Chilling Out

Making Better Winter Protection Decisions

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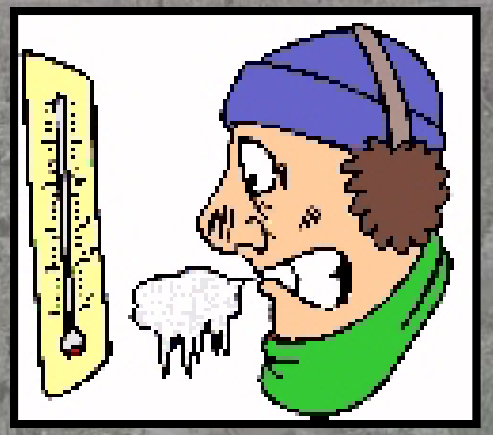


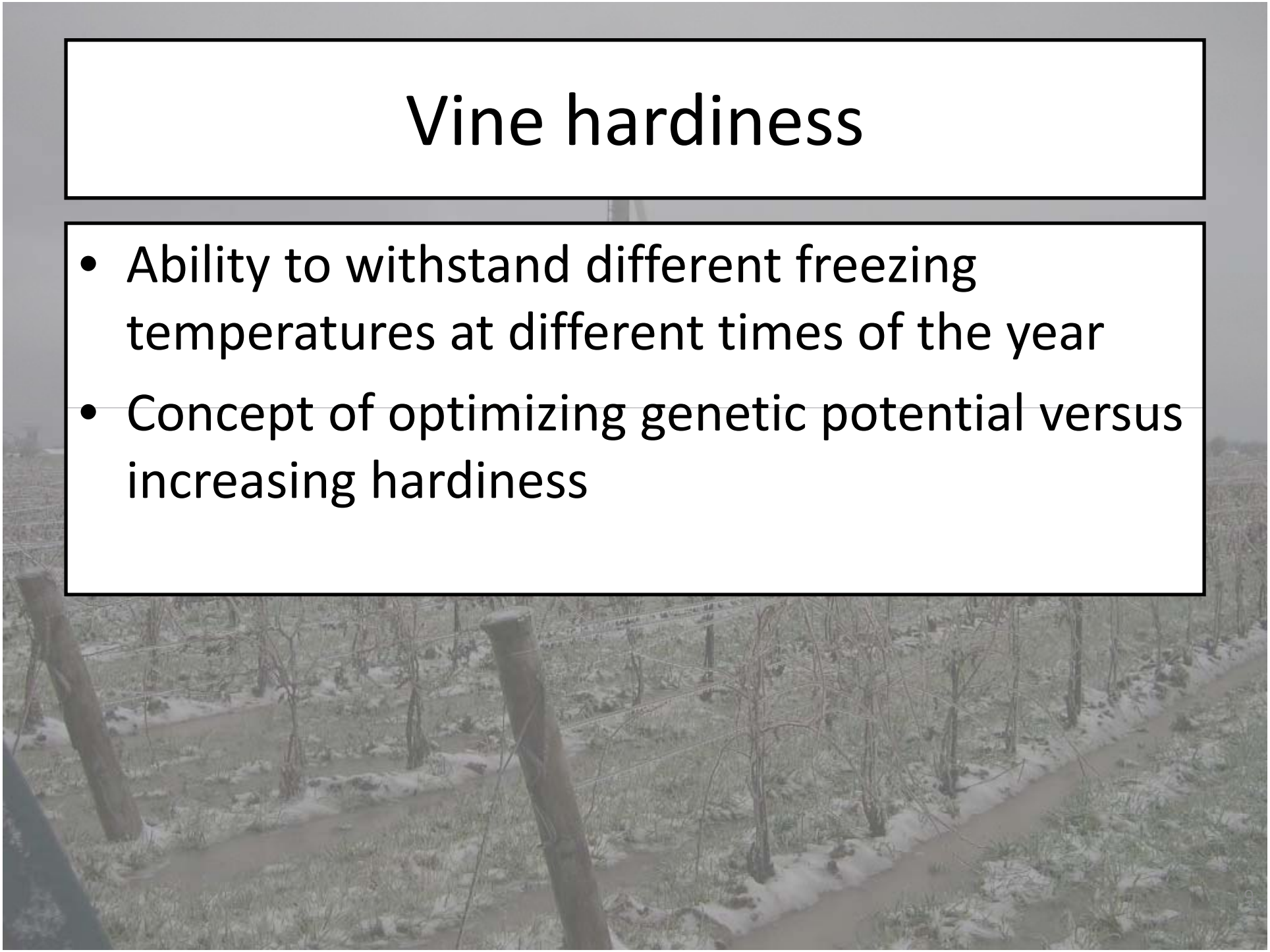
What is Winter Injury

Direct

Indirect

Vine hardiness

- Ability to withstand different freezing temperatures at different times of the year
- Concept of optimizing genetic potential versus increasing hardiness

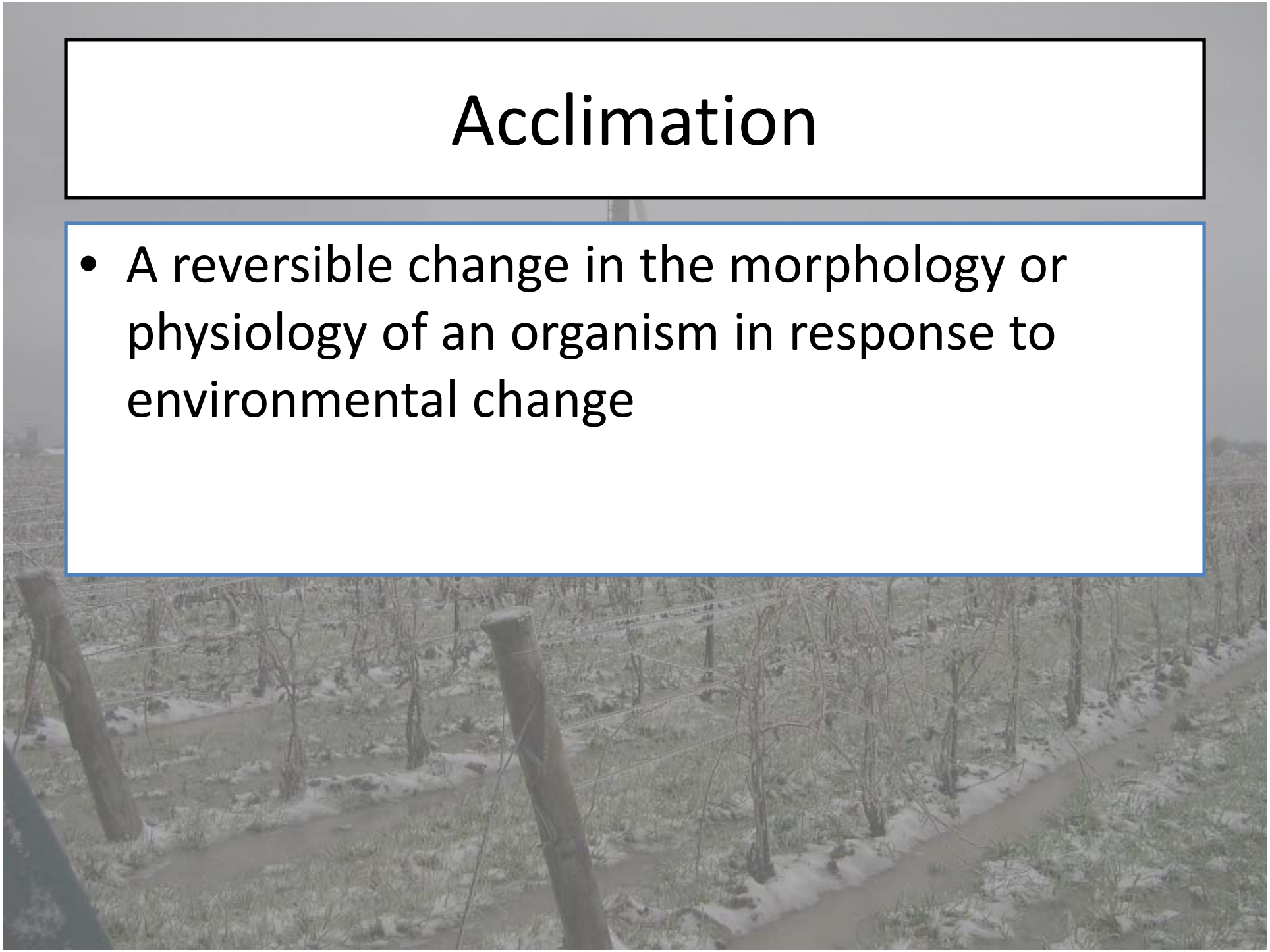


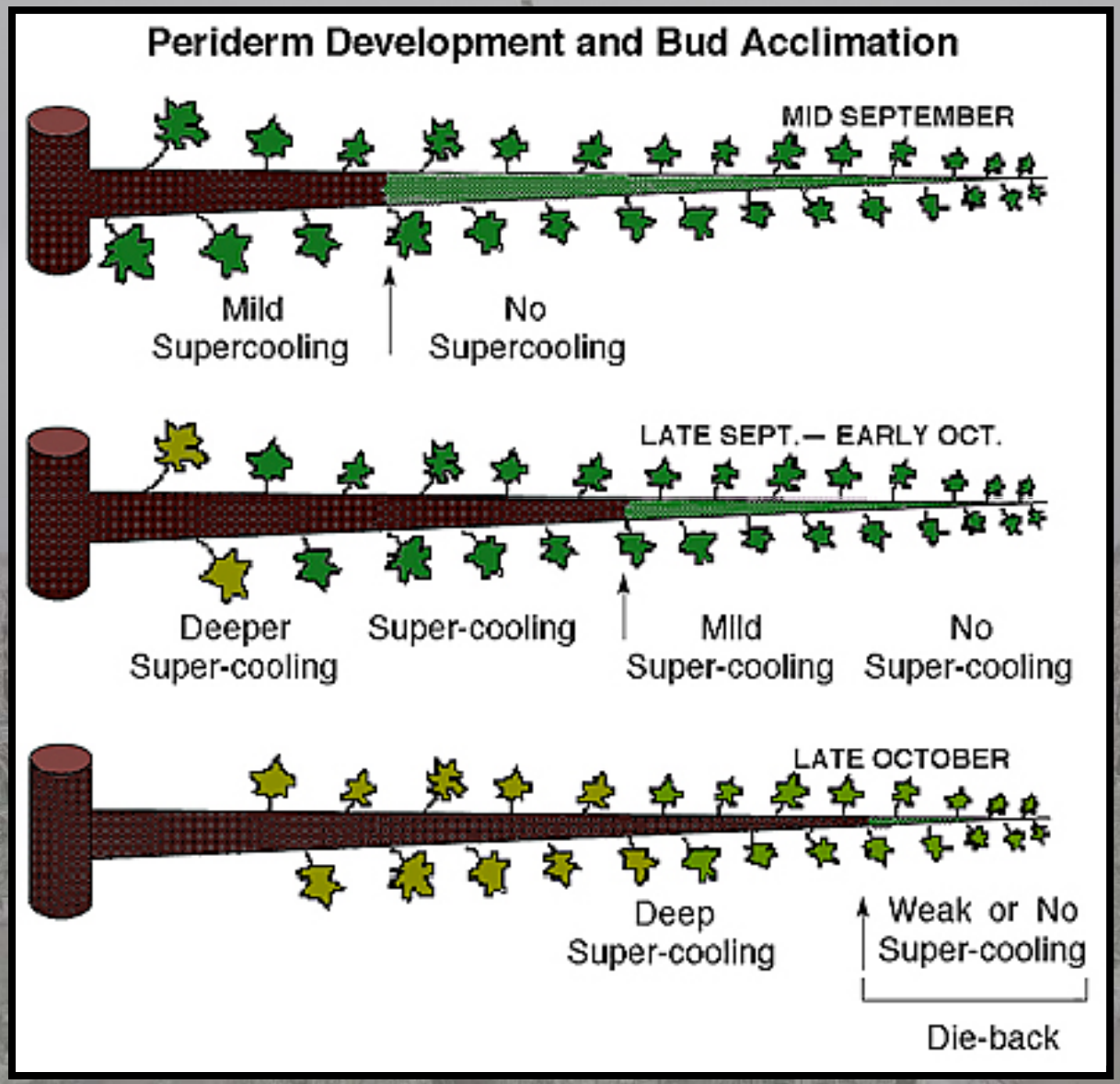
Vine Acclimation/Deacclimation

- What is vine acclimation
  - Physical
  - Chemical
- When does it start
- When does it end
  - Concept of early to bed , early to rise
- Cues

Acclimation

- A reversible change in the morphology or physiology of an organism in response to environmental change

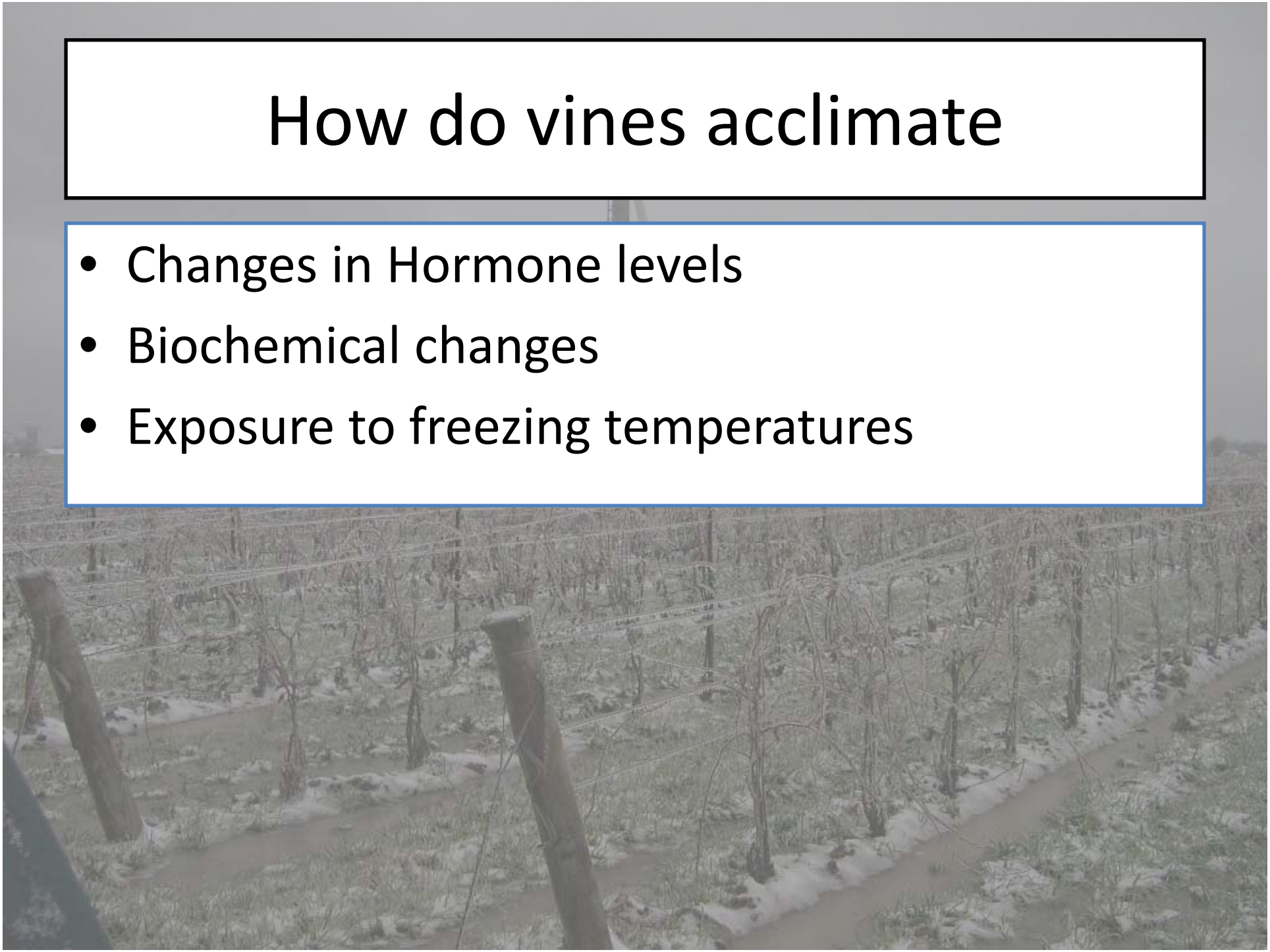




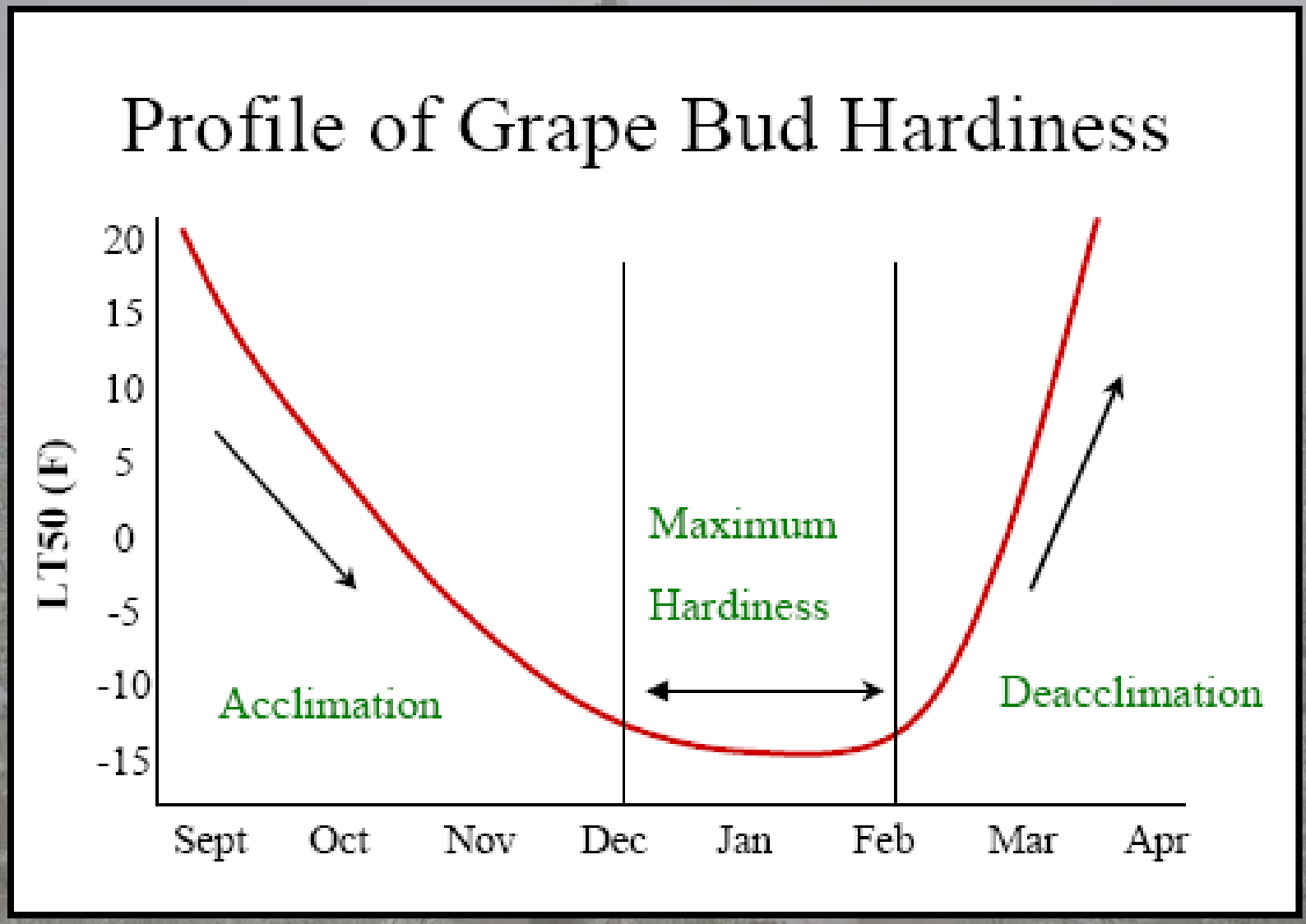
From Wine East 2001

How do vines acclimate

- Changes in Hormone levels
- Biochemical changes
- Exposure to freezing temperatures



Vine Acclimation/Deacclimation



Factors that Influence Vine Hardiness

- Cultivars and clones
- Rootstocks
- Site influence on seasonal rate of growth
- Seasonal impact – early or late maturation
- Precipitation – excessively dry or wet seasons
- Cultural management – crop level, crop balance, nutrition,

What are we doing?

- Multi researcher project investigating use of wind machines (Ker, Fisher, Fraser, Slingerland)
- Documenting use of machines and weather profiles
- Sampling to determine bud survival under natural conditions
- Measure hardiness at different times of the dormant period – use of a programmable freezer

What do we measure?

- Using a programmable freezer, we measure electrical conductivity across a plate to determine when water freezes :

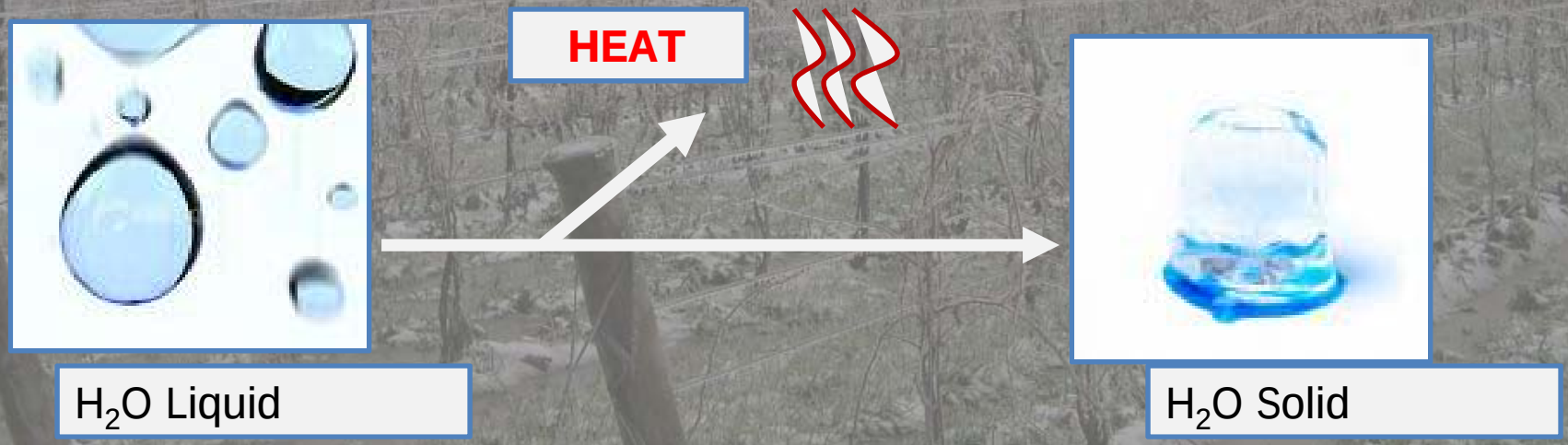
  – external to individual cells (Extracellular water) – High Temperature Exotherm

  – and internal cell water (Intracellular water)

  Low Temperature Exotherm

What is an Exotherm?

- Definition – Amount of heat given off by a chemical reaction
- As water freezes (ice nucleation) heat is released from the system (exotherm)
- When **ice crystals form** inside buds, xylem or phloem, an **exotherm** is generated & measured with sensitive equipment



Prototype Freezer Unit

Modeled from California system (Wample – Fresno)

Chiller Unit

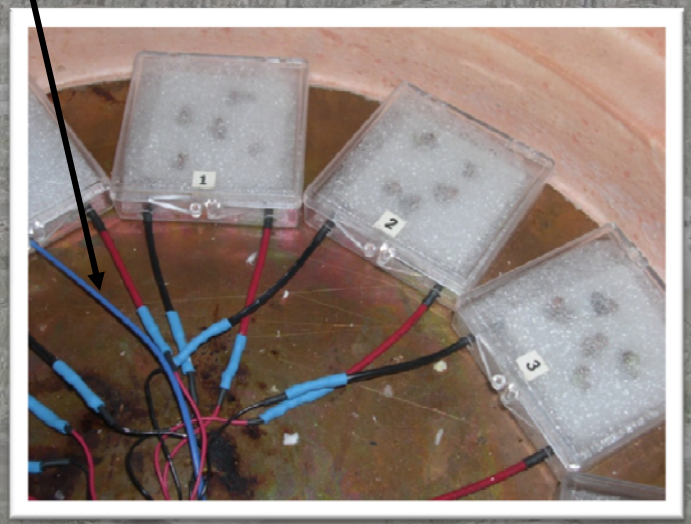
- Liquid cooled
- Chiller set point and rate of cooling are controlled by computer software
- Set points decrease by intervals of 0.40°C
- When liquid is cooled to within 0.05°C of set point, then software proceeds to next set point interval (4°C/hr)

Sample Chamber

- Cooled liquid travels from chiller, through insulated tubing, into the top of the sample chamber and back to chiller

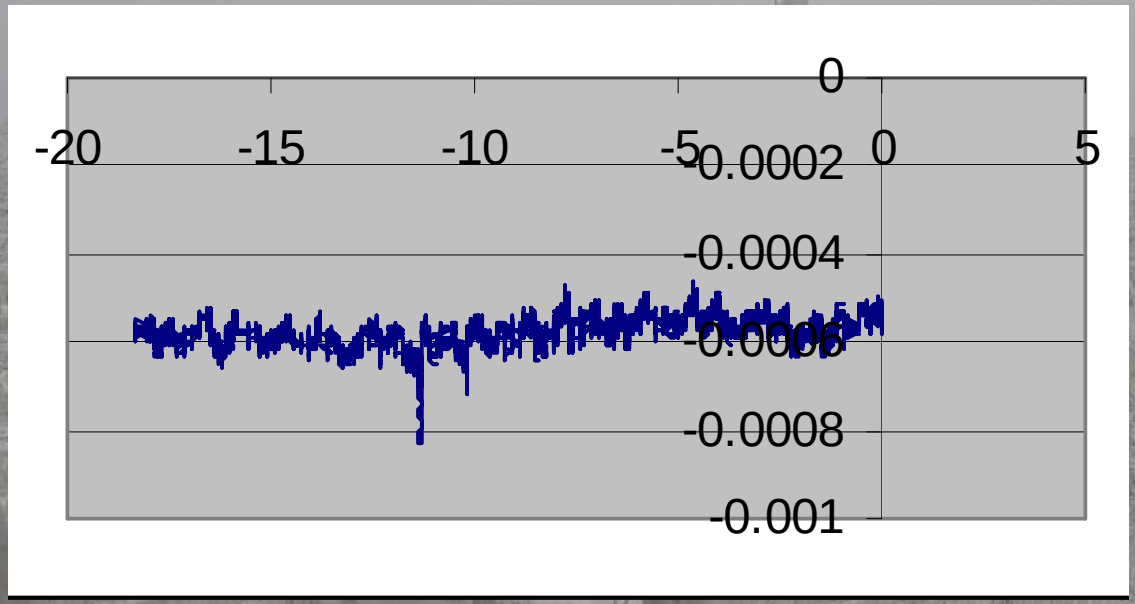
Sample Chamber

- Thermistor measures the temperature inside the sample chamber (blue wire)



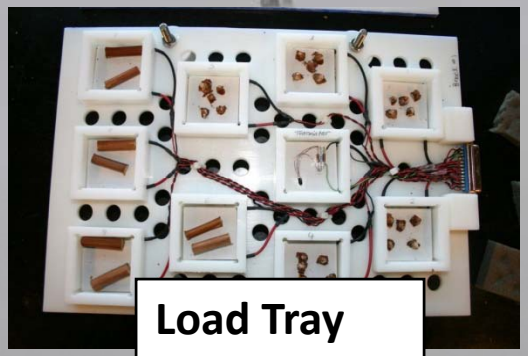
Prototype Freezer Problems…

Occasionally a LTE was recorded



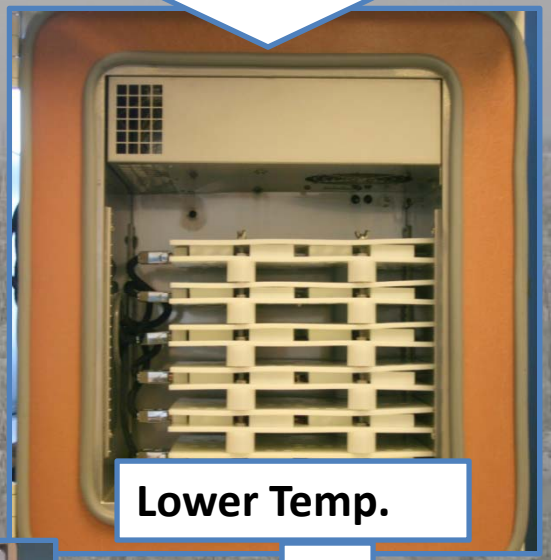
Tenney DTA Freezer System

Tenney DTA System



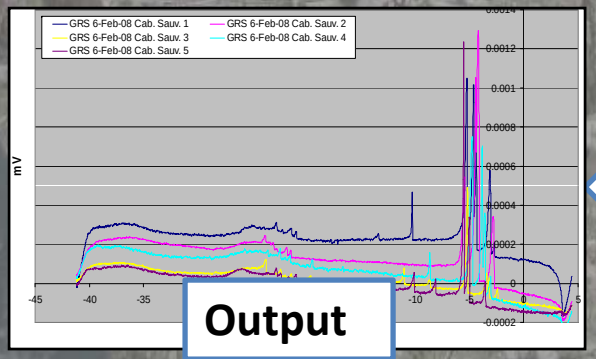
Load Tray

Sample Prep.



Lower Temp.

Data Collection



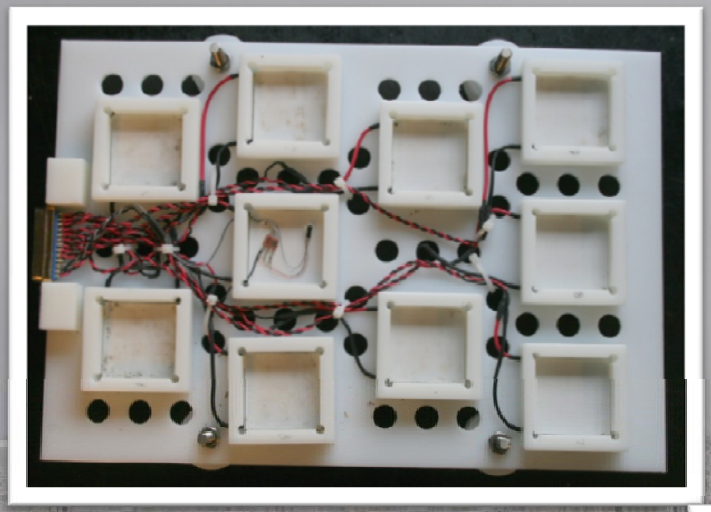
Output

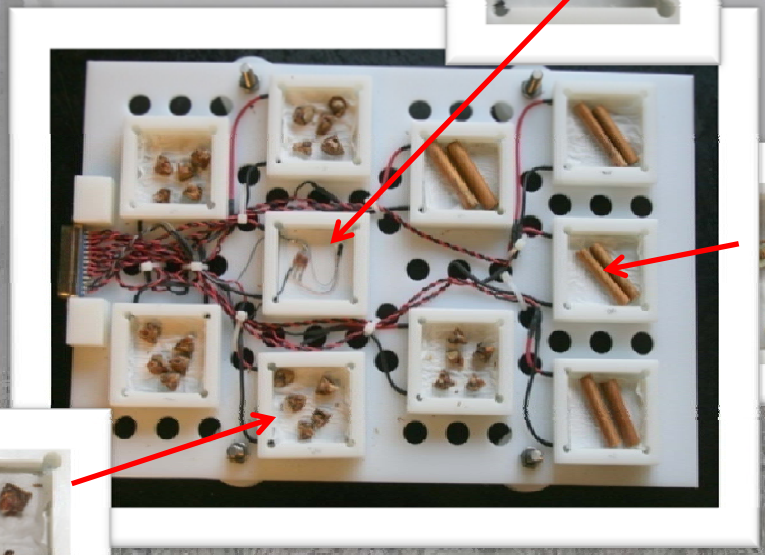
Bud Sample Preparation

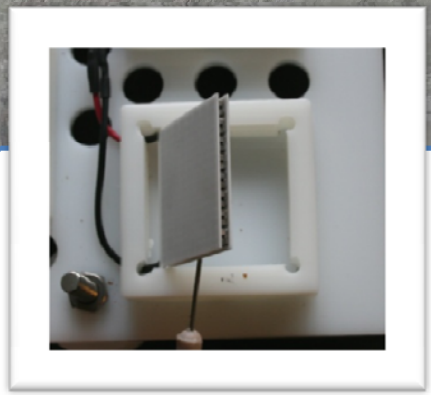
Cut #1

Cut #2

Sample Trays

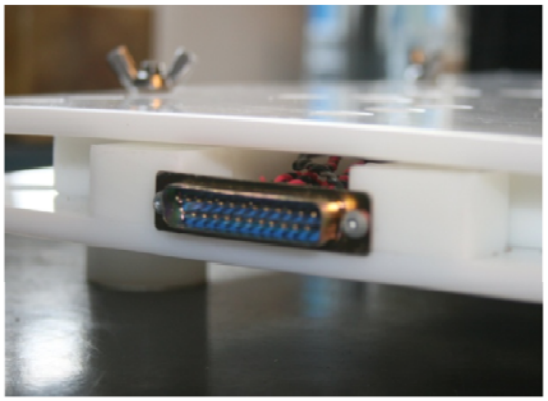


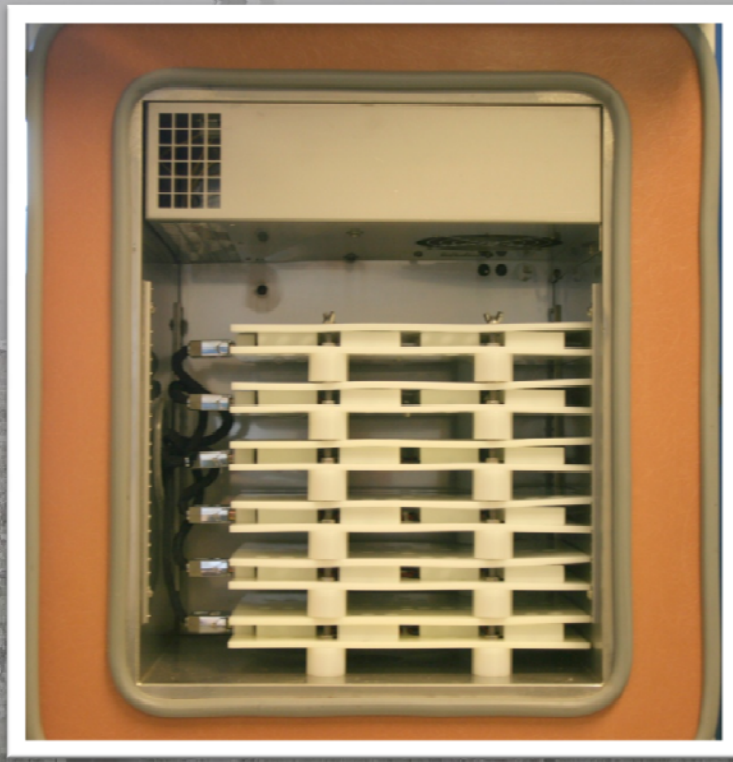




- 10 Wells per Sample Tray x 6 Trays/Freezer
  - 9 sample wells
  - 1 well with thermistor
- Samples placed on Peltier plates that detect temperature gradients generated by exotherms and covert the thermal signals to voltage (mV) outputs

Sample Trays





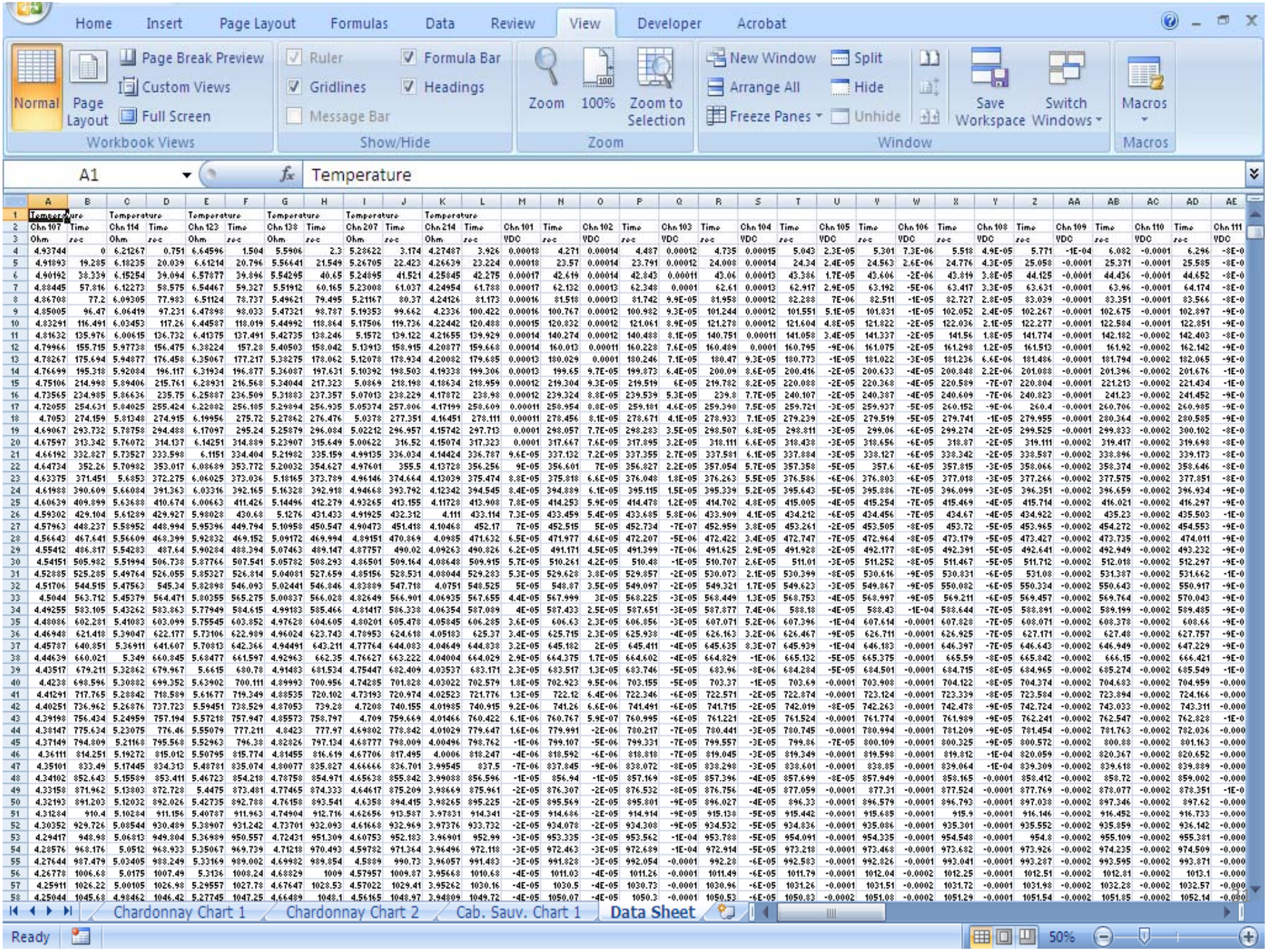
All peltier plates and thermistor are wired through serial port and connected to multimeter.

Multimeter (DAS)

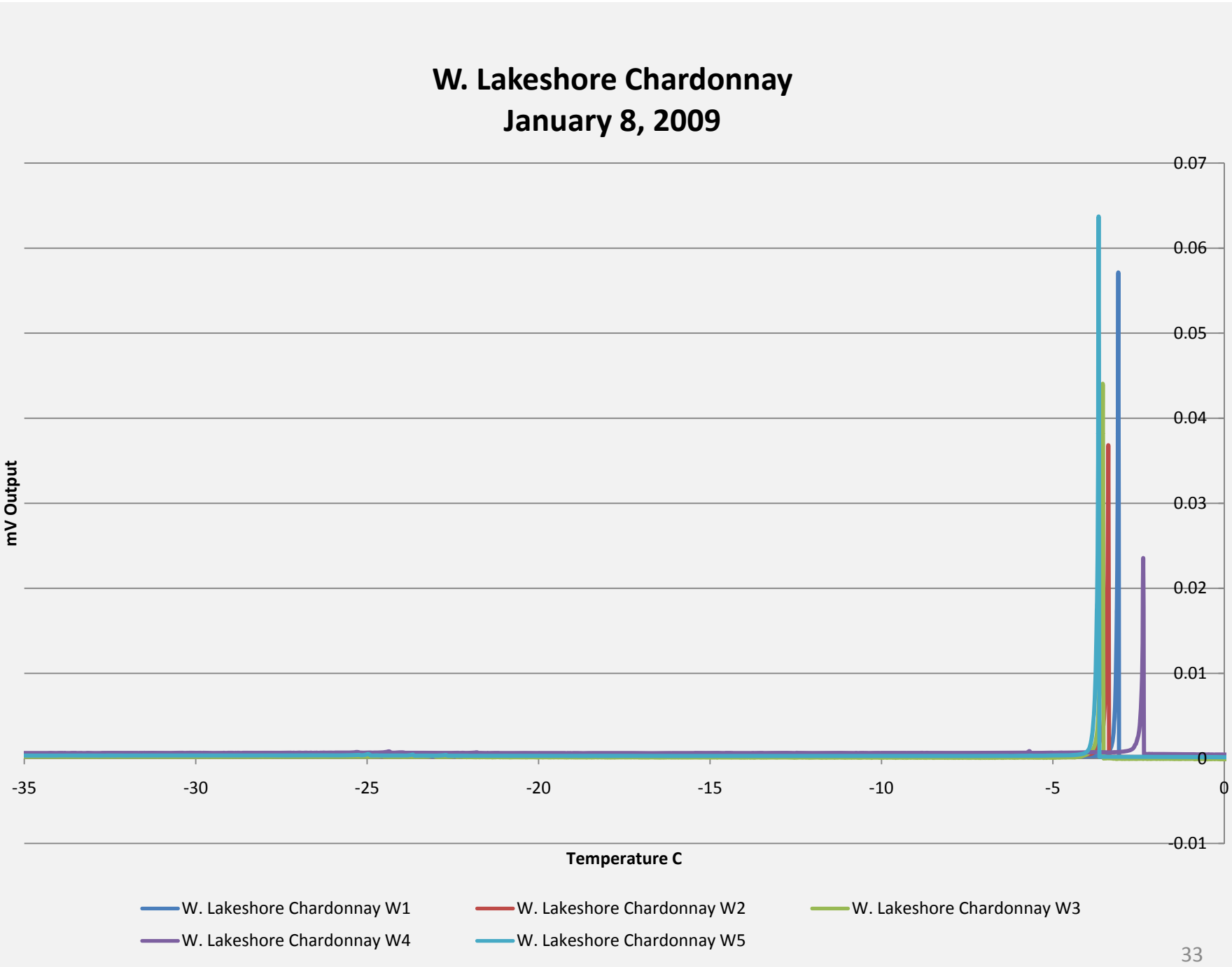
- Data Acquisition System (DAS)
- 2 x 40 Channel Multimeter (10 wells x 6 trays per DAS)
  - Scans all wells every 15 sec.
  - Connects directly to desktop computer and records data using ExcelLINX

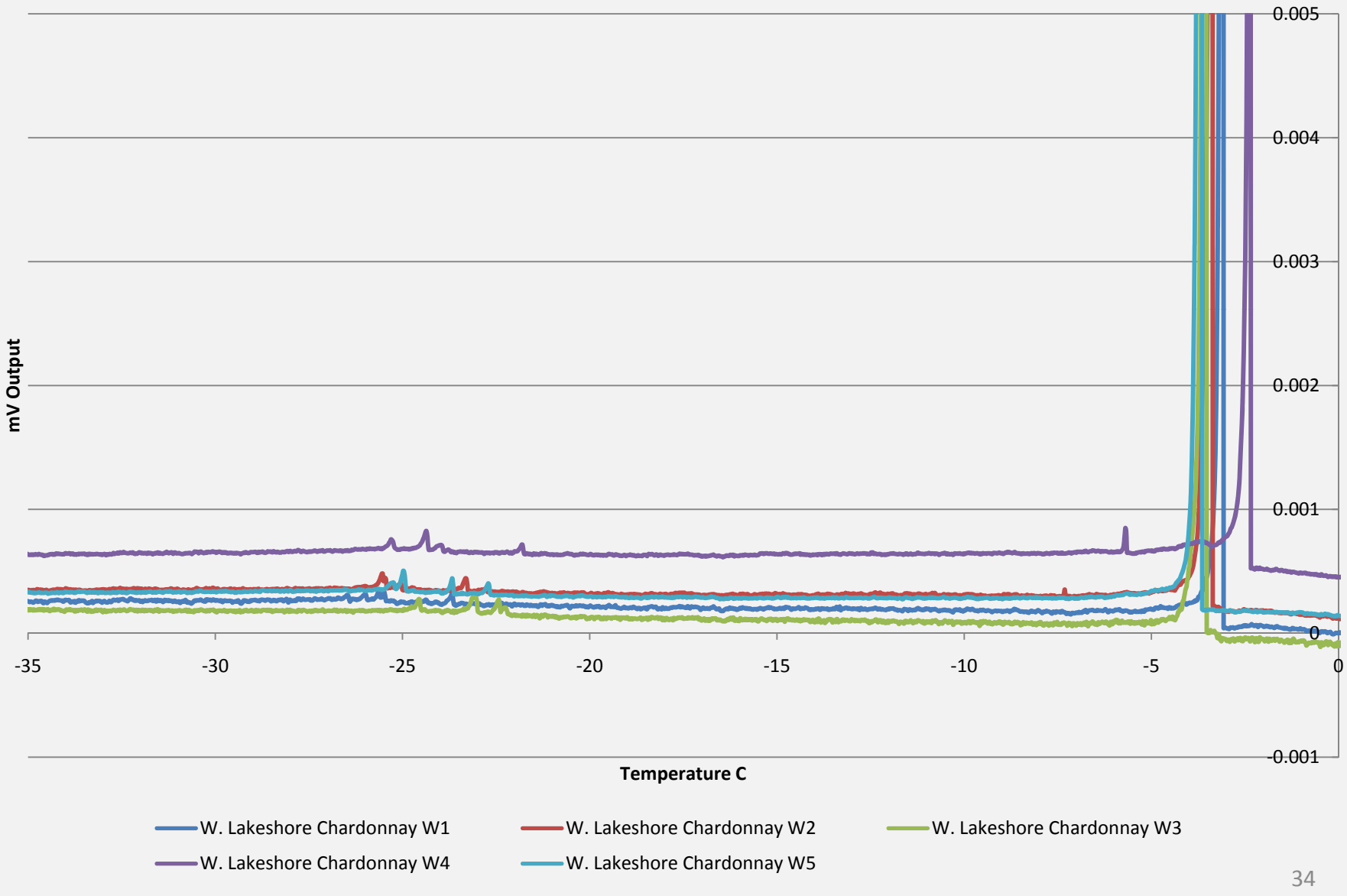
Capacity

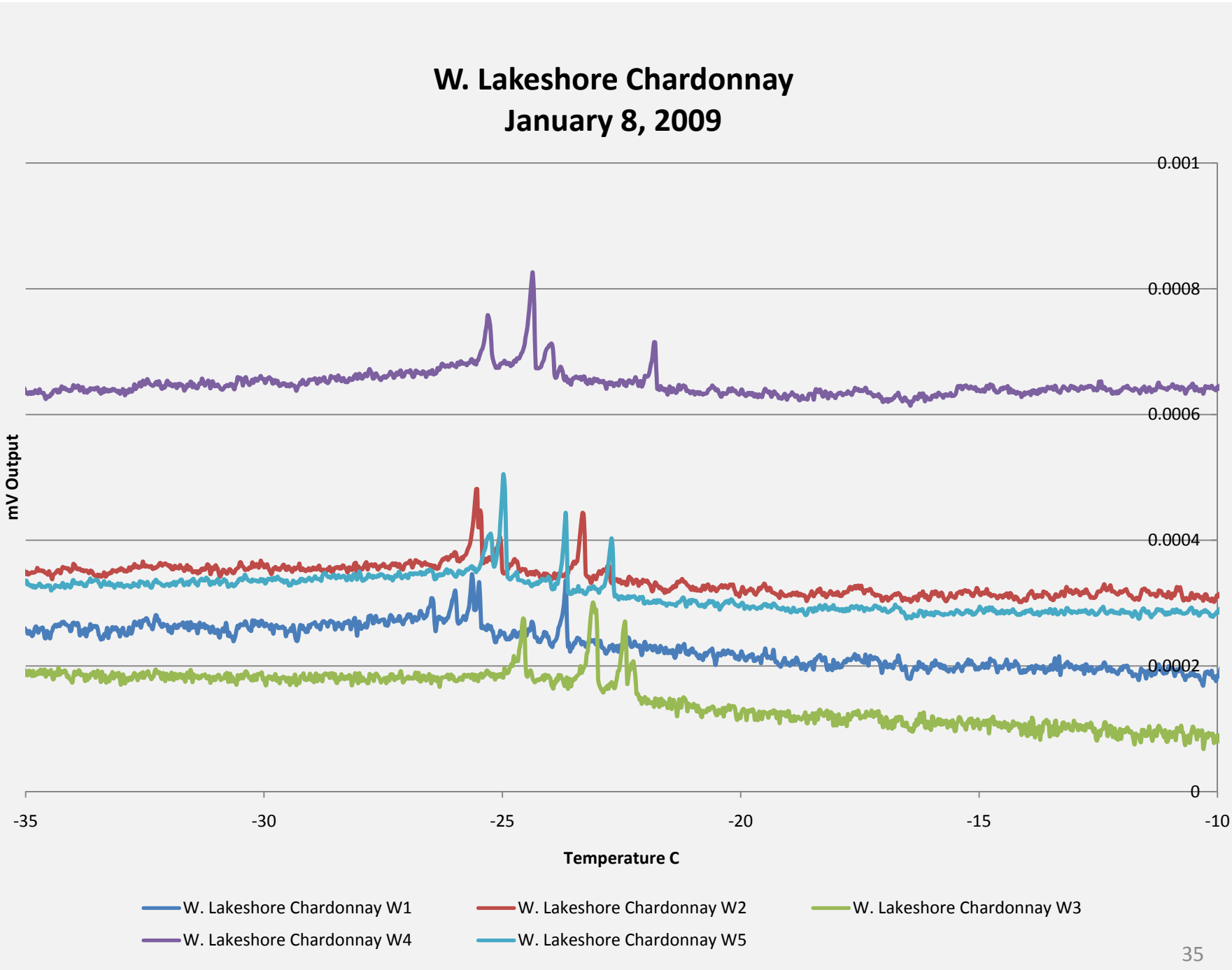
# of Tenney DTA Freezer Units	**2**
# of sample trays	**12** 2 freezer units x 6 trays per freezer
# of wells per tray	**10** 9 sample wells + 1 thermistor
Max # of buds per sample run	**540** 5 buds/well x 9 sample wells x 12 trays


Home
Insert
Page Layout
Formulas
Data
Review
View
Developer
Acrobat
Normal
Page Layout
Page Break Preview
Custom Views
Full Screen
Workbook Views
Ruler
Gridlines
Message Bar
Formula Bar
Headings
Show/Hide
Zoom
100%
Zoom to Selection
Zoom
New Window
Arrange All
Freeze Panes
Split
Hide
Unhide
Save Workspace
Switch Windows
Window
Macros
Macros
A1
Temperature
Chardonnay Chart 1
Chardonnay Chart 2
Cab. Sauv. Chart 1
Data Sheet
Ready
50%

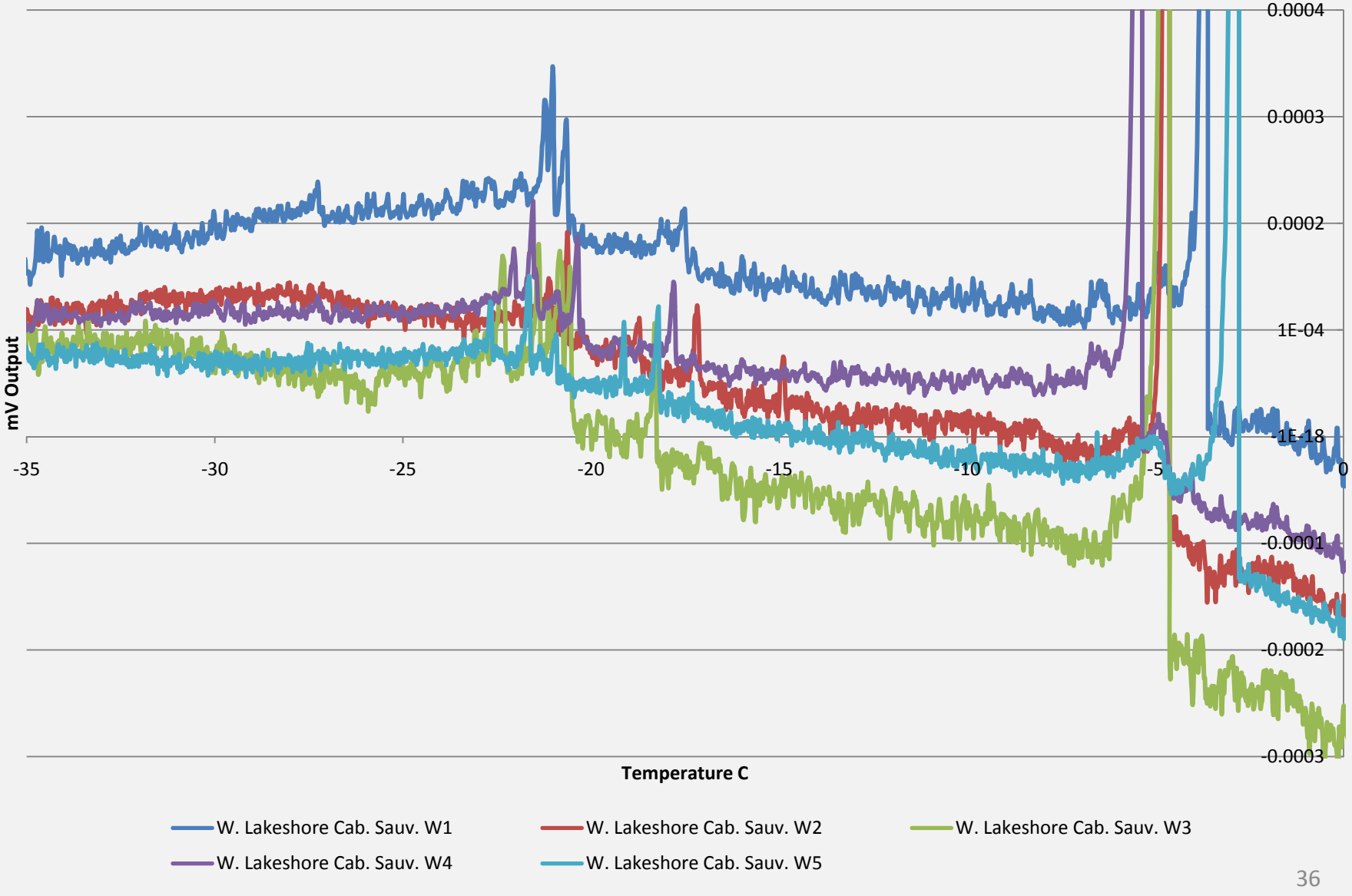

Results

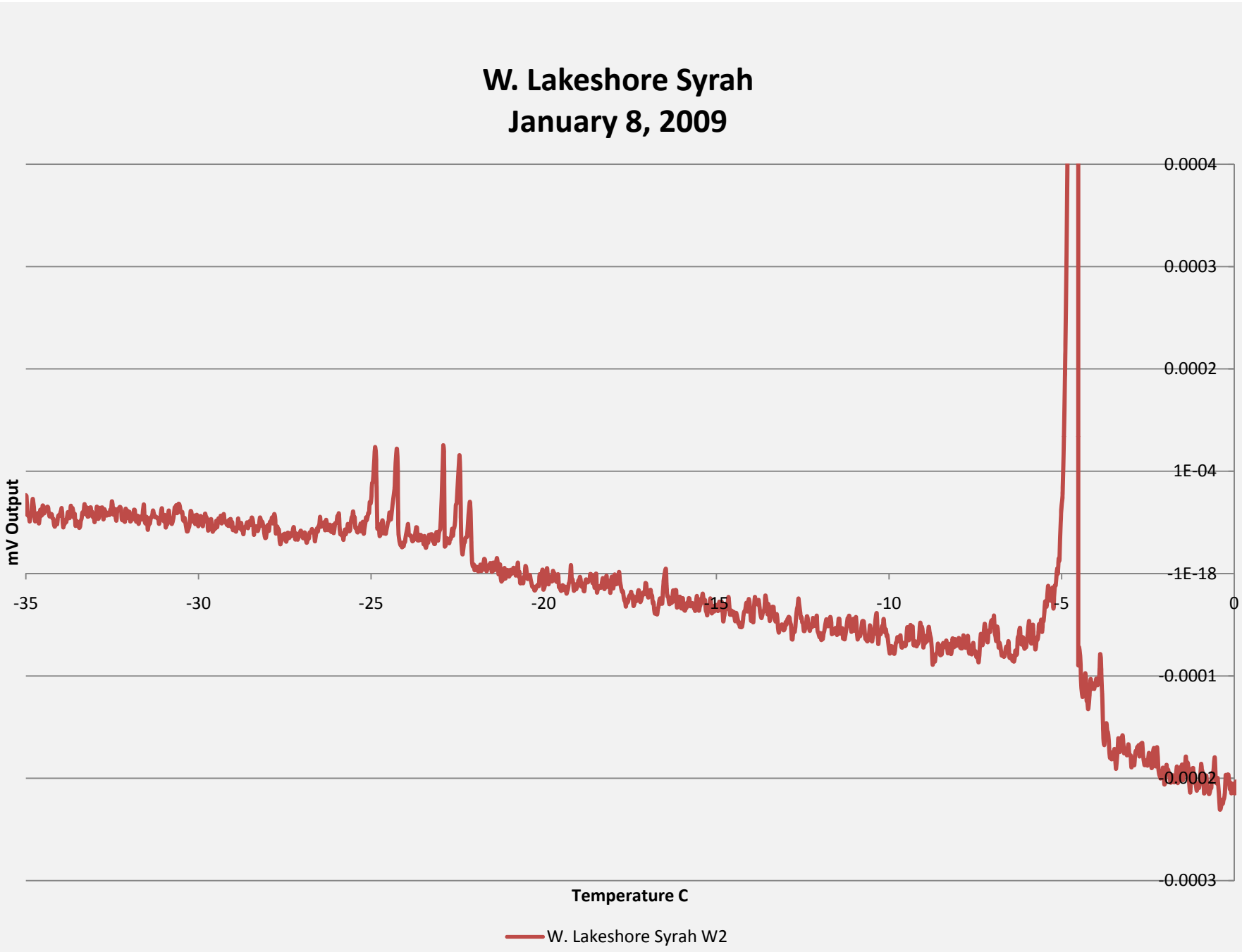

W. Lakeshore Chardonnay
January 8, 2009
mV Output
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-35
-30
-25
-20
-15
-10
-5
0
Temperature C
W. Lakeshore Chardonnay W1
W. Lakeshore Chardonnay W2
W. Lakeshore Chardonnay W3
W. Lakeshore Chardonnay W4
W. Lakeshore Chardonnay W5

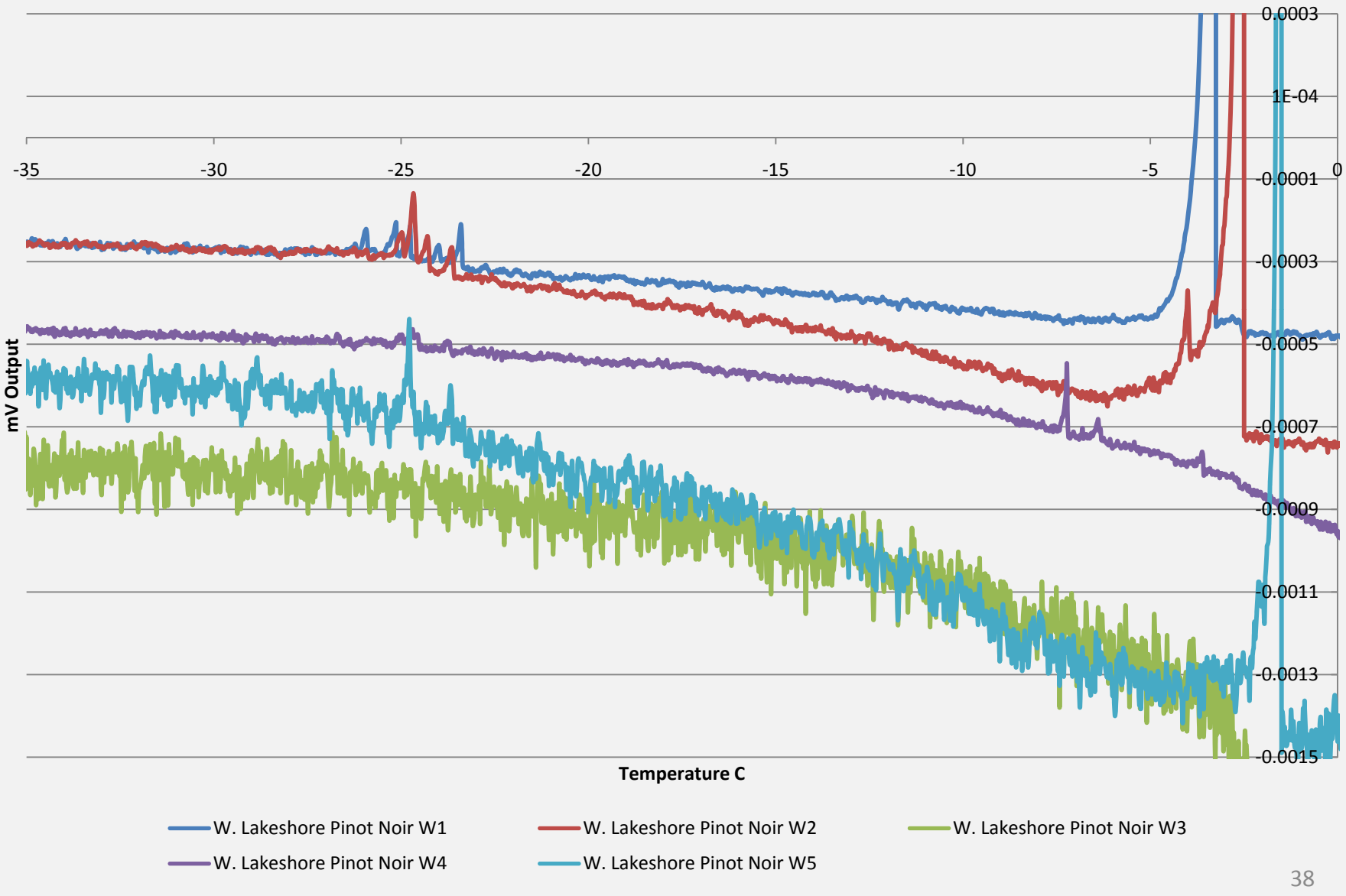

W. Lakeshore Chardonnay
January 8, 2009
mV Output
0.005
0.004
0.003
0.002
0.001
0
-0.001
-35
-30
-25
-20
-15
-10
-5
0
Temperature C
W. Lakeshore Chardonnay W1
W. Lakeshore Chardonnay W2
W. Lakeshore Chardonnay W3
W. Lakeshore Chardonnay W4
W. Lakeshore Chardonnay W5


W. Lakeshore Chardonnay
January 8, 2009
mV Output
0.001
0.0008
0.0006
0.0004
0.0002
0
-35
-30
-25
-20
-15
-10
Temperature C
W. Lakeshore Chardonnay W1
W. Lakeshore Chardonnay W2
W. Lakeshore Chardonnay W3
W. Lakeshore Chardonnay W4
W. Lakeshore Chardonnay W5

W. Lakeshore Cabernet Sauvignon
January 8, 2009

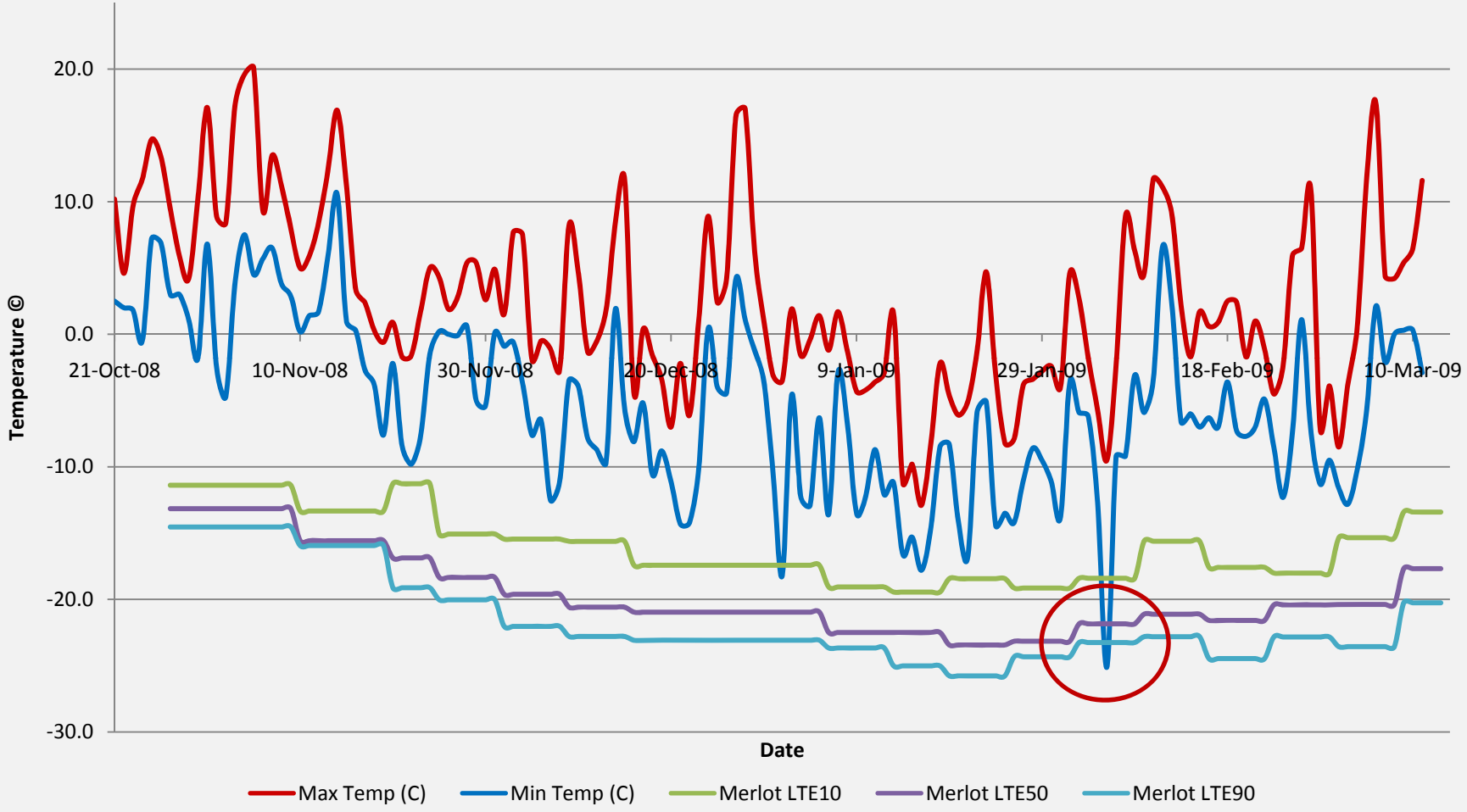



W. Lakeshore Syrah
January 8, 2009
mV Output
0.0004
0.0003
0.0002
1E-04
-1E-18
-0.0001
-0.0002
-0.0003
-35
-30
-25
-20
-15
-10
-5
0
Temperature C
W. Lakeshore Syrah W2


W. Lakeshore Pinot Noir
January 8, 2009
mV Output
0.0003
1E-04
-0.0001
-0.0003
-0.0005
-0.0007
-0.0009
-0.0011
-0.0013
-0.0015
-35
-30
-25
-20
-15
-10
-5
0
Temperature C
W. Lakeshore Pinot Noir W1
W. Lakeshore Pinot Noir W2
W. Lakeshore Pinot Noir W3
W. Lakeshore Pinot Noir W4
W. Lakeshore Pinot Noir W5

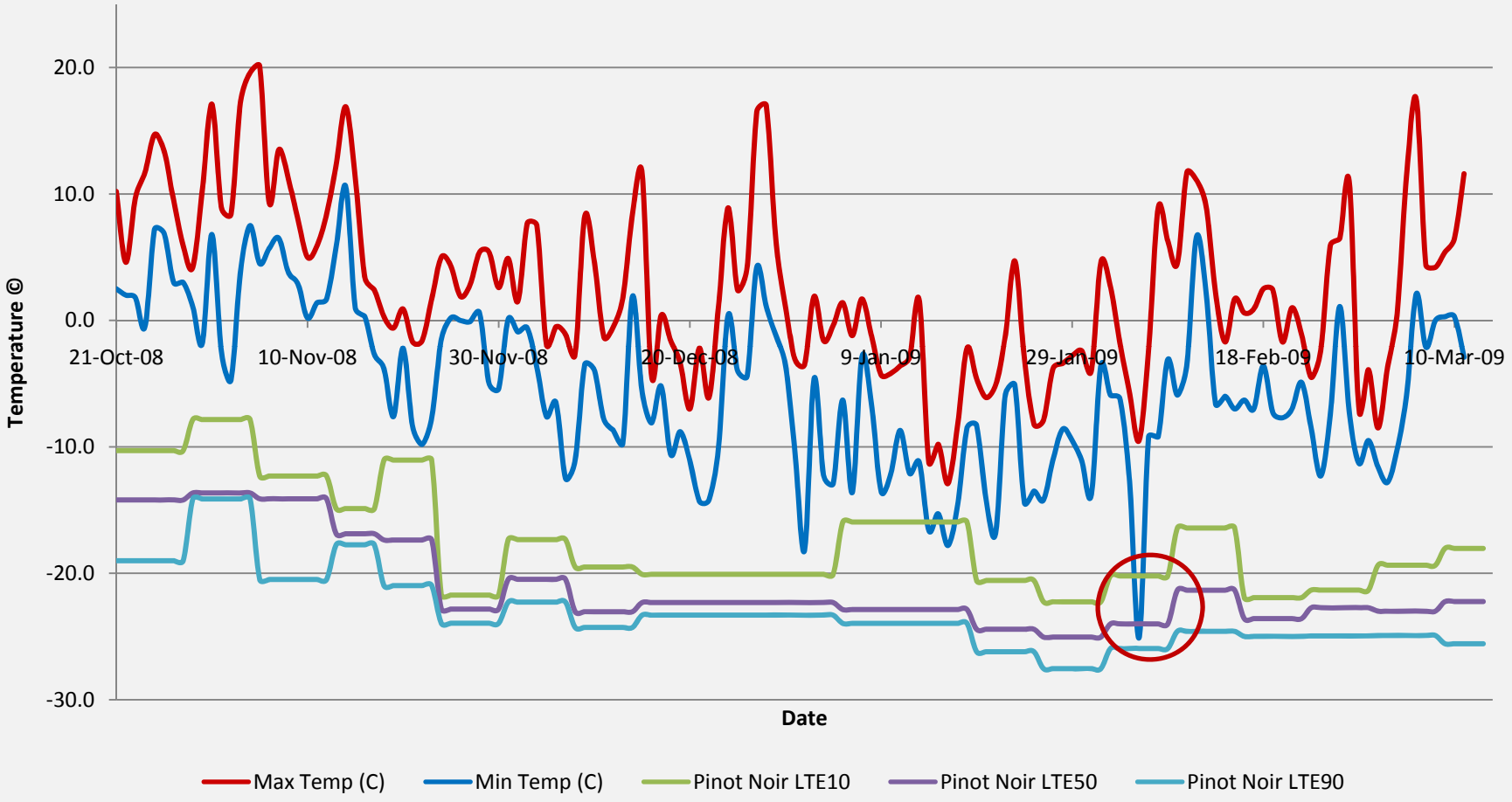

Critical events

2008/09 Vineland
Min/Max Temperatures & Merlot LTE Values



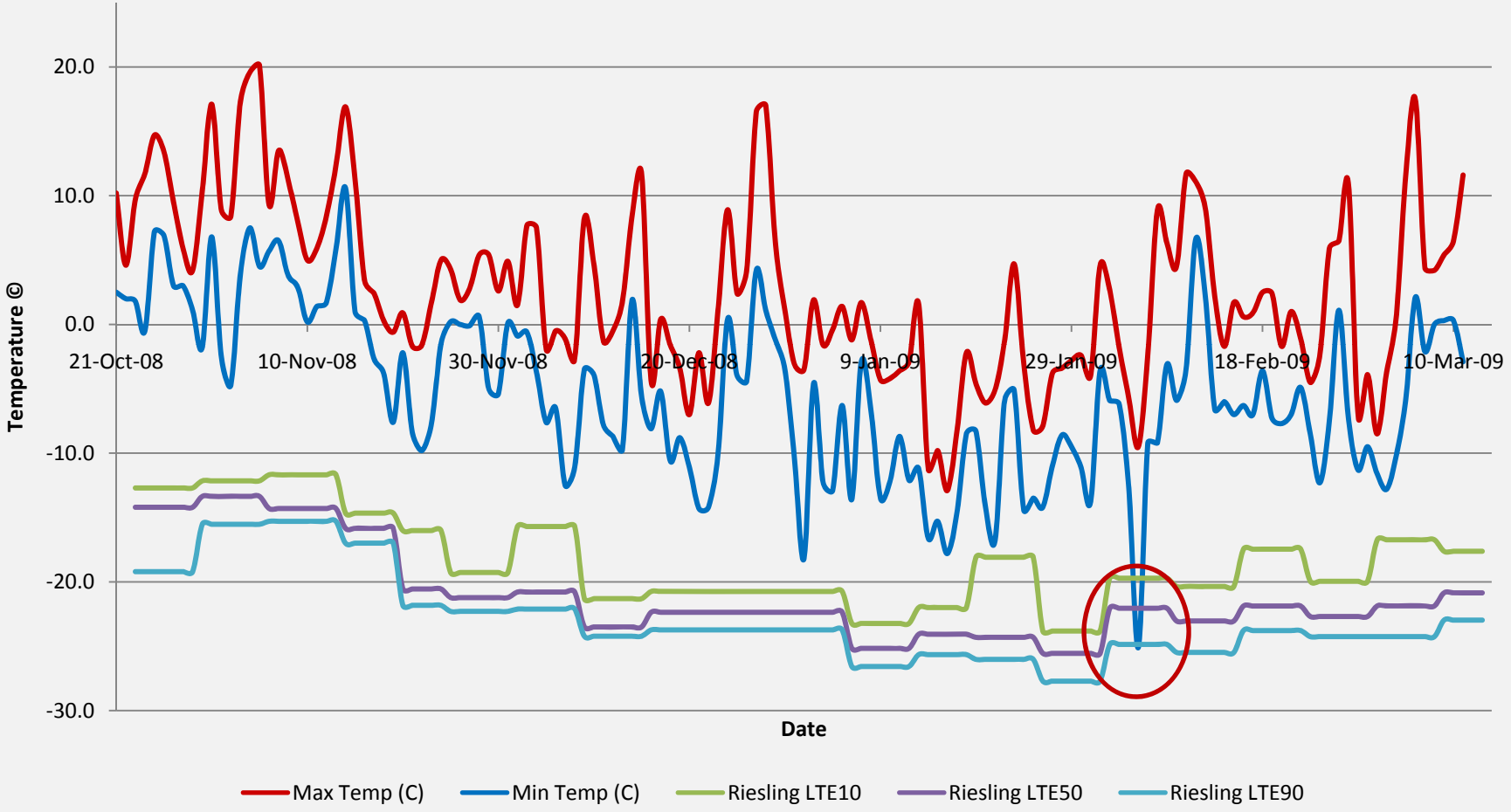
	Dec 15, 08	Jan 12, 09	Feb 9, 08	Feb 23, 08
Primary Bud Survival	99%	100%	34%	24%

2008/09 Vineland
Min/Max Temperatures & Pinot Noir LTE Values



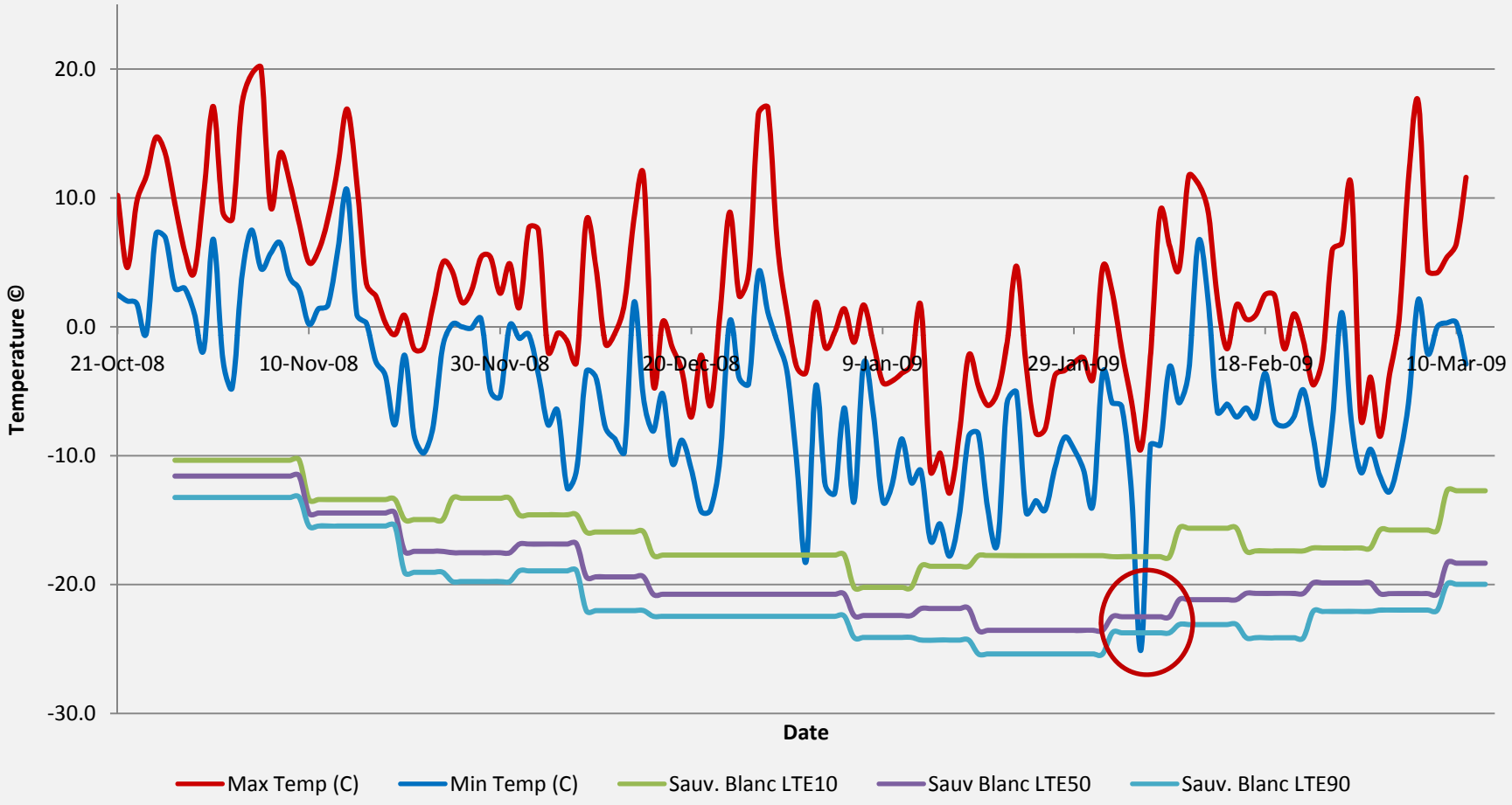
	Dec 15, 08	Jan 12, 09	Feb 9, 08	Feb 23, 08
Primary Bud Survival	98%	93%	73%	55%

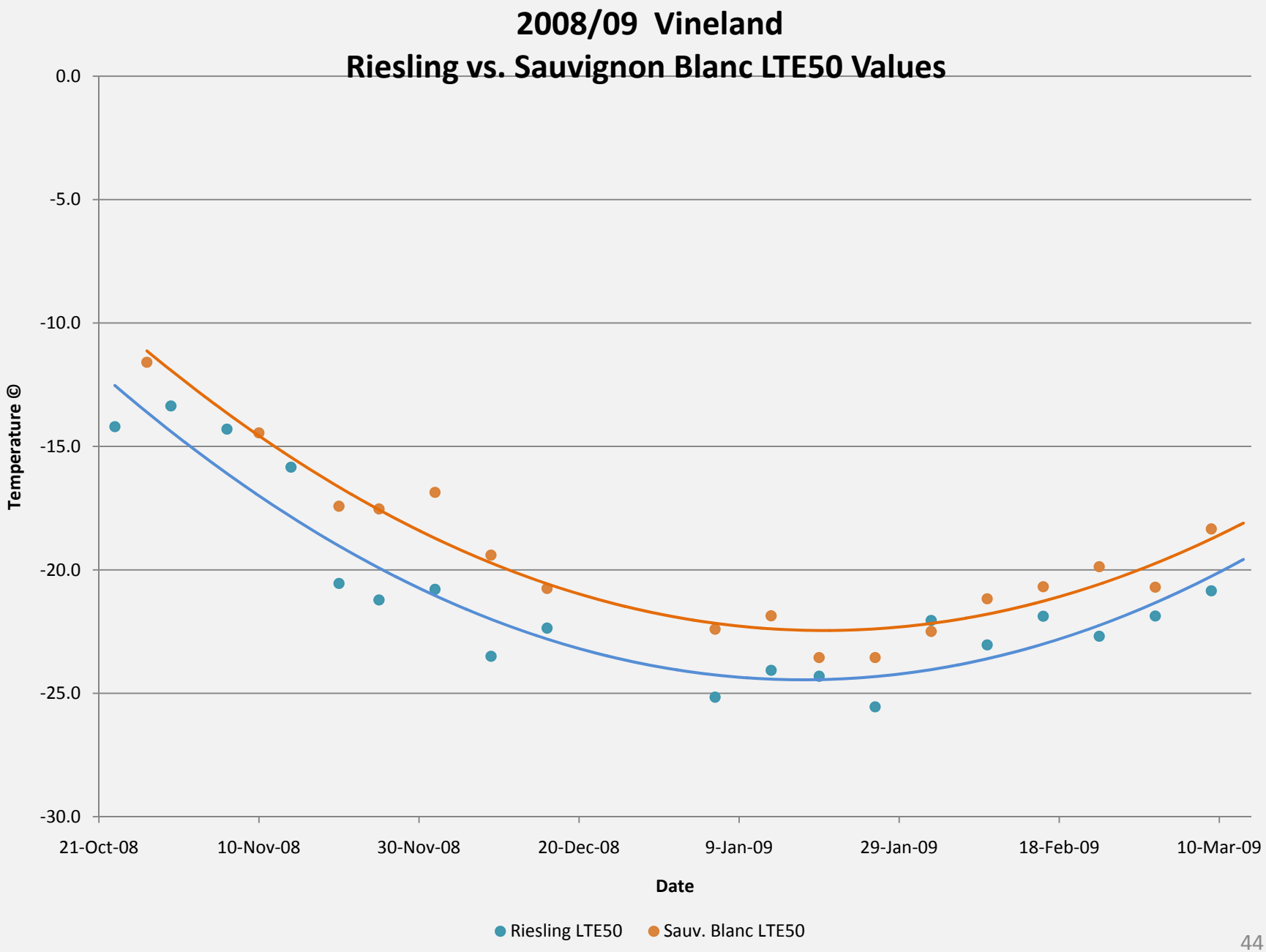
2008/09 Vineland
Min/Max Temperatures & Riesling LTE Values

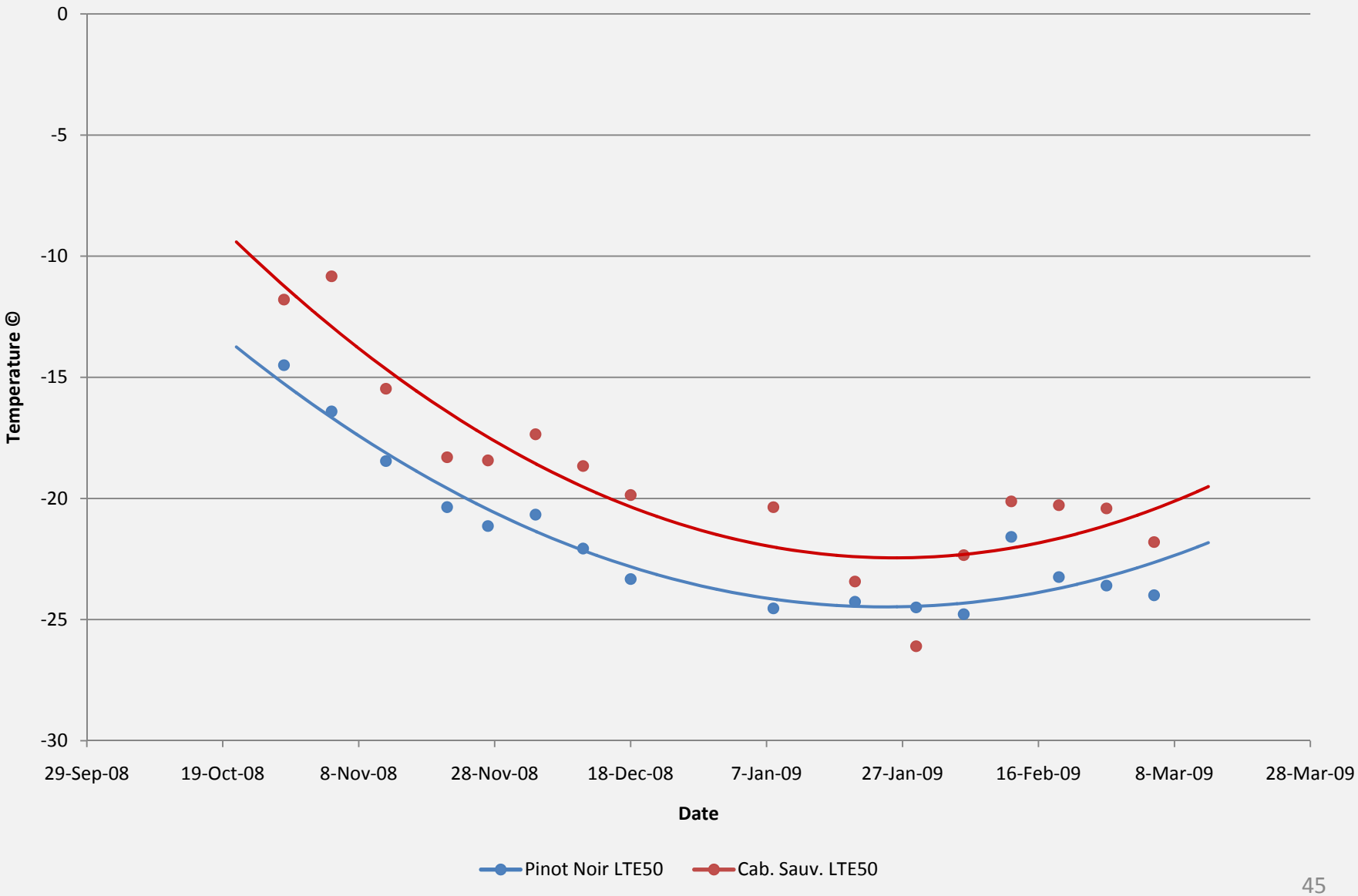


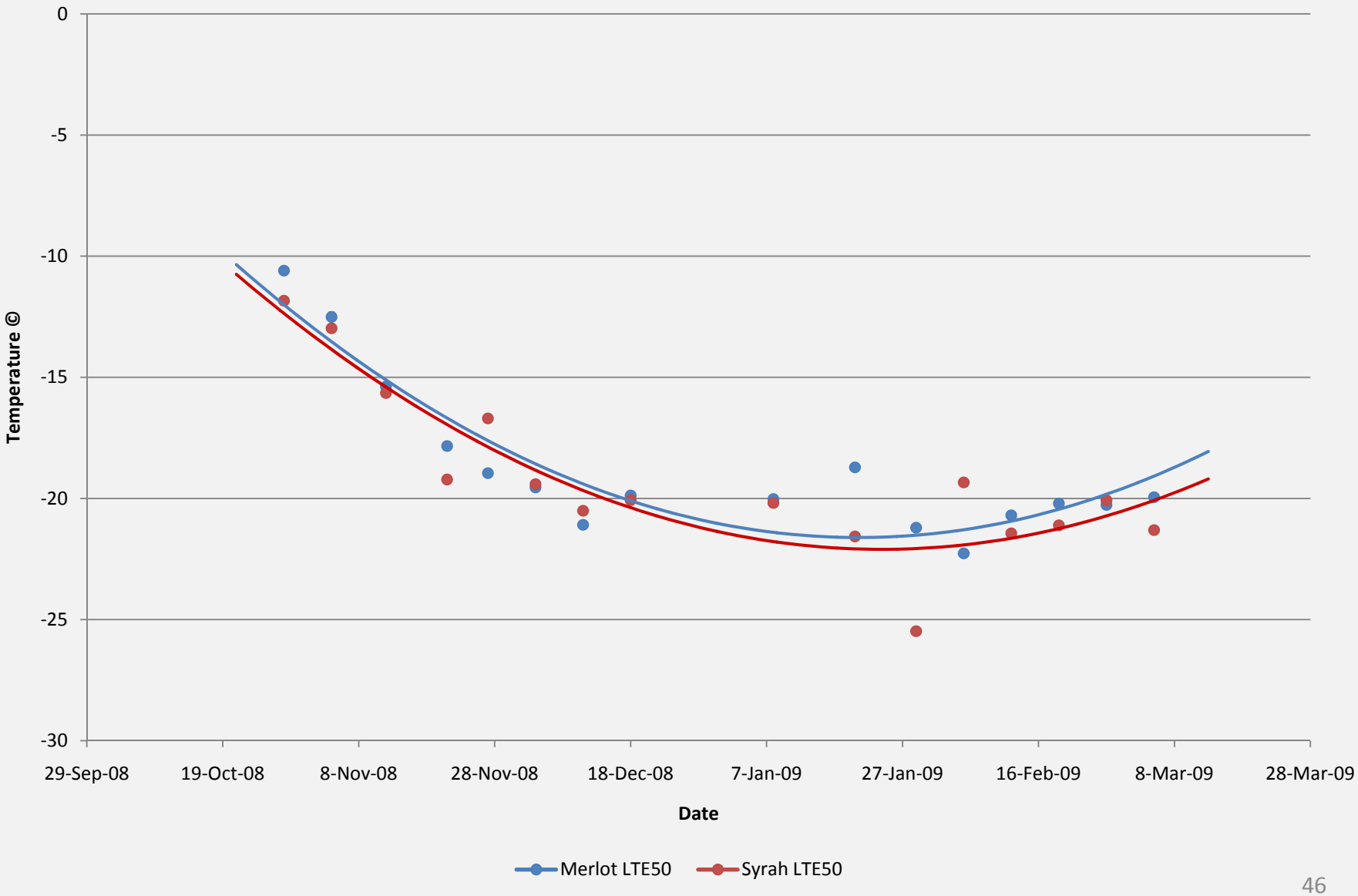
	Dec 15, 08	Jan 12, 09	Feb 9, 08	Feb 23, 08
Primary Bud Survival	98%	97%	78%	68%

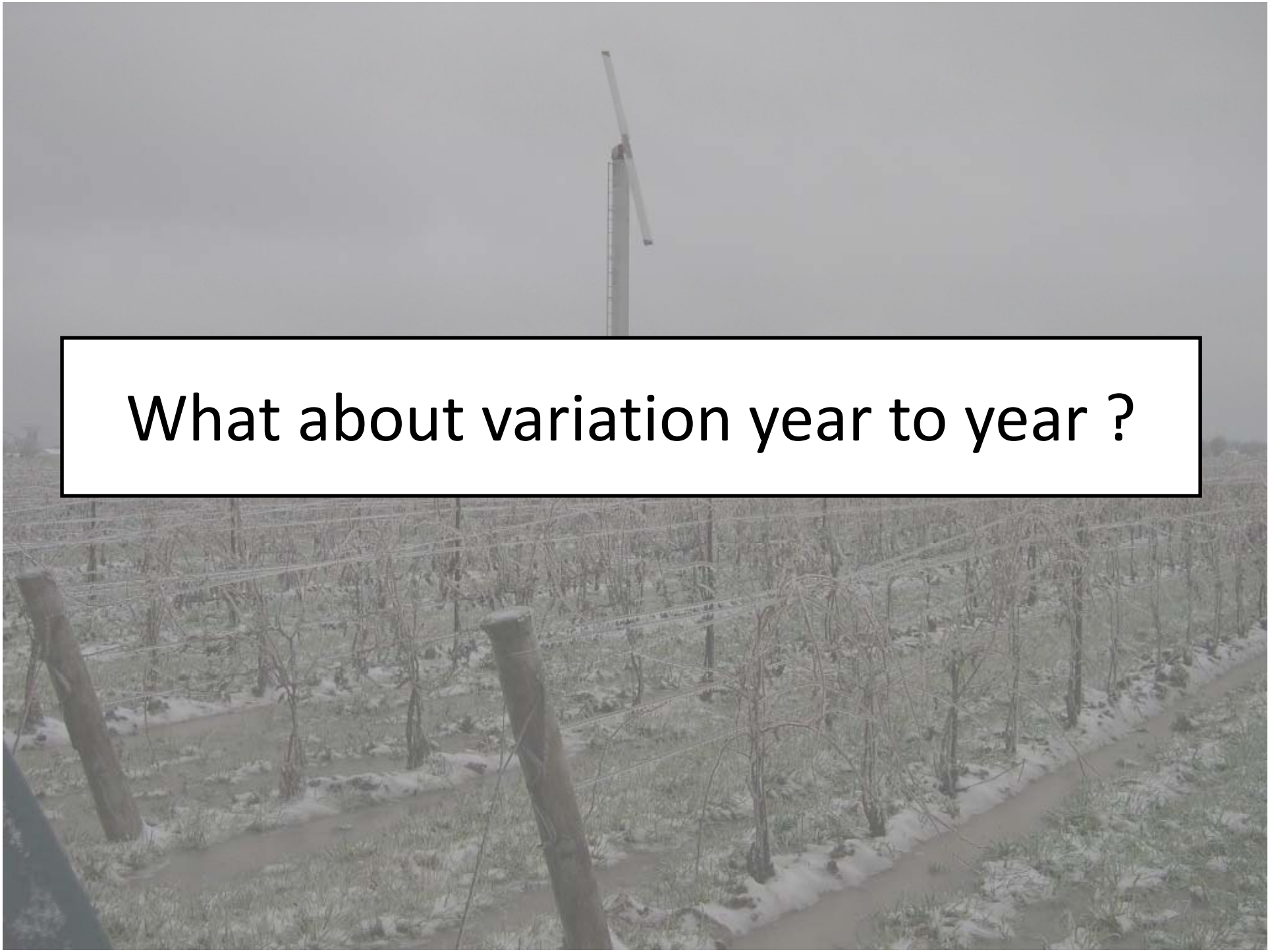
2008/09 Vineland
Min/Max Temperatures & Sauv. Blanc LTE Values

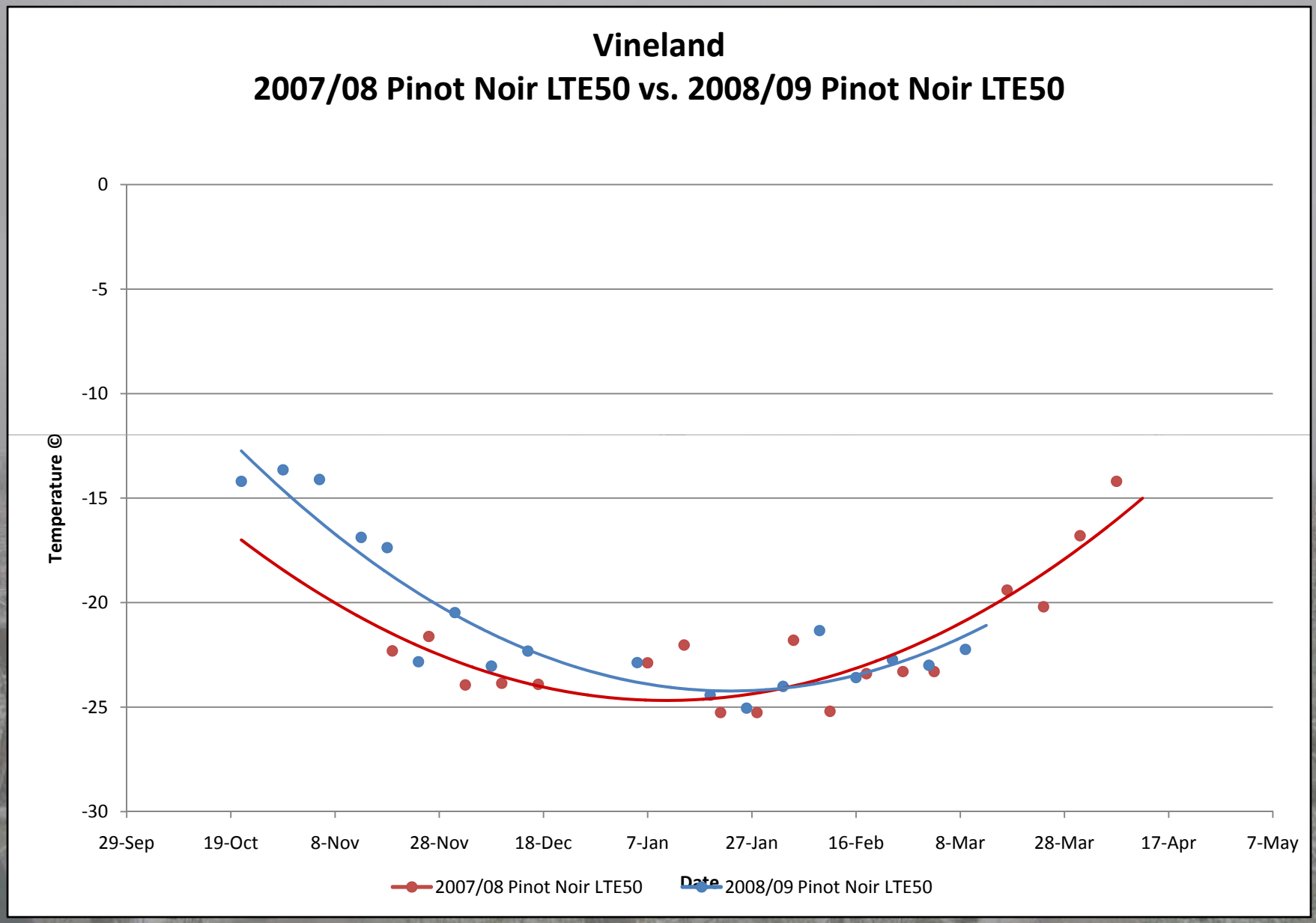


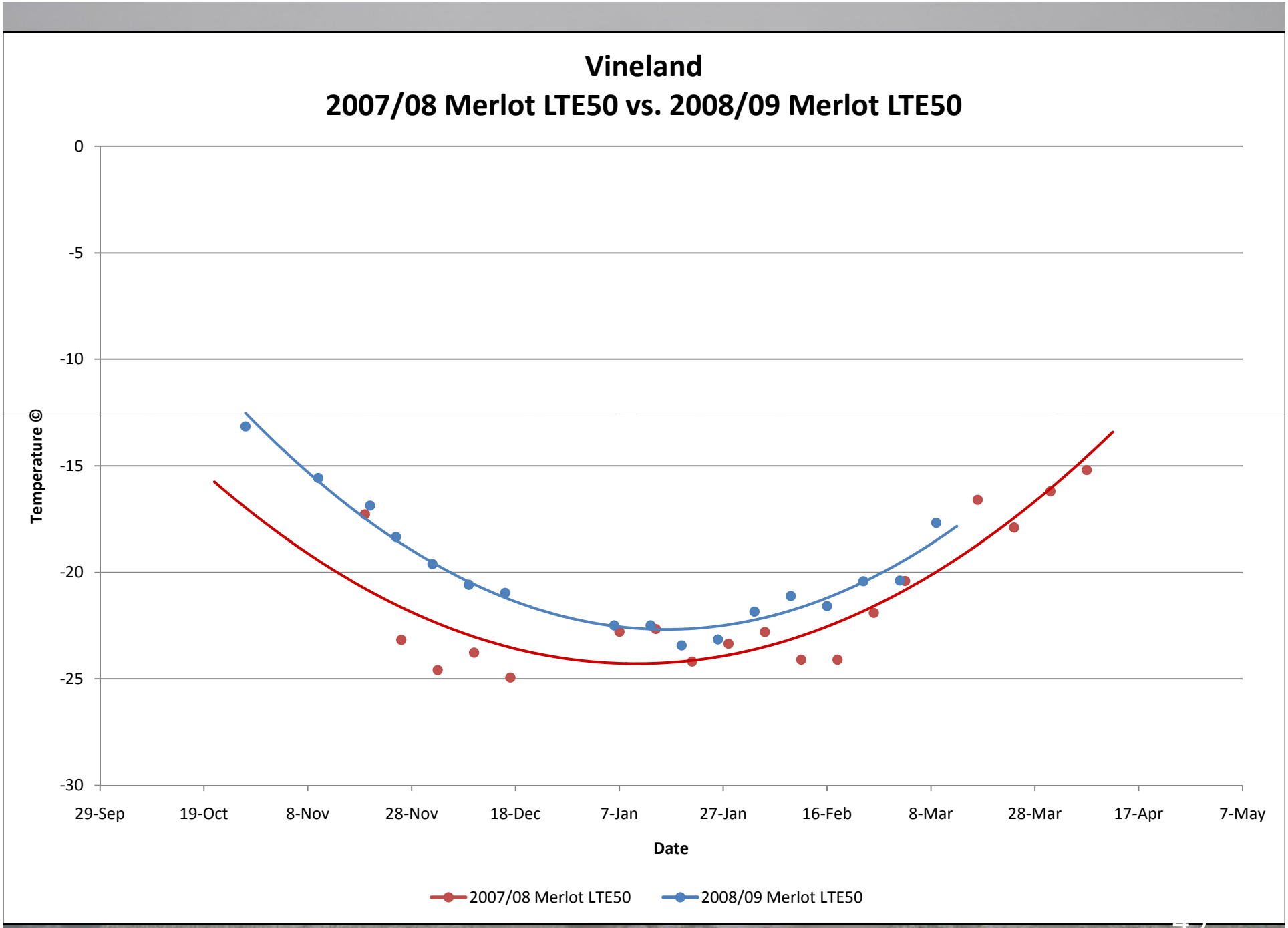

2008/09 Vineland
Riesling vs. Sauvignon Blanc LTE50 Values
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
Temperature ©
21-Oct-08
10-Nov-08
30-Nov-08
20-Dec-08
9-Jan-09
29-Jan-09
18-Feb-09
10-Mar-09
Date
Riesling LTE50
Sauv. Blanc LTE50

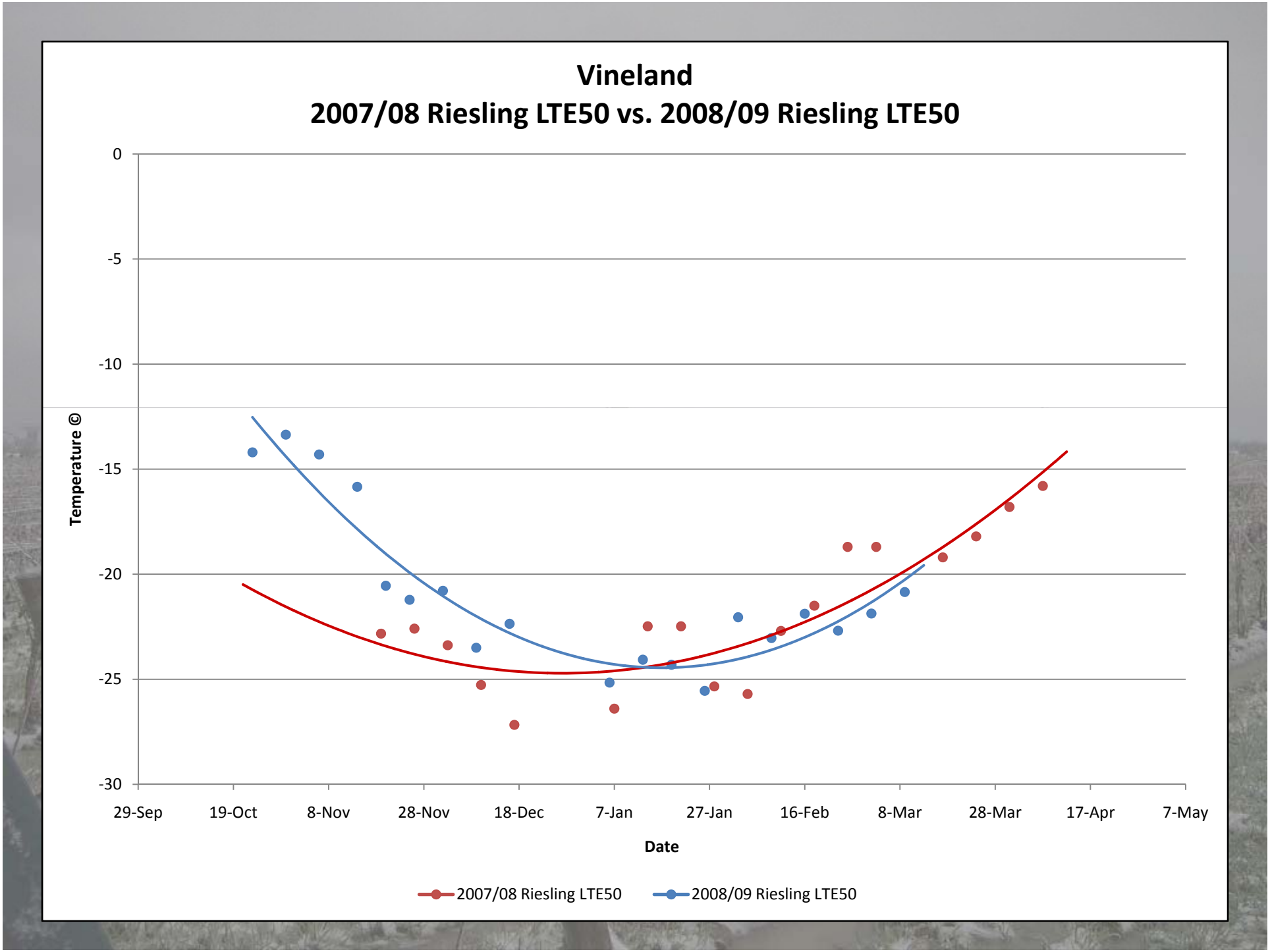

2008/09 W. Lakeshore
Pinot Noir vs. Cabernet Sauvignon LTE50 Values
0
-5
-10
-15
-20
-25
-30
Temperature ©
29-Sep-08
19-Oct-08
8-Nov-08
28-Nov-08
18-Dec-08
7-Jan-09
27-Jan-09
16-Feb-09
8-Mar-09
28-Mar-09
Date
Pinot Noir LTE50
Cab. Sauv. LTE50

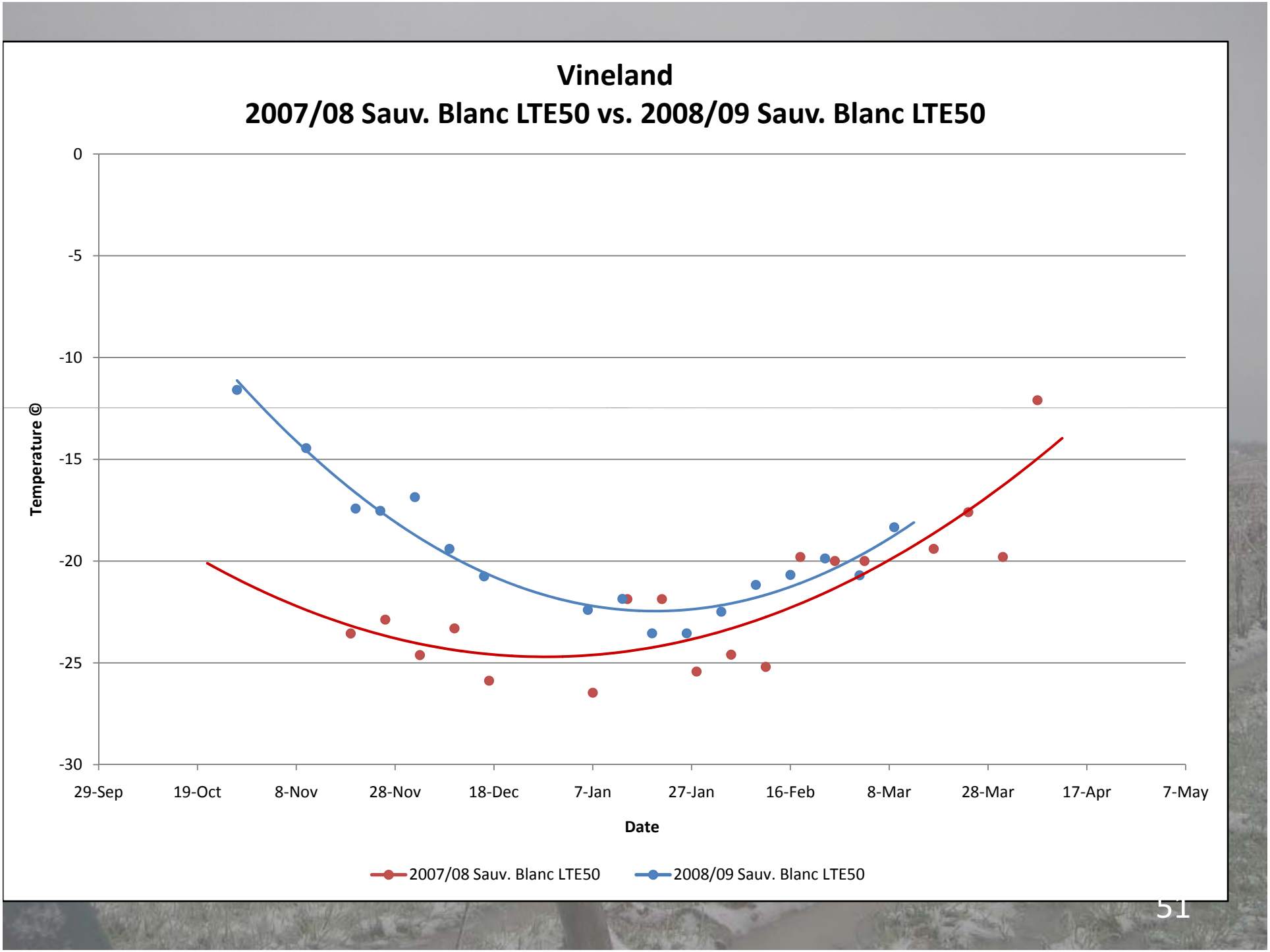

2008/09 W. Lakeshore
Merlot vs. Syrah LTE50 Values
0
-5
-10
-15
-20
-25
-30
Temperature ©
29-Sep-08
19-Oct-08
8-Nov-08
28-Nov-08
18-Dec-08
7-Jan-09
27-Jan-09
16-Feb-09
8-Mar-09
28-Mar-09
Date
Merlot LTE50
Syrah LTE50


What about variation year to year ?


Vineland
2007/08 Pinot Noir LTE50 vs. 2008/09 Pinot Noir LTE50
0
-5
-10
-15
-20
-25
-30
Temperature ©
29-Sep
19-Oct
8-Nov
28-Nov
18-Dec
7-Jan
27-Jan
16-Feb
8-Mar
28-Mar
17-Apr
7-May
Date
2007/08 Pinot Noir LTE50
2008/09 Pinot Noir LTE50


Vineland
2007/08 Merlot LTE50 vs. 2008/09 Merlot LTE50
0
-5
-10
-15
-20
-25
-30
Temperature ©
29-Sep
19-Oct
8-Nov
28-Nov
18-Dec
7-Jan
27-Jan
16-Feb
8-Mar
28-Mar
17-Apr
7-May
Date
2007/08 Merlot LTE50
2008/09 Merlot LTE50


Vineland
2007/08 Riesling LTE50 vs. 2008/09 Riesling LTE50
0
-5
-10
-15
-20
-25
-30
Temperature ©
29-Sep
19-Oct
8-Nov
28-Nov
18-Dec
7-Jan
27-Jan
16-Feb
8-Mar
28-Mar
17-Apr
7-May
Date
2007/08 Riesling LTE50
2008/09 Riesling LTE50


Vineland
2007/08 Sauv. Blanc LTE50 vs. 2008/09 Sauv. Blanc LTE50
0
-5
-10
-15
-20
-25
-30
Temperature ©
29-Sep
19-Oct
8-Nov
28-Nov
18-Dec
7-Jan
27-Jan
16-Feb
8-Mar
28-Mar
17-Apr
7-May
Date
2007/08 Sauv. Blanc LTE50
2008/09 Sauv. Blanc LTE50

Special thanks

- Tom MacDonald and Art Reimer - Brock University – Electrical and Mechanical shop
- CCOVI faculty and staff
- GGO, WCO , KCMS and other project funding groups
- Schenck Farms Ltd

Special thanks

- Research project colleagues – Helen Fisher, Hugh Fraser and Ken Slingerland
- Ryan Brewster and Charlene Yungblut – KCMS
- Bob Wample (Fresno State) , Markus Keller (WSU) and others

Special thanks

- Tom MacDonald and Art Reimer - Brock University – Electrical and Mechanical shop
- CCOVI faculty and staff
- GGO, WCO , KCMS and other project funding groups
- Growers for samples and ideas
- Schenck Farms ltd

Future Research Possibilities

- Impact of cultural practices
  - Canopy management
  - Training system
  - Vine spacing
  - Irrigation
  - Crop Level influence
  - Vine nutrition

Future Research Possibilities

- Bud hardiness based on node position
- Long term effects from ice wine production
- Clonal evaluations
- Doing vineyard specific vine selections for propagation
- Influence of pest injury
- And ????????