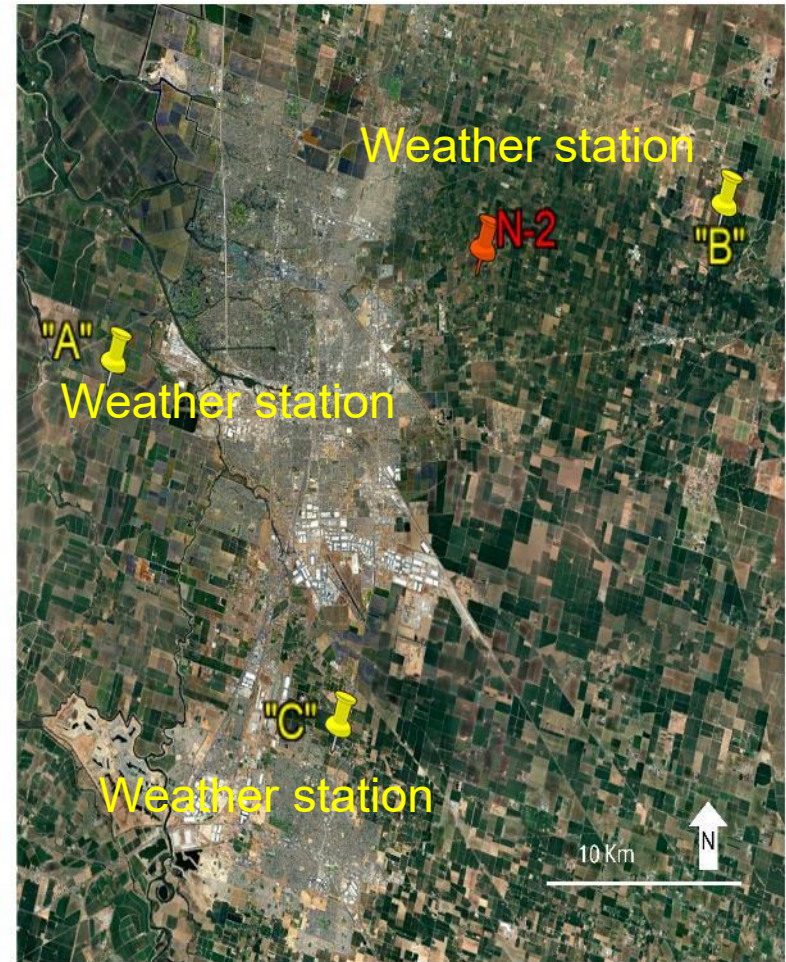
Cherry Chill Shiny App

<https://ucanr-igis.shinyapps.io/cherrychill/>

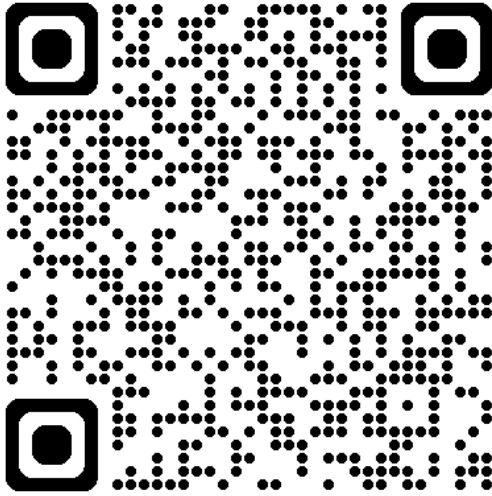
Predicts 'Tree temperature' from public weather data



Test.data	RMSE.test	RMSE.train	R2.test	R2.train
N1	1.941	1.471	0.937	0.962
N2	1.526	1.631	0.956	0.956
S	2.406	1.416	0.917	0.961



Objective 4: Developing an on line calculator for the TreeChill accumulation



Tree Chill Calculator for Cherry

[Compute Chill](#) [More Info](#) [Contact Us](#)

Introduction

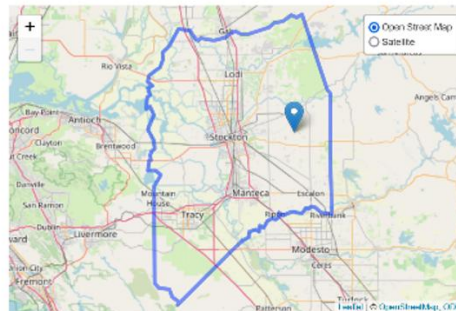
Accumulated winter chill is an important measure for cherry and other tree crops because it predicts when the trees are likely to bloom in the spring. This calculator computes accumulated chill portions for a specific location using the i) traditional air temperature method as well as ii) a new "bark temperature" method. For details see the 'More Info' tab.

Caveats

- This prototype calculator only works for San Joaquin County (which is where the field work for the new method was conducted). Eventually, the area supported will cover additional cherry growing areas of California.
- This calculator only works with the 2023-2024 growing season.
- This calculator is still under development and should not be used for orchard management decisions.

1. Select location

Only locations in San Joaquin County are currently supported.



Coordinates:

-121.05927, 37.96831

2. Select crop year

The web app will only show chill for a single crop year. Researchers who want to compute chill for multiple years can use the R package.

2023

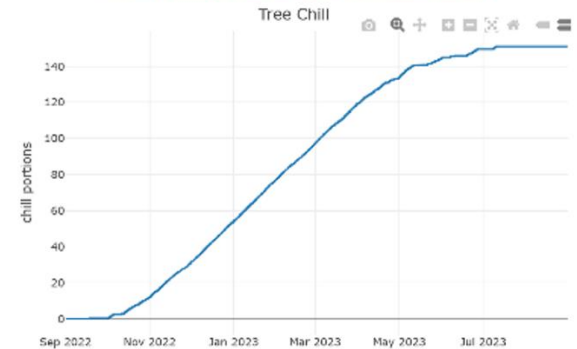
3. Select chill portion thresholds

The idea here is to allow the user to enter one or more accumulated chill portions to highlight in the results (i.e., with a vertical line in the plot, with a red font in the table. But only if that would be useful)

Calculate

Results

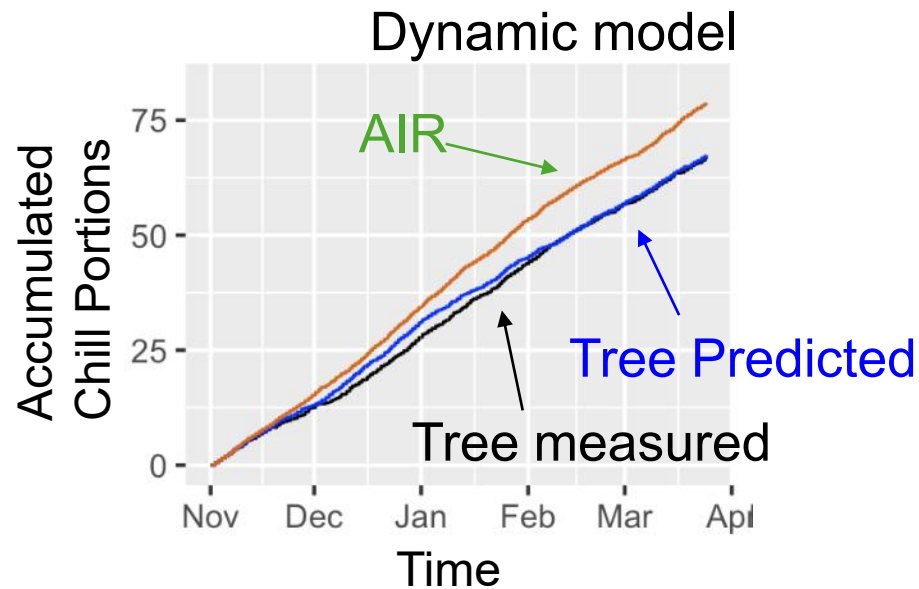
Note: The following are real data, but not for the selected location.



Still to come:

- A second line on the plot showing the traditional chill portions
- A button to download the data as an Excel file

Application - Chill accumulation calculations

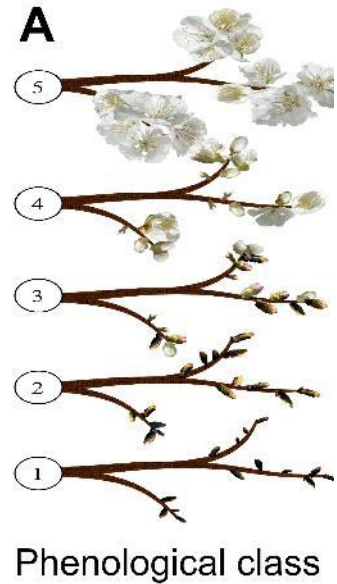


The 'Chill_tree' is **~10 CP lower** than the 'Chill_Air'

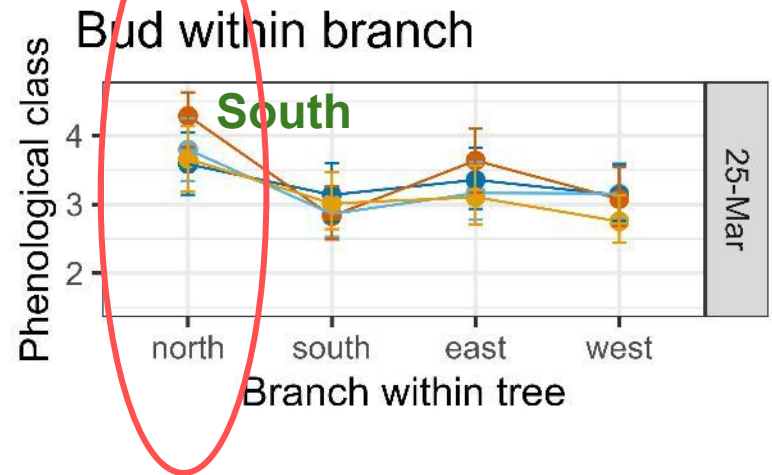
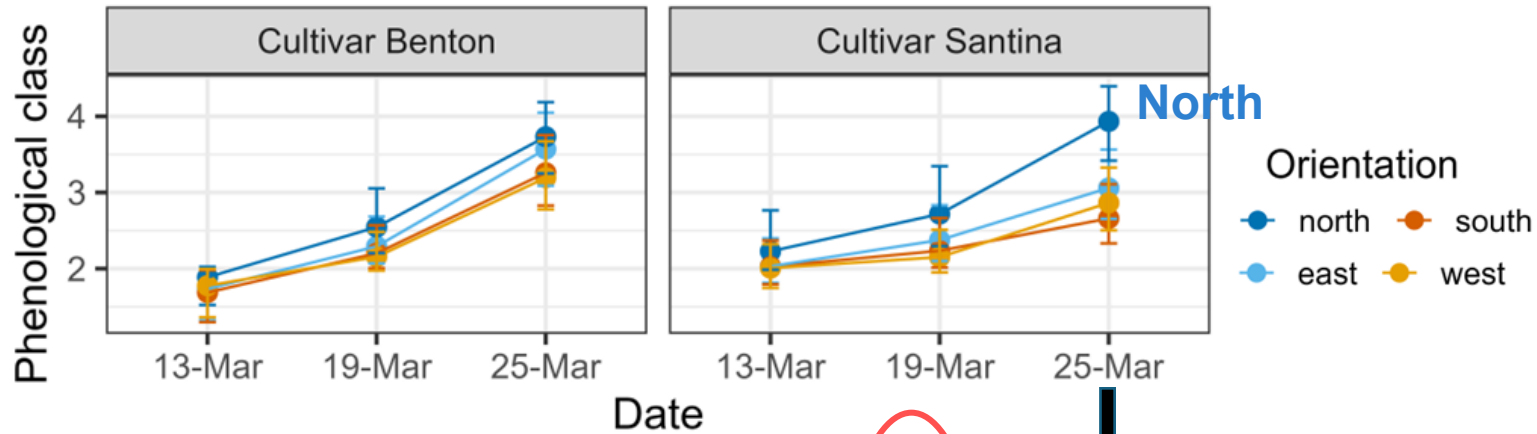
Orchard	Year	S	N	E	W	T _{tree}	pT _{tree}	T _{air}
N-1	2020-2021	58.9	67.5	65.0	59.5	62.6	62.9	71.4
	2021-2022	58.2	64.8	63.5	57.4	59.0	60.7	73.1
	2022-2023	69.2	70.9	68.4	67.2	68.7	71.5	78.3

'Tree chill' calculator: <https://ucanr-igis.shinyapps.io/cherrychill/>

Phenology



B Branch within tree



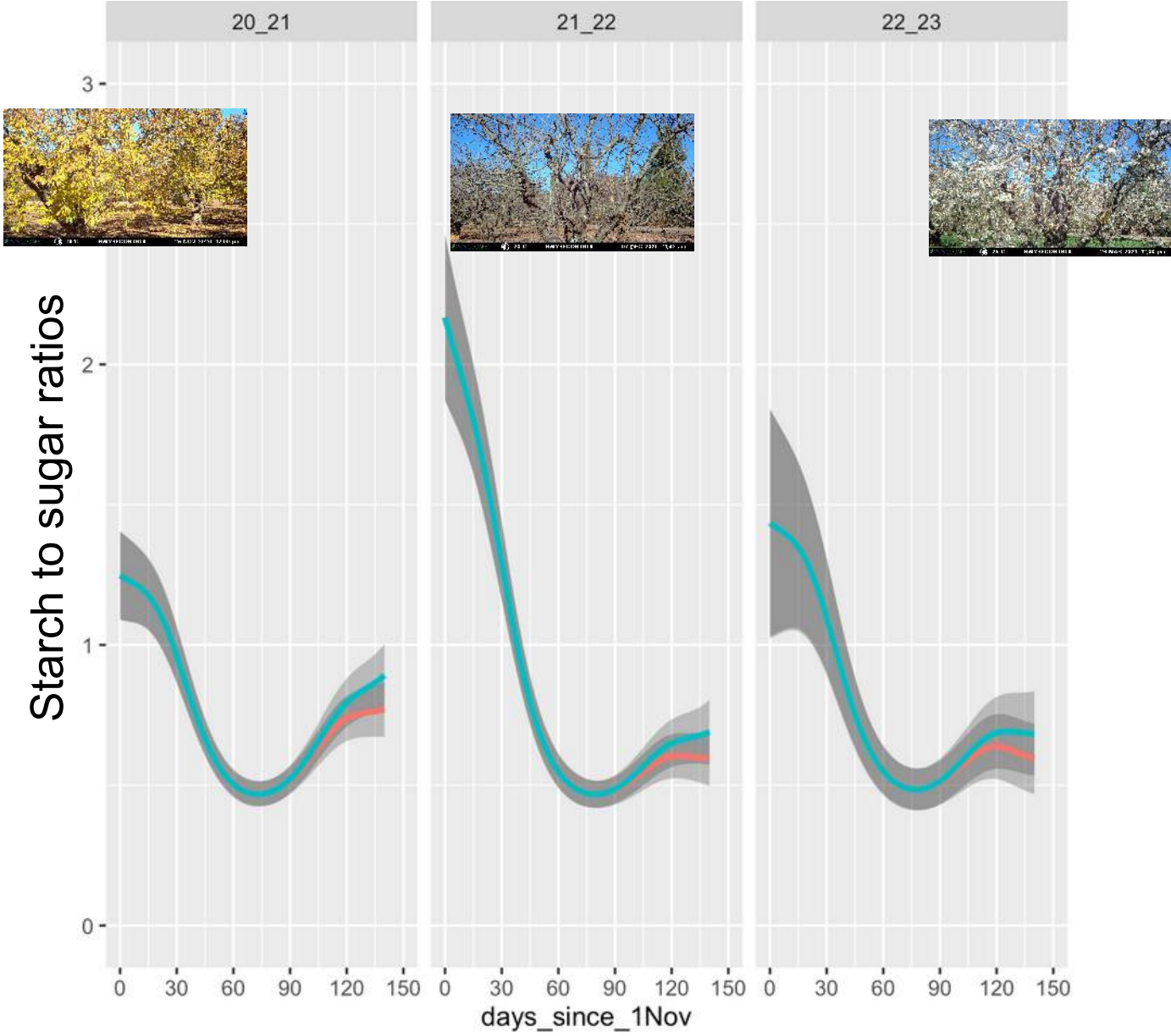
Buds located in the **south** of the **north** branches bloom first:

1st Colder branch orientations – chill accumulation

2nd Warmer bud orientations – heat accumulation

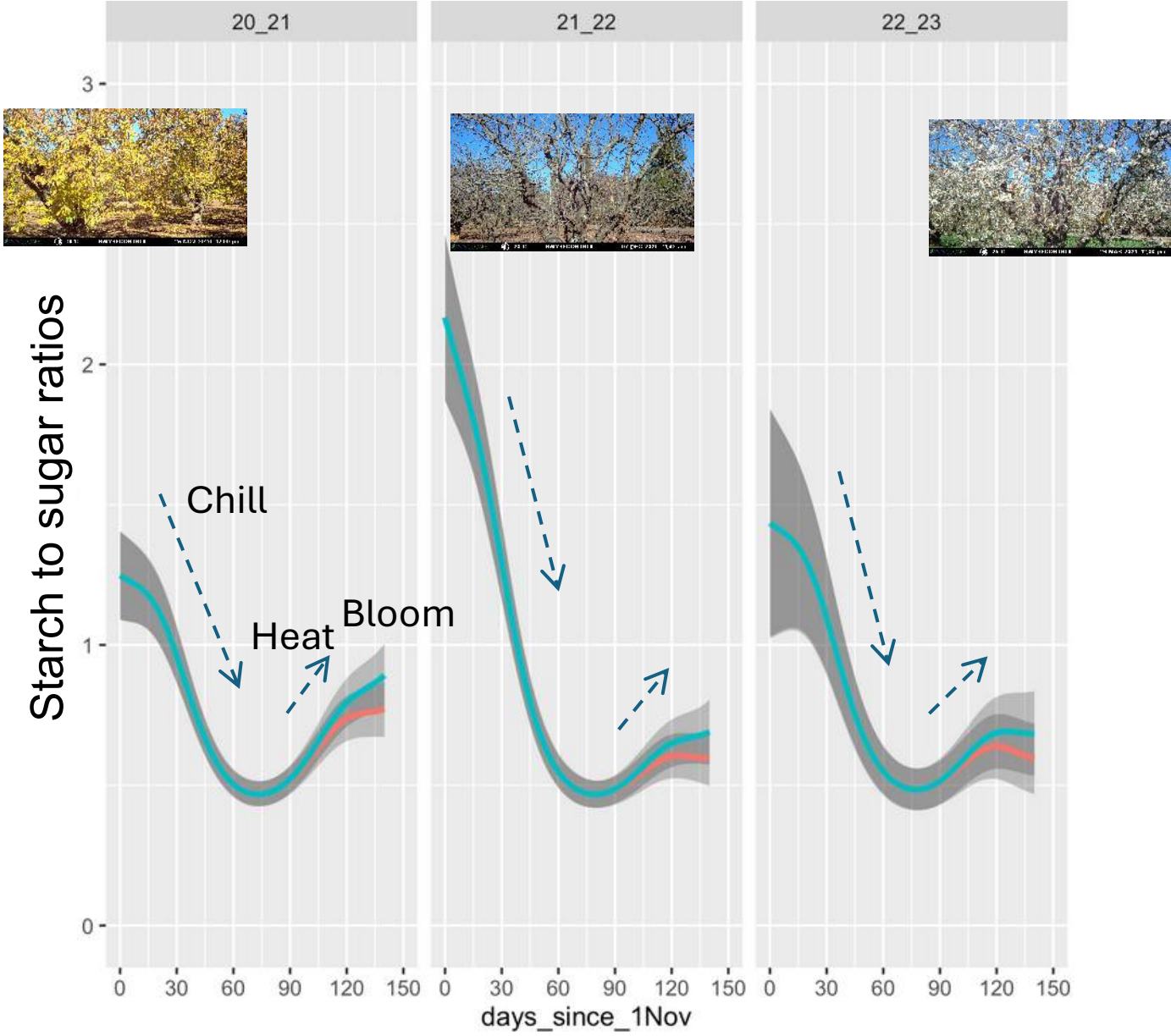
Non-structural carbohydrate dynamics

All orchards

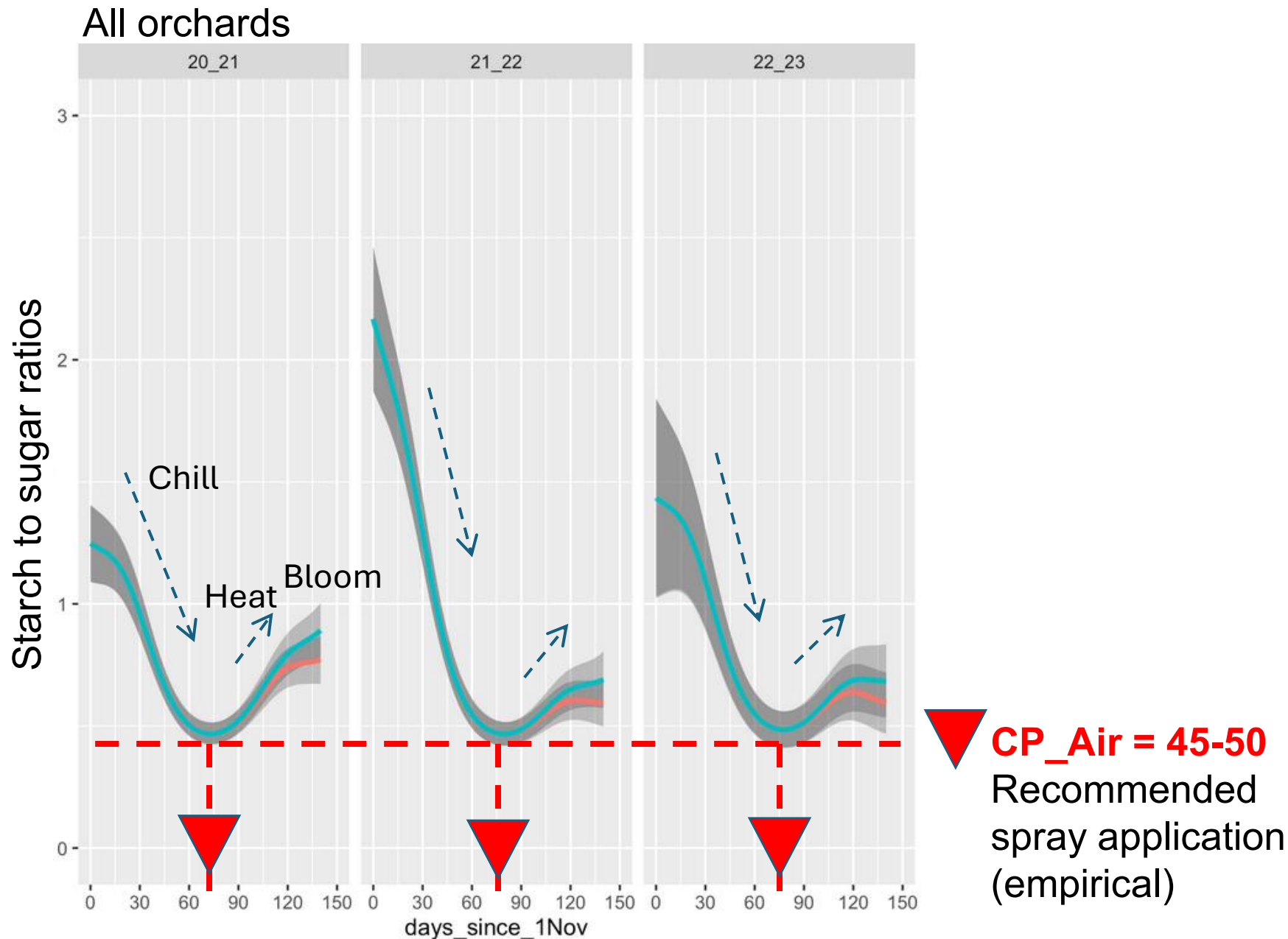


Non-structural carbohydrate dynamics

All orchards



Non-structural carbohydrate dynamics



Applications and outcomes

- Better understanding of the mechanisms of chill
- Improve management: Dormancy breaking agent (DBA) timing, pest modeling, cultivar selection, orchard design, etc.

Next steps

- Timing DBA application based on '*TreeChill*' and NSC
- Apply an energy balance approach to the '*TreeChill*' model to adapt it to different locations
- Integrate whole-tree temperature dynamics