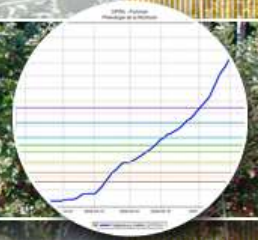




Agriculture et
Agroalimentaire Canada

Agriculture and
Agri-Food Canada



CIPRA: using real-time weather information to forecast crop phenology, insects, diseases and physiological disorders

Dominique Plouffe and Gaétan Bourgeois

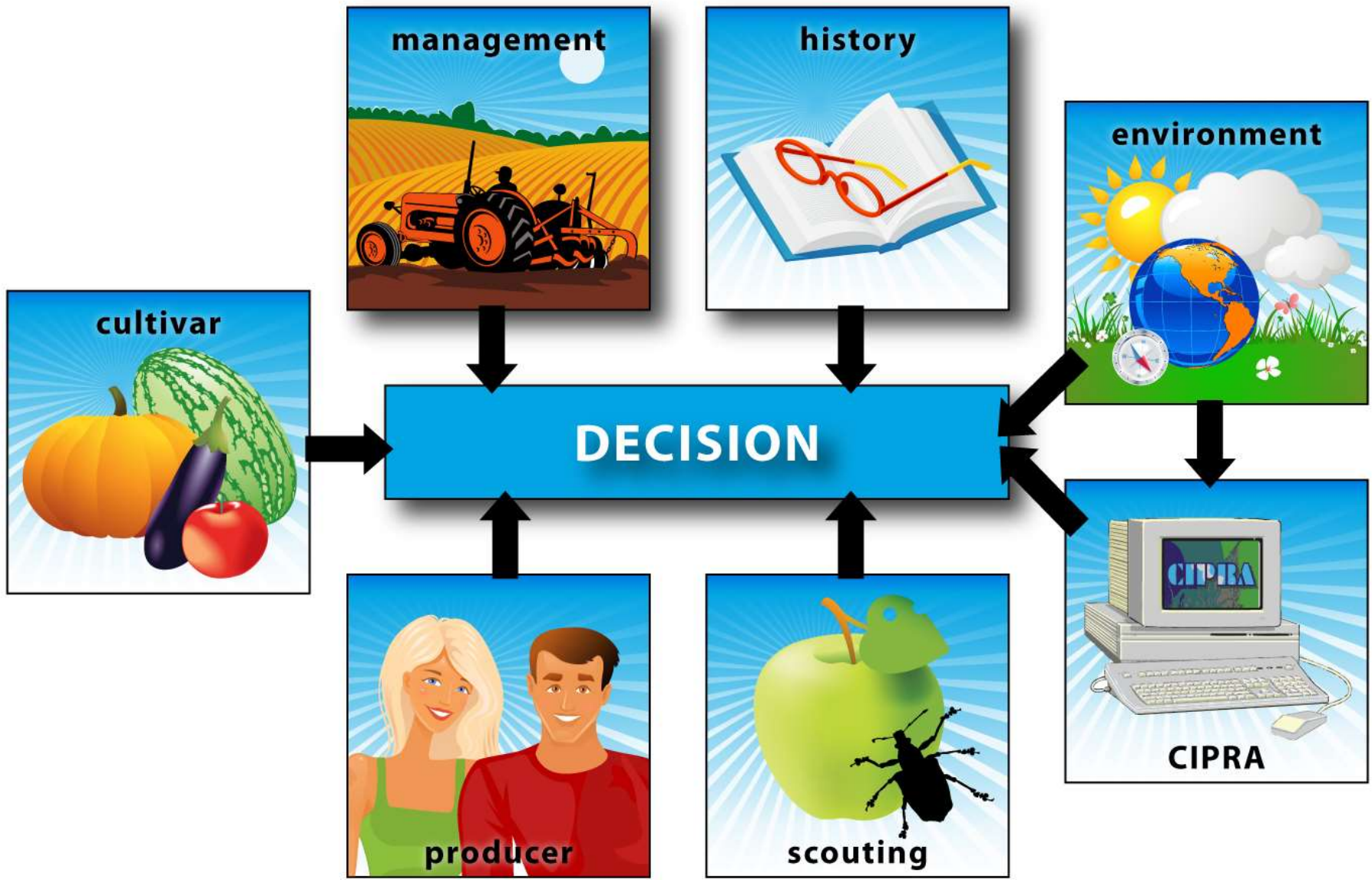
Horticulture Research and Development Centre, Saint-Jean-sur-Richelieu, QC

Canada

Presentation

- **What is CIPRA?**
- **Source of weather data**
 - Observations
 - Forecasts
 - Normals
- **Meteorological module**
- **Bioclimatic models in fruit crops: some examples**
- **Conclusion**





Computer Centre for Agricultural Pest Forecasting



1
9
9
4



2
0
1
5



>100 Bioclimatic models and indices → ~25 Crops

Tair, Tsoil, RH, Wind,
SolRad, Precip

Tair, RH, Precip (%prob.),
Cloud Cover, Wind

Tmax, Tmin, Precip

**Weather
observations
(hourly)**

**Weather
forecasts
(hourly)**

**Climate
normals
(daily)**

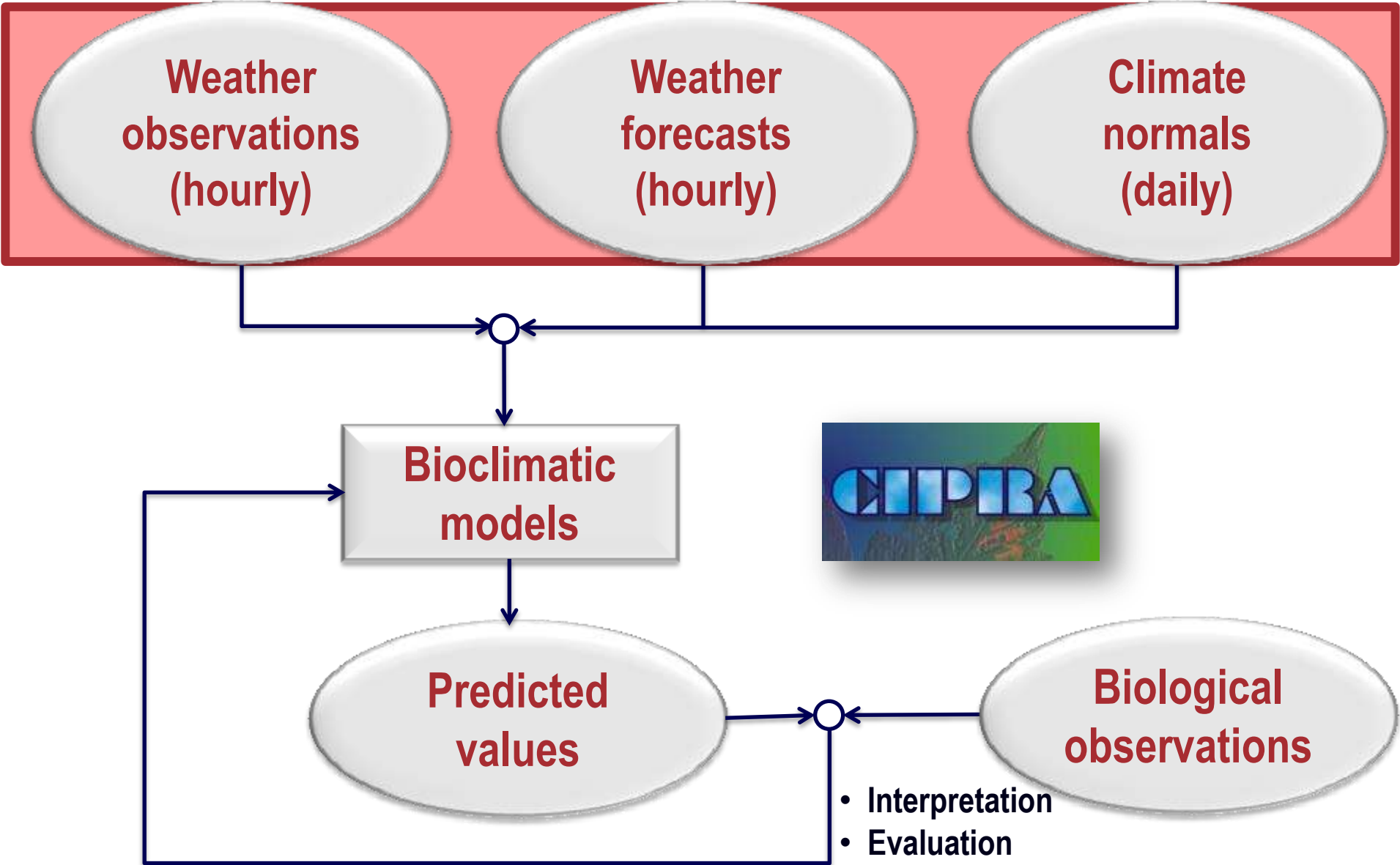
**Bioclimatic
models**



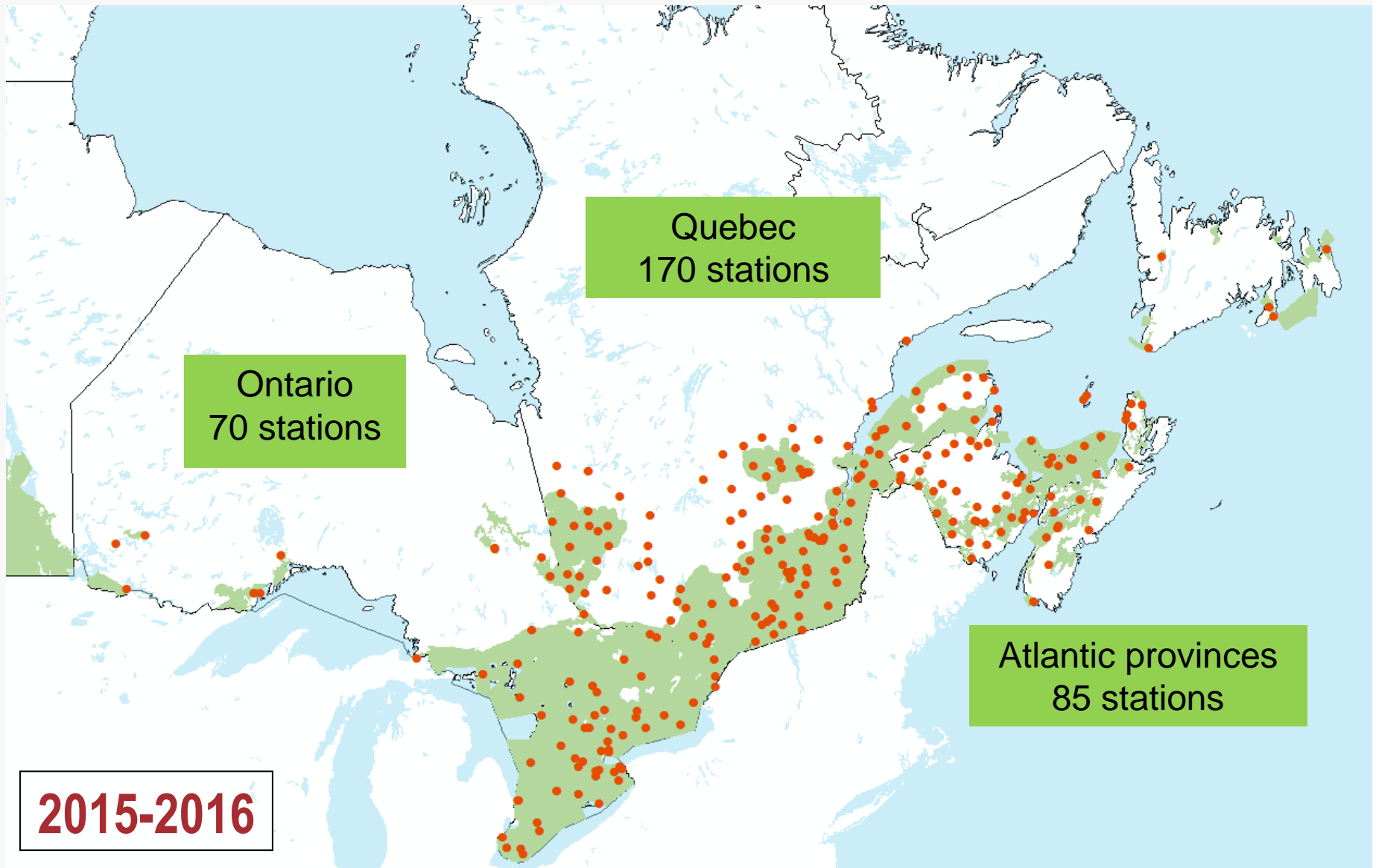
**Predicted
values**

**Biological
observations**

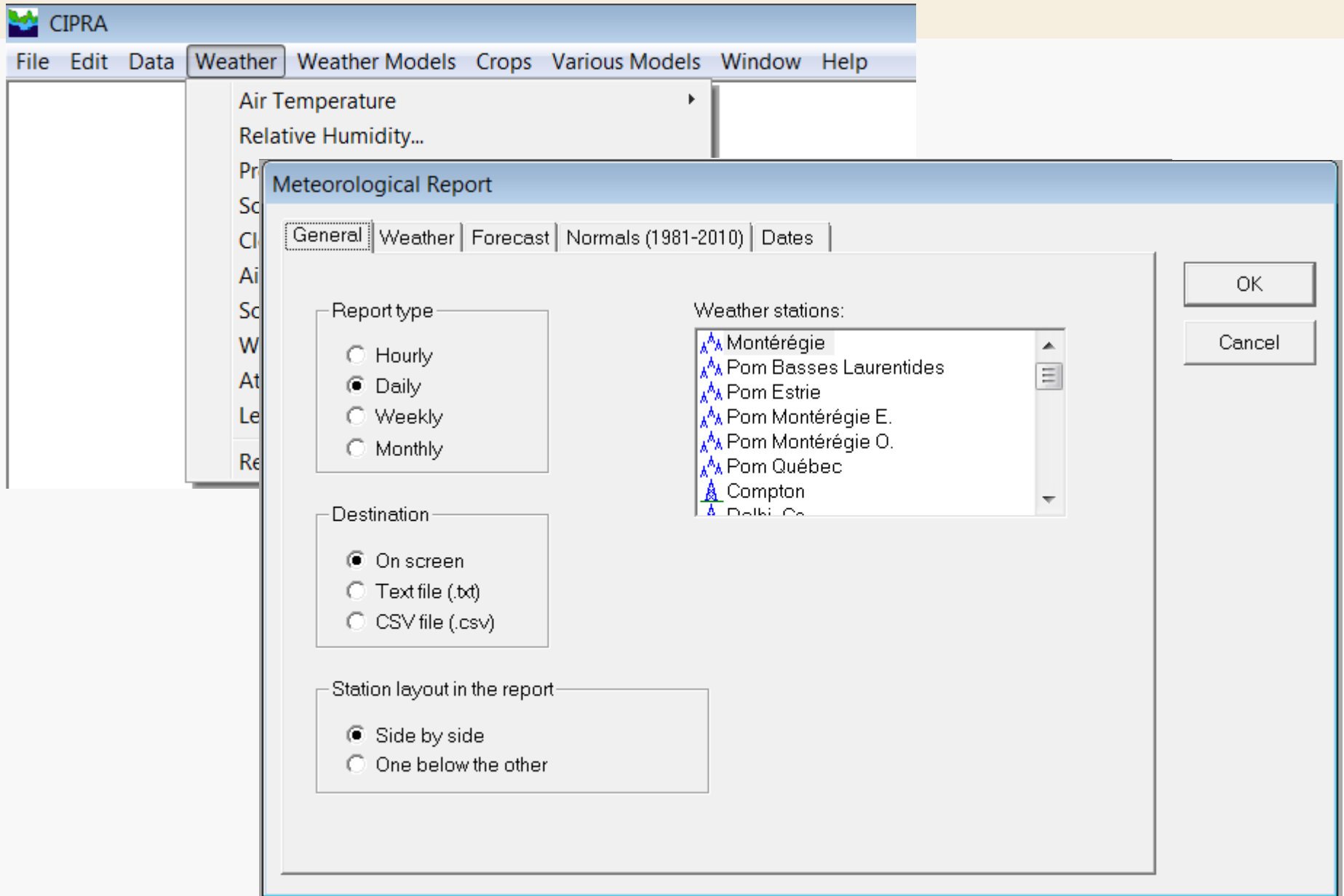
- Interpretation
- Evaluation
- Development and/or update
- Technology transfer



Operational weather network for bioclimatic models implemented in CIPRA for Eastern Canada (“real time”)



Weather module



Weather observations: air temperature

Meteorological Report

General | **Weather** | Forecast | Normals (1981-2010) | Dates

Maximum temperature
 Minimum temperature
 Mean temperature
 Mean maximum temperature
 Mean minimum temperature
 Relative humidity
 Precipitation
 Cumulated precipitation
 Solar radiation
 Air temperature at 5 cm above ground

Soil temperature at 5 cm
 Soil temperature at 10 cm
 Soil temperature at 20 cm
 Soil temperature at 50 cm
 Wind speed
 Wind direction
 Atmospheric pressure
 Leaf wetness (index)
 Leaf wetness (minutes)

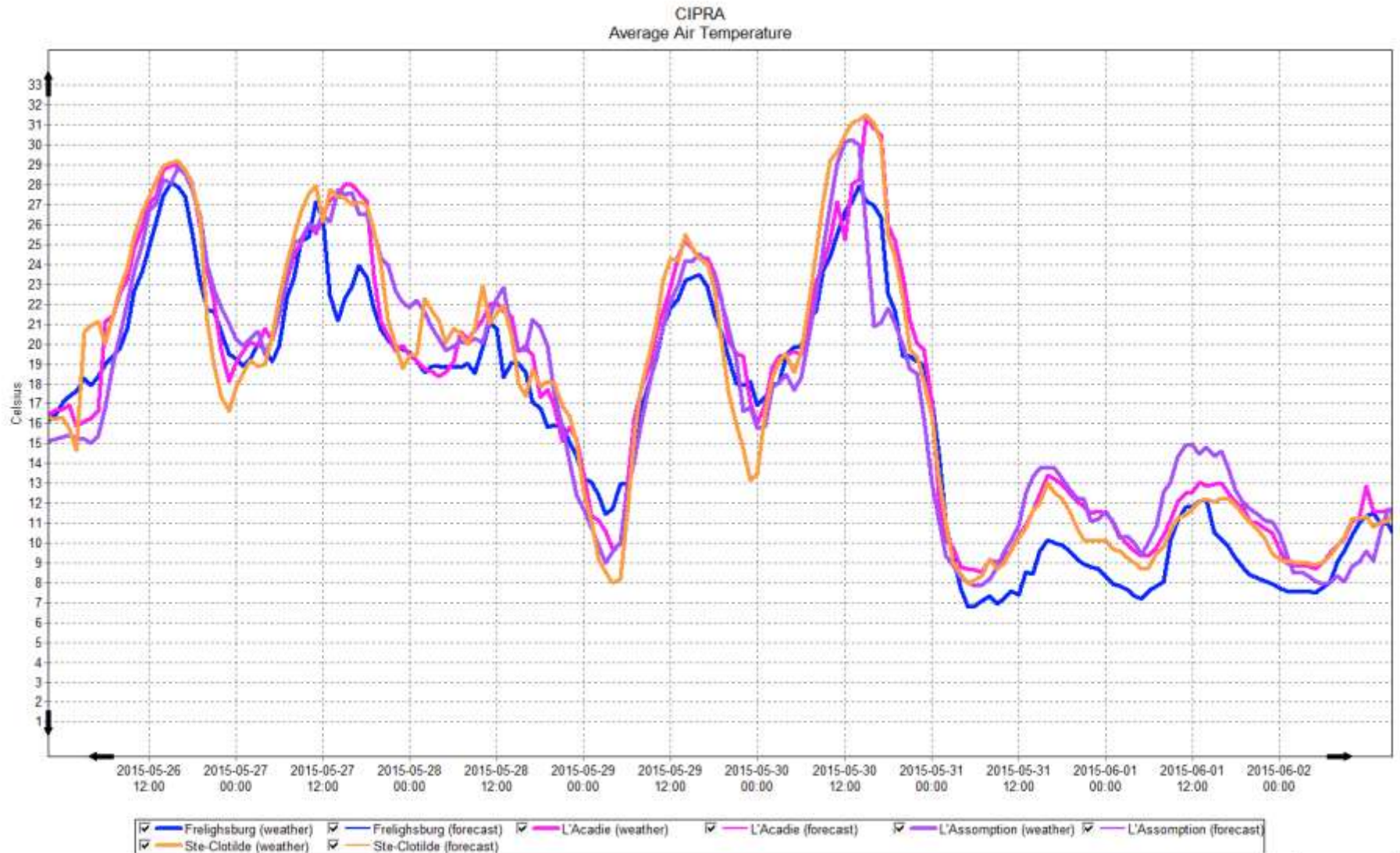
Cumulative heat units Base temp. Optimum temp.

DD - Single average	5	40
DD - Single sine (Baskerville)	5	40
Corn heat units	5	40

DD=degree days

OK
Cancel

Weather observations: air temperature



Weather forecast: air temperature

Meteorological Report

General | Weather | **Forecast** | Normals (1981-2010) | Dates

Maximum temperature

Minimum temperature

Mean temperature

Relative humidity

Precipitation

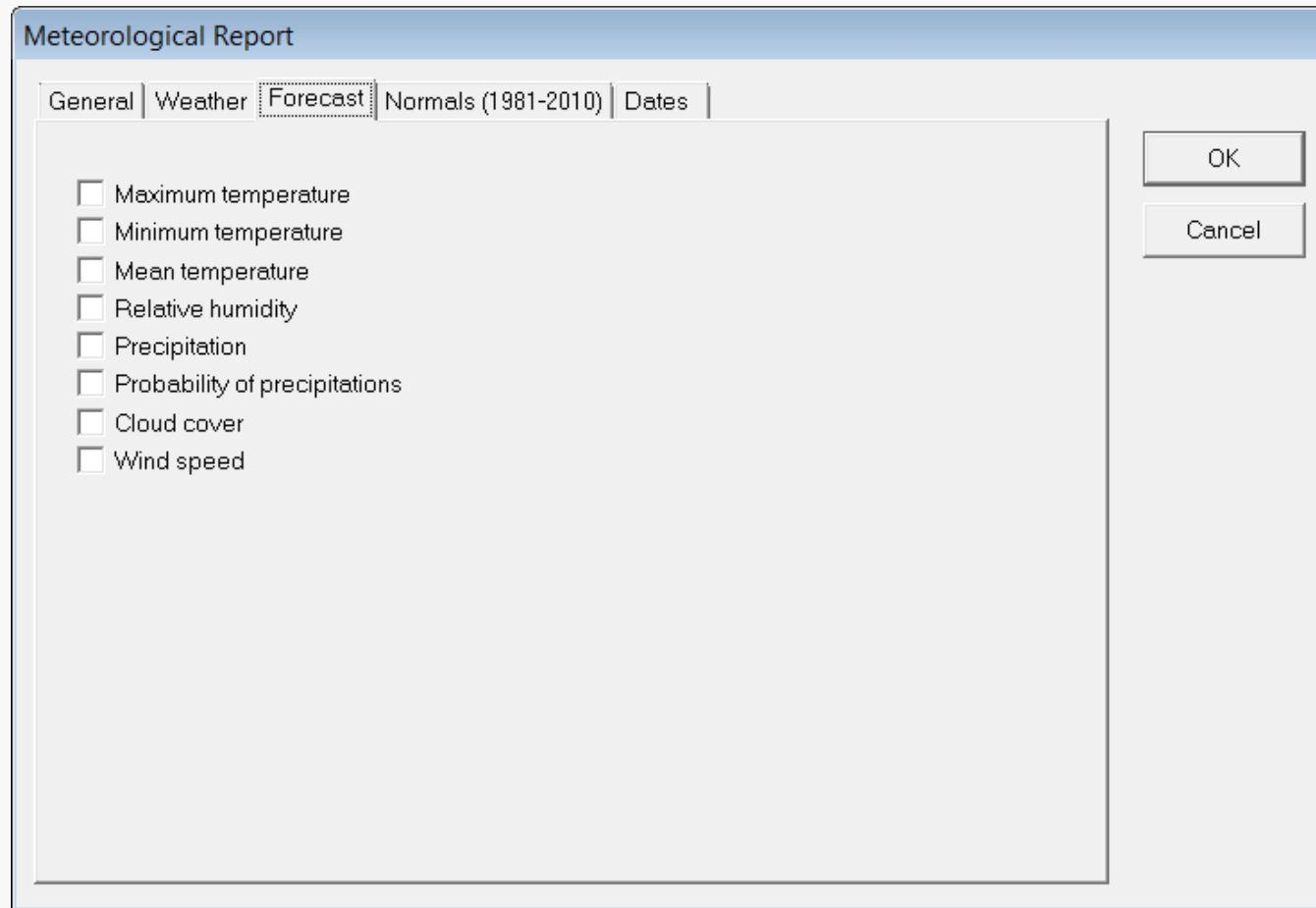
Probability of precipitations

Cloud cover

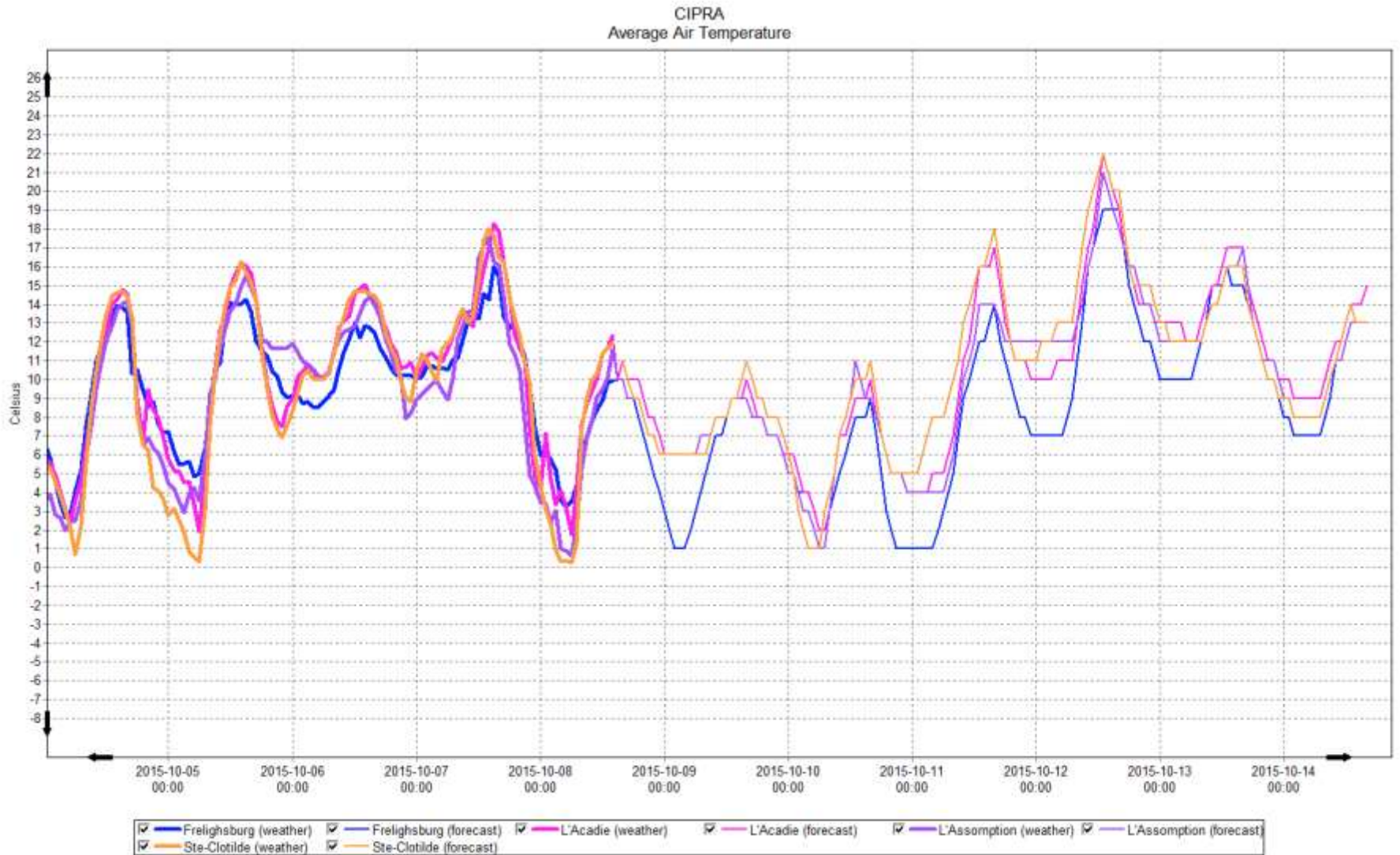
Wind speed

OK

Cancel

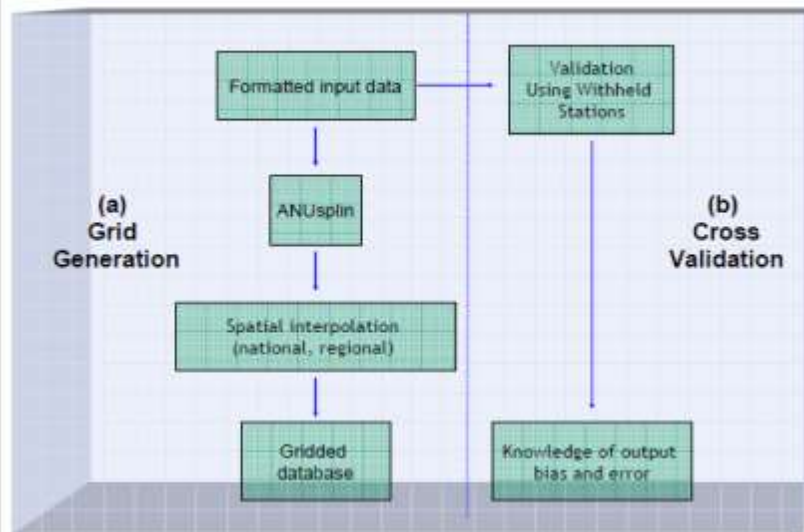


Weather forecast: air temperature

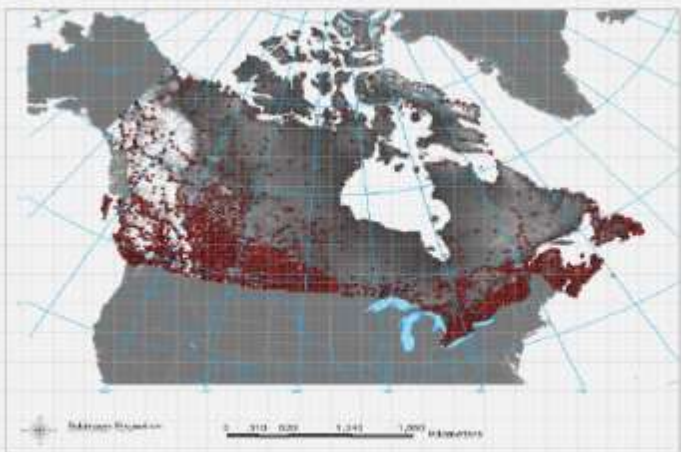


Climate normals (averages of 30 years) generated from the daily 10 km gridded climate dataset for Canada (1950 to 2012)

Methodology



Grid Generation: Input Data



- Daily Max/Min Temperature and Precipitation data acquired from EC.
- Data acquired for period 1961–2003 (approximately 7514 stations).

Grid Generation: Output Data (Raster Grids)



- Albers Conic Equal Area projection.
- Grid cell size: 10 km; (Rows: 260, Columns: 544).
- GeoTIFF raster format.

Grid Generation: Output Data (ASCII Point Grids)



- Albers Conic Equal Area projection.
- Grid point spacing: 10 km.
- Comma-delimited (.csv) text file format.

Tair, Tsoil, RH, Wind,
SolRad, Precip

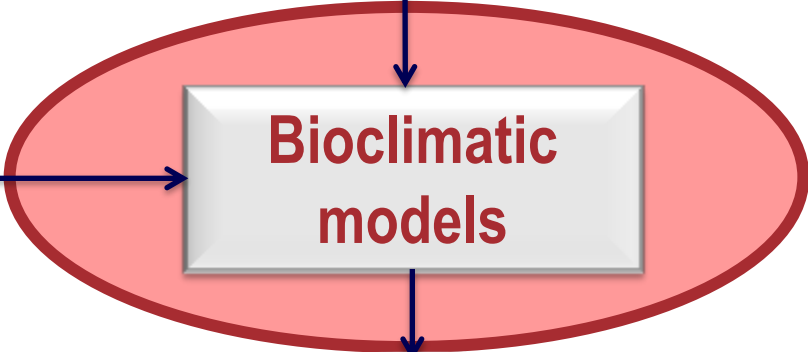
Tair, RH, Precip (%prob.),
Cloud Cover, Wind

Tmax, Tmin, Precip

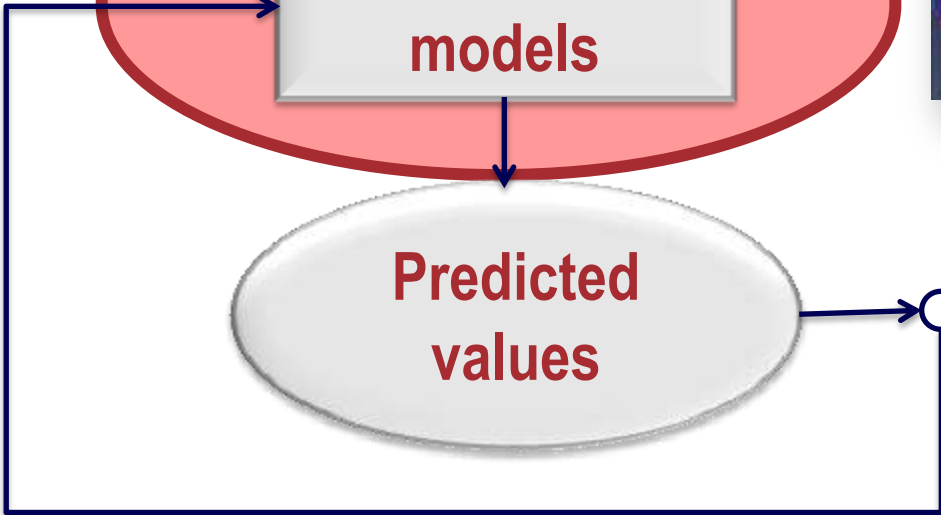
**Weather
observations
(hourly)**

**Weather
forecasts
(hourly)**

**Climate
normals
(daily)**



- Interpretation
- Evaluation
- Development or Update
- Technology Transfer



Bioclimatic models in apple

Apple

On-Screen Chart | Summary Report | Special Report

Insects

- Codling moth *
- Plum curculio
- European apple sawfly
- Spotted tentiform leafminer
- Apple maggot
- Speckled green fruitworm
- Tarnished plantbug
- Dogwood borer
- European red mite
- Obliquebanded leafroller
- Redbanded leafroller
- Fruit-tree leafroller
- Oriental fruit moth (Michigan)
- Oriental fruit moth (Pennsylvania)
- Oriental fruit moth (Penn/AAFC)

Phenology

- McIntosh (DD)
- McIntosh (BBCH)
- Firmness of McIntosh
 - Kilograms-force
 - Pounds-force

Postharvest Disorders

- Low temperature breakdown
- Superficial scald

Diseases


- Apple scab (Mills)
- Apple scab (St-Arnaud, Z=0)
- Apple scab (AAFC/IRDA)
 - Show infection and ascospores
 - Show infection only
 - Wetness estimation (CPVQ 1988)
 - Wetness estimation (MacHardy 1996)
- Fire blight (CougarBlight 2010)

Weather stations:

- ▲ Montérégie
- ▲ Pom Basses Laurentides
- ▲ Pom Estrie
- ▲ Pom Montérégie E.
- ▲ Pom Montérégie O.
- ▲ Pom Québec
- ▲ Compton
- ▲ Dalke Co.

*** Presentation of results**

- Cumulated degree days
- Cumulative curve (%)
- Relative curve (%)

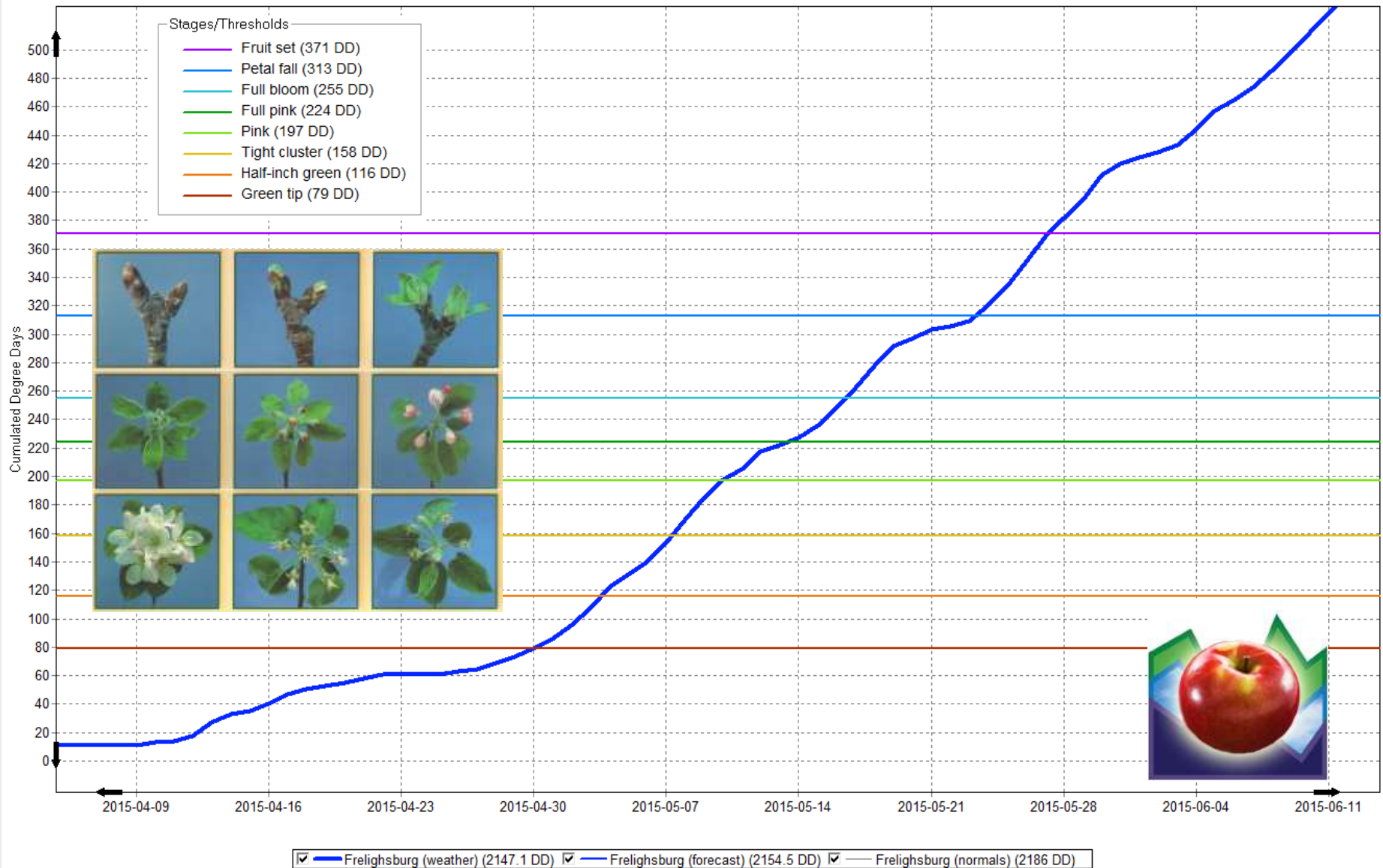


Display the Chart

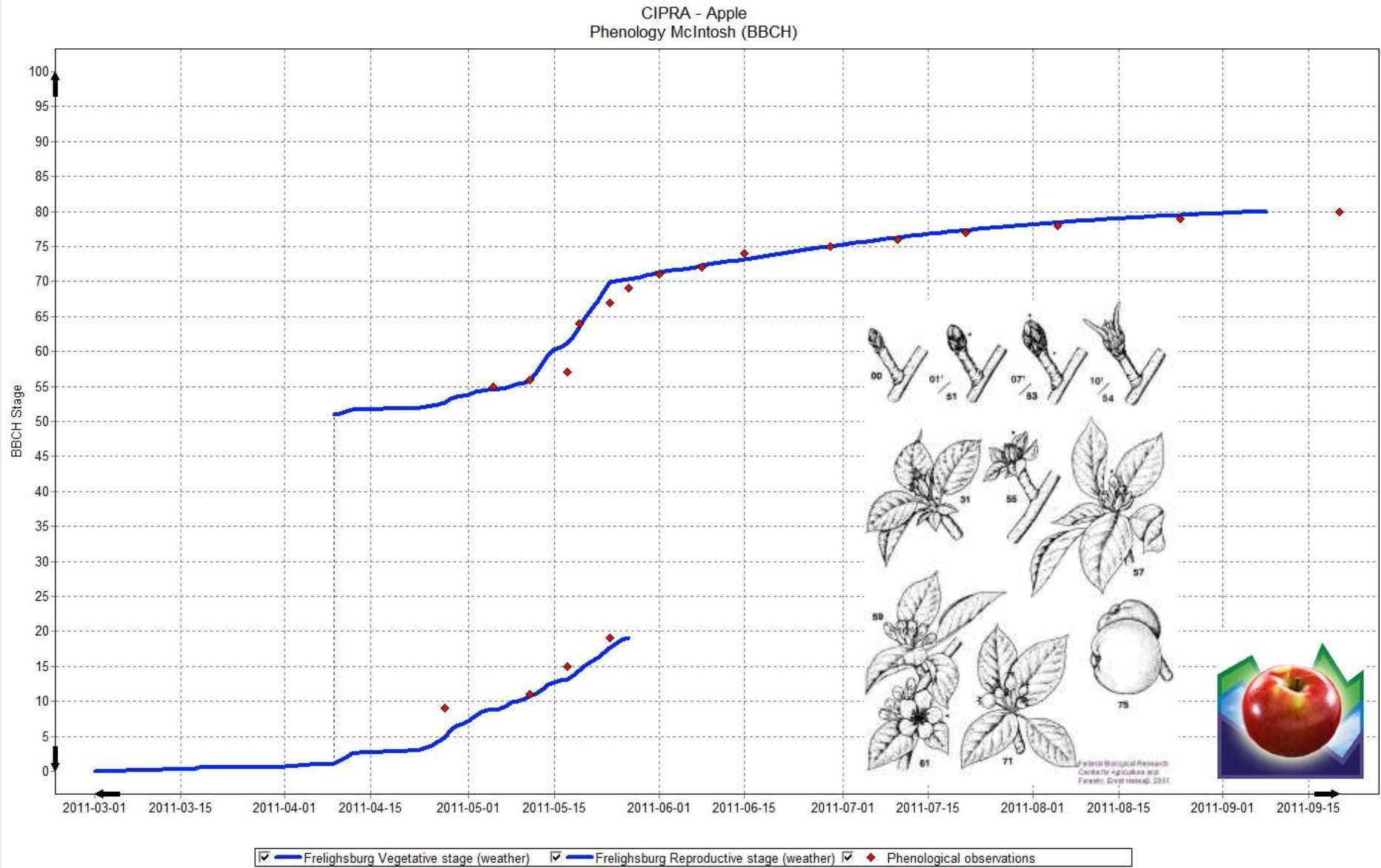
Close

Predicting apple phenology: cumulated degree days

CIPRA - Apple
Phenology McIntosh (DD)



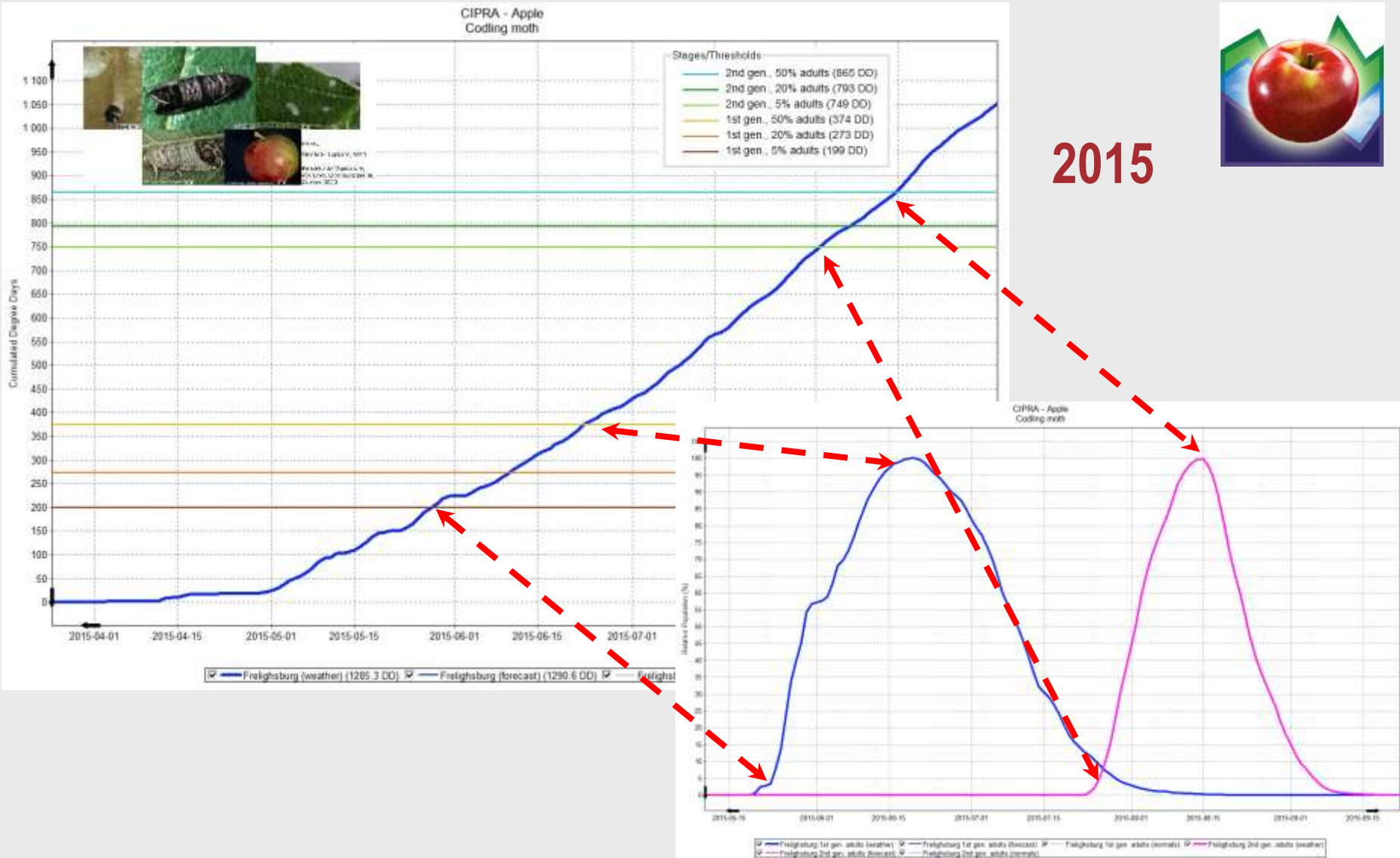
Predicting apple phenology: BBCH stage



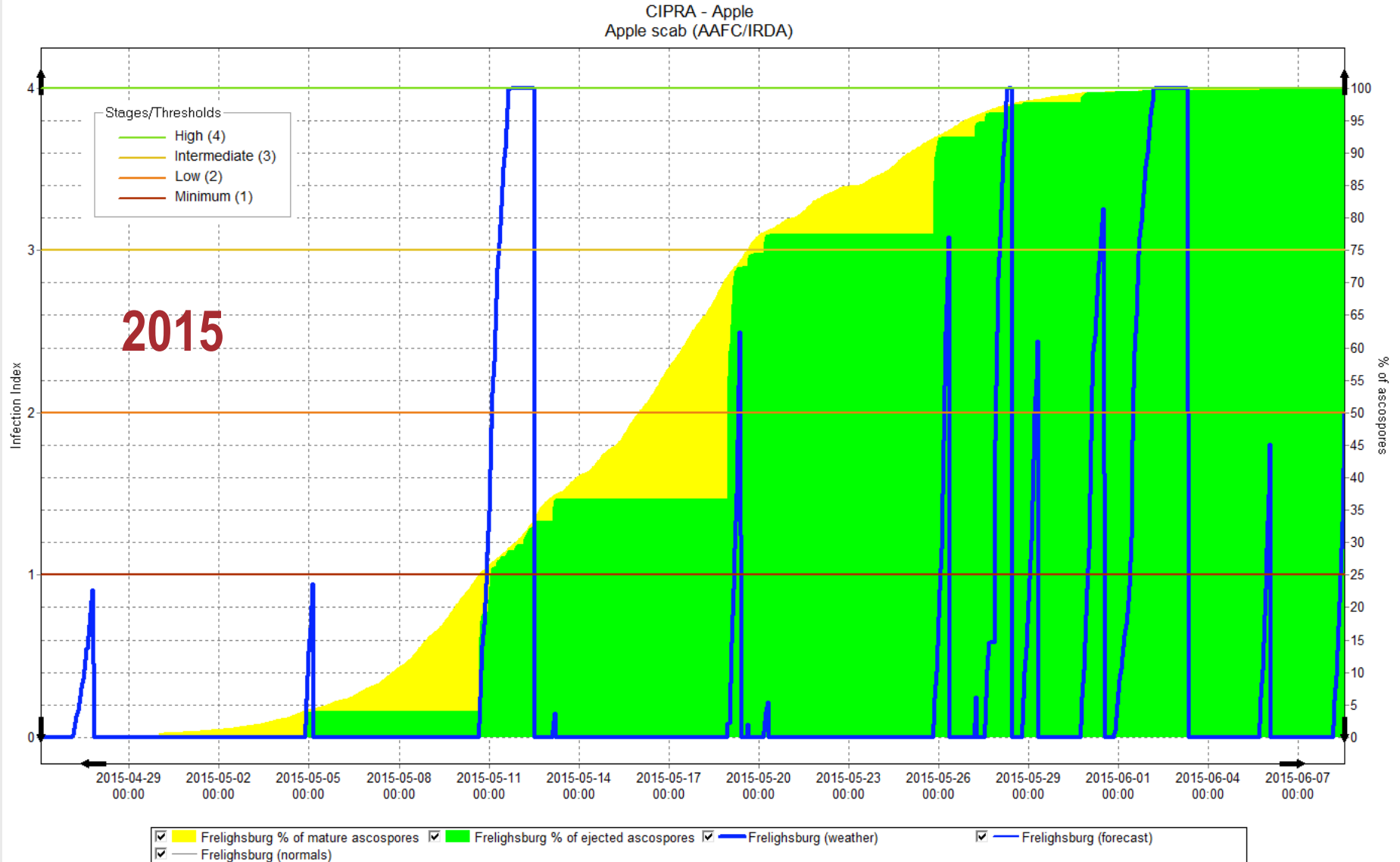
Forecasting codling moth: based on cumulated degree-days



2015



Forecasting Apple Scab

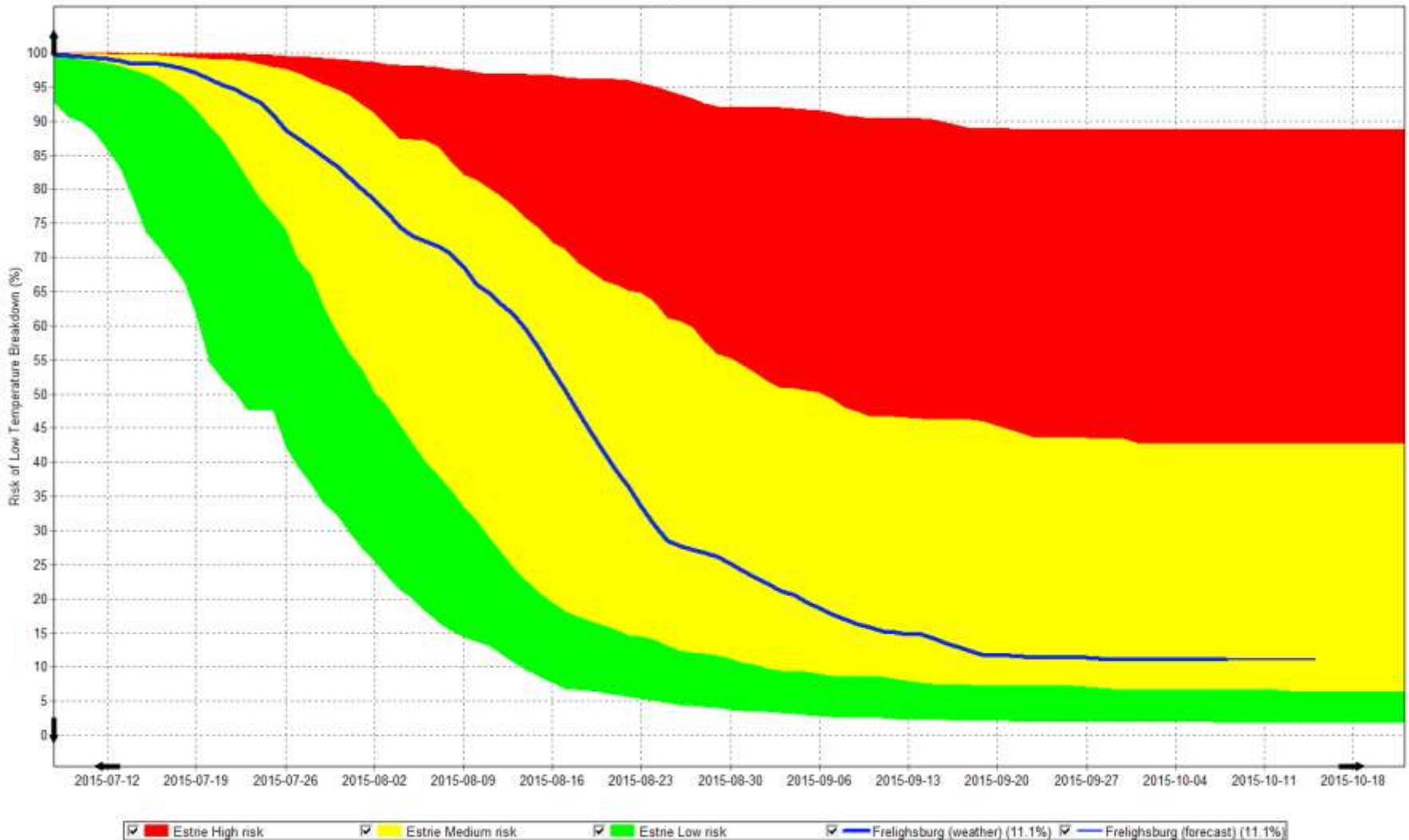


Forecasting Low Temperature Breakdown



2015

CIPRA - Apple
Low temperature breakdown

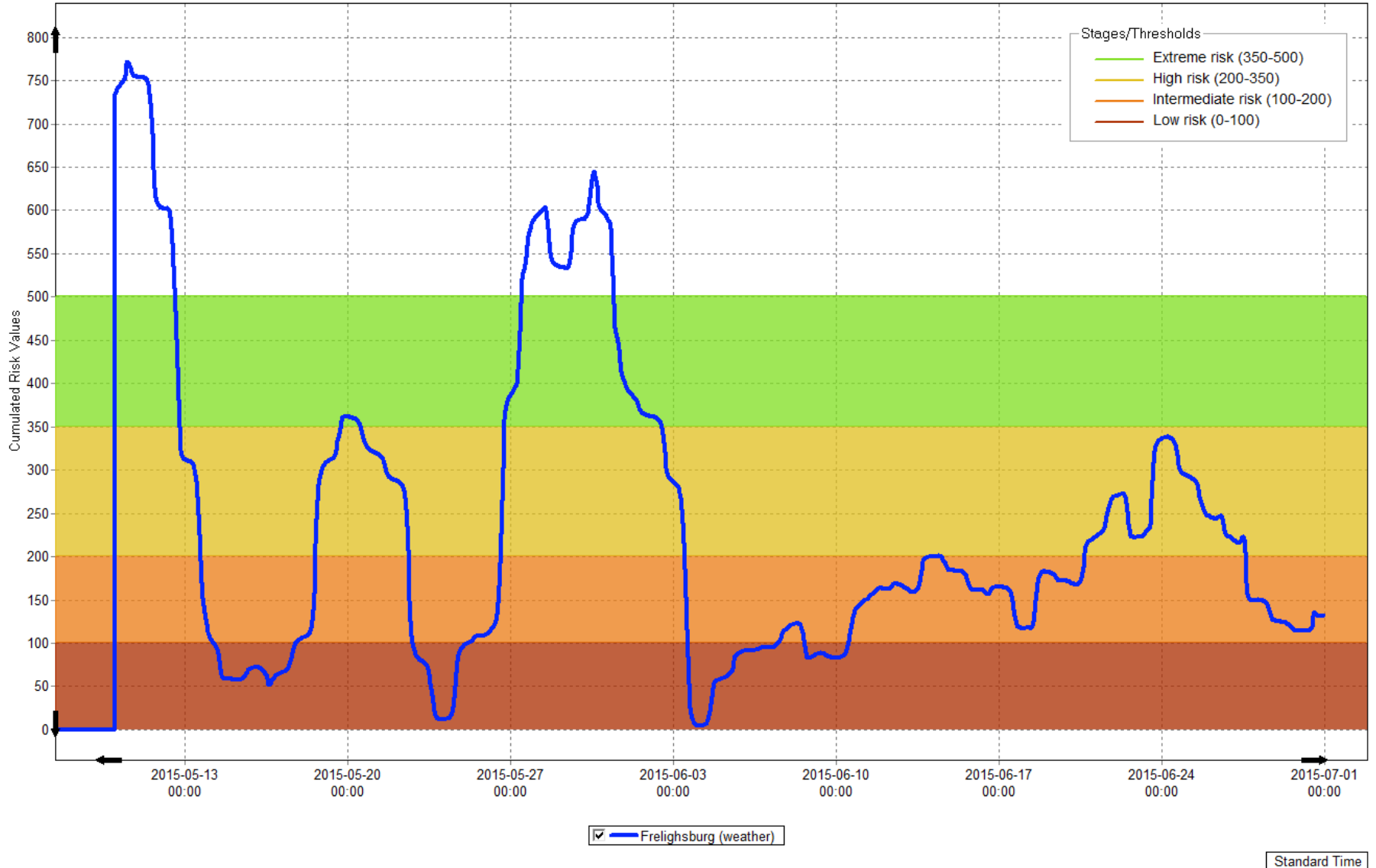


Forecasting Fire Blight



2015

CIPRA - Apple
Fire blight (CougarBlight 2010)



Bioclimatic models in other fruit crops

Cranberry

On-Screen Chart | Summary Report

Insects

- Cranberry tipworm *
- Cranberry fruitworm *

Phenology


- Cranberry

Weather stations:

- ▲▲ France
- ▲▲ Montérégie
- ▲▲ Pom Basses Laurentides
- ▲▲ Pom Estrie
- ▲▲ Pom Montérégie E.
- ▲▲ Pom Montérégie O.
- ▲▲ Pom Québec
- ▲▲ Assens (EP)

* Presentation of results

- Cumulated degree days
- Cumulative curve (%)
- Relative curve (%)



Display the Chart

Close



Bioclimatic models in other fruit crops

Strawberry

On-Screen Chart | Summary Report

Insects

Strawberry bud weevil


Phenology

Bounty

Redcoat

Diseases

Ramularia leaf spot



Weather stations:

- France
- Montérégie
- Pom Basses Laurentides
- Pom Estrie
- Pom Montérégie E.
- Pom Montérégie O.
- Pom Québec
- Angers (FR)

Display the Chart

Close



Bioclimatic models in other fruit crops

Elderberry

On-Screen Chart | Summary Report

Phenology

Native *

Early flowering *

Early midseason flowering *

Weather stations:

- France
- Montérégie
- Pom Basses Laurentides
- Pom Estrie
- Pom Montérégie E.
- Pom Montérégie O.
- Pom Québec
- Appels (EP)

* Presentation of results

Cumulated degree days

Cumulative curve (%)

Relative curve (%)

Display the Chart

Close

Bioclimatic models in other fruit crops

Vineyard

On-Screen Chart | Summary Report

Insects

- Leafhopper *
- Grape Phylloxera
- Tarnished plantbug *
- Grape berry moth

Phenology


- Seyval Blanc
- Early bud burst vine varieties
- Semi-late bud burst vine varieties

Diseases

- Grape powdery mildew

Cold Hardiness

- Concord
- Chardonnay
- Cabernet Sauvignon



Weather stations:

- ▲▲ France
- ▲▲ Montérégie
- ▲▲ Pom Basses Laurentides
- ▲▲ Pom Estrie
- ▲▲ Pom Montérégie E.
- ▲▲ Pom Montérégie O.
- ▲▲ Pom Québec
- ▲▲ Appal (FD)

* Presentation of results

- Cumulated degree days
- Cumulative curve (%)
- Relative curve (%)

Display the Chart

Close

Bioclimatic models in other fruit crops

Raspberry

On-Screen Chart | Summary Report

Insects

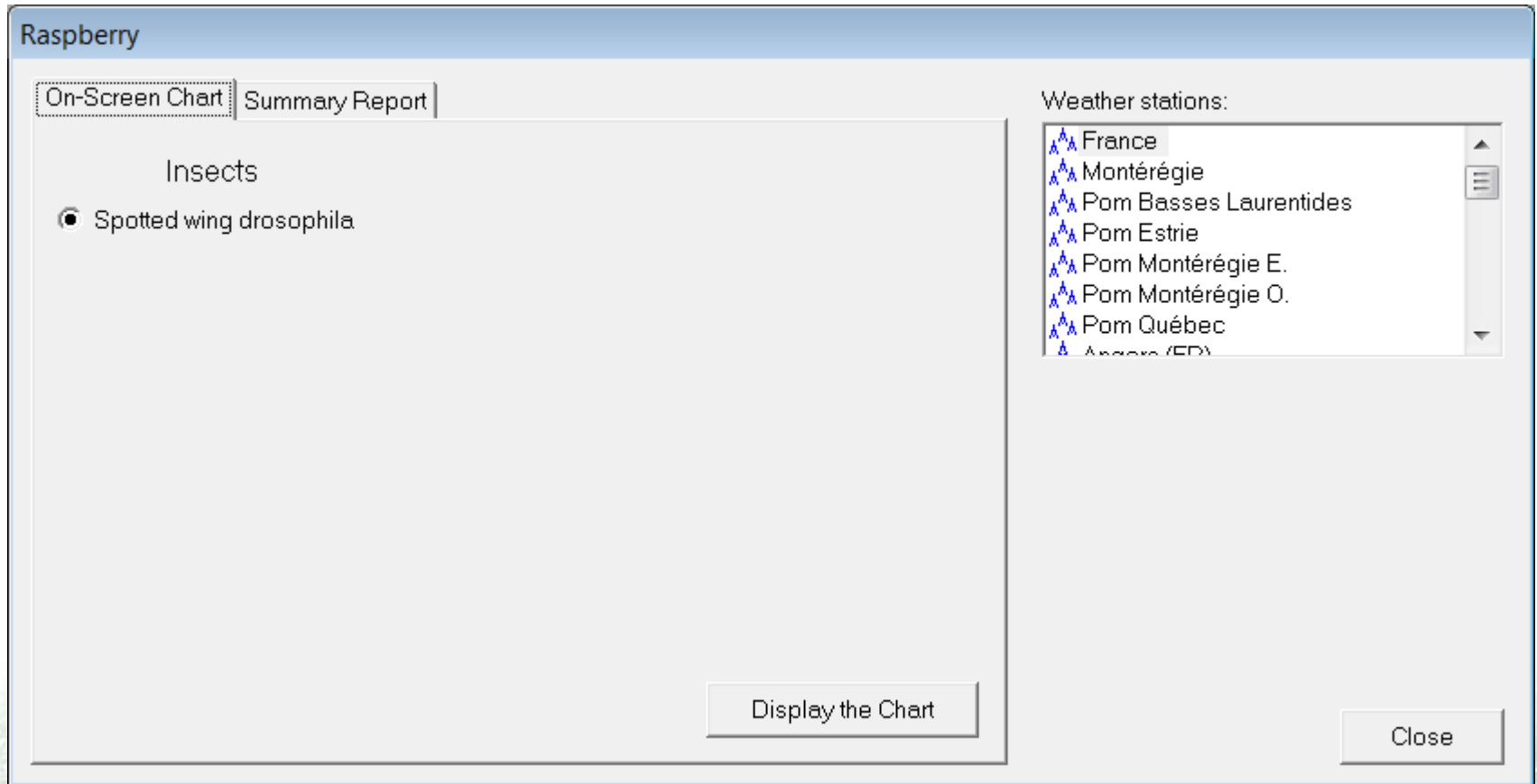
Spotted wing drosophila

Weather stations:

- France
- Montérégie
- Pom Basses Laurentides
- Pom Estrie
- Pom Montérégie E.
- Pom Montérégie O.
- Pom Québec
- Appels (EP)

Display the Chart

Close



CIPRA at a glance

- ✓ 23 crops: vegetables (9), fruits (6), grains (3), forage (3), potatoe, turfgrass
- ✓ Models : phenology (24), insects (36), diseases (14), physiological disorders (2)
- ✓ Real-time and forecasted predictions (observations and weather forecast)
- ✓ ± 215 users:
 - Canada (195), France (6), USA (4), Spain (2), Canary Islands (1), Ireland (1), Korea (1), Morocco (1), Namibia (1), Nigeria (1), Dakar (1), Ethiopia (1)



For more information on bioclimatic models

- **Guide on bioclimatic models of CIPRA**
- **Available on-line**
- **Information**
 - ✓ **Pest descriptions**
 - ✓ **References for the models (thresholds, dev. temp., etc.)**
 - ✓ **Interpretations of the curves**

Published in November 2014

<http://publications.gc.ca/pub?id=9.698631&sl=0>

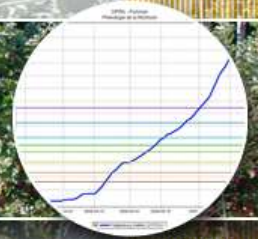


Crop Guide



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Thank you !

Horticultural R&D Centre, Saint-Jean-sur-Richelieu, QC
For more information: Dominique.Plouffe@agr.gc.ca

Canada 