Swooshes and Notches in the T-REX Experimental Area

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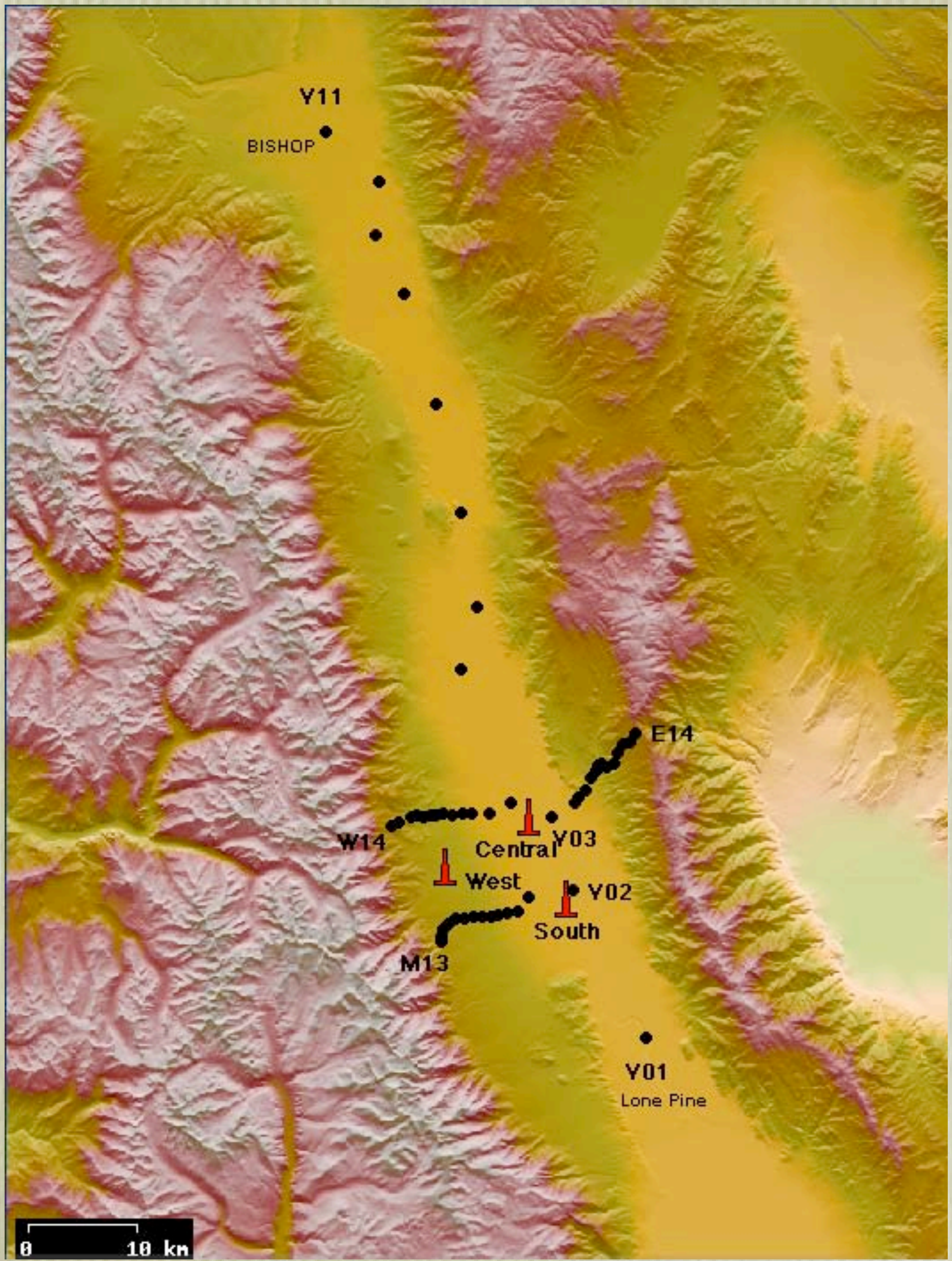
Locations of HOBOs and ISFF towers



HOBOs collected one data point every 5 min for 2+ months.

The valley line (V01-V11) runs up the OV, providing info on along-valley T differences.

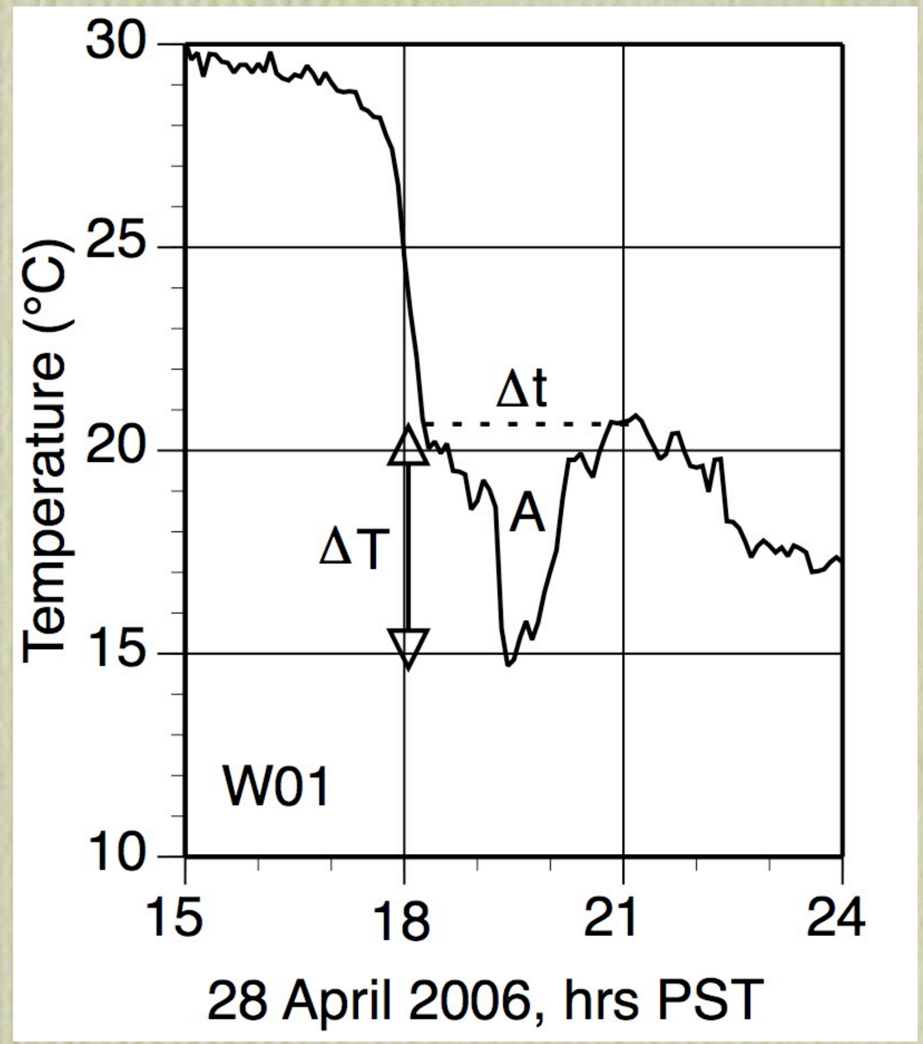
Three lines runs up the OV sidewalls (W01-W13, E01-E14, and M01-M13) providing info on vertical T structure and its cross-valley and along-sidewall variations.

Comparison of the M and W lines has provided info on the effect of Kearsarge Pass on the W and E lines that run through Independence, CA.

HOBO Notch Analysis

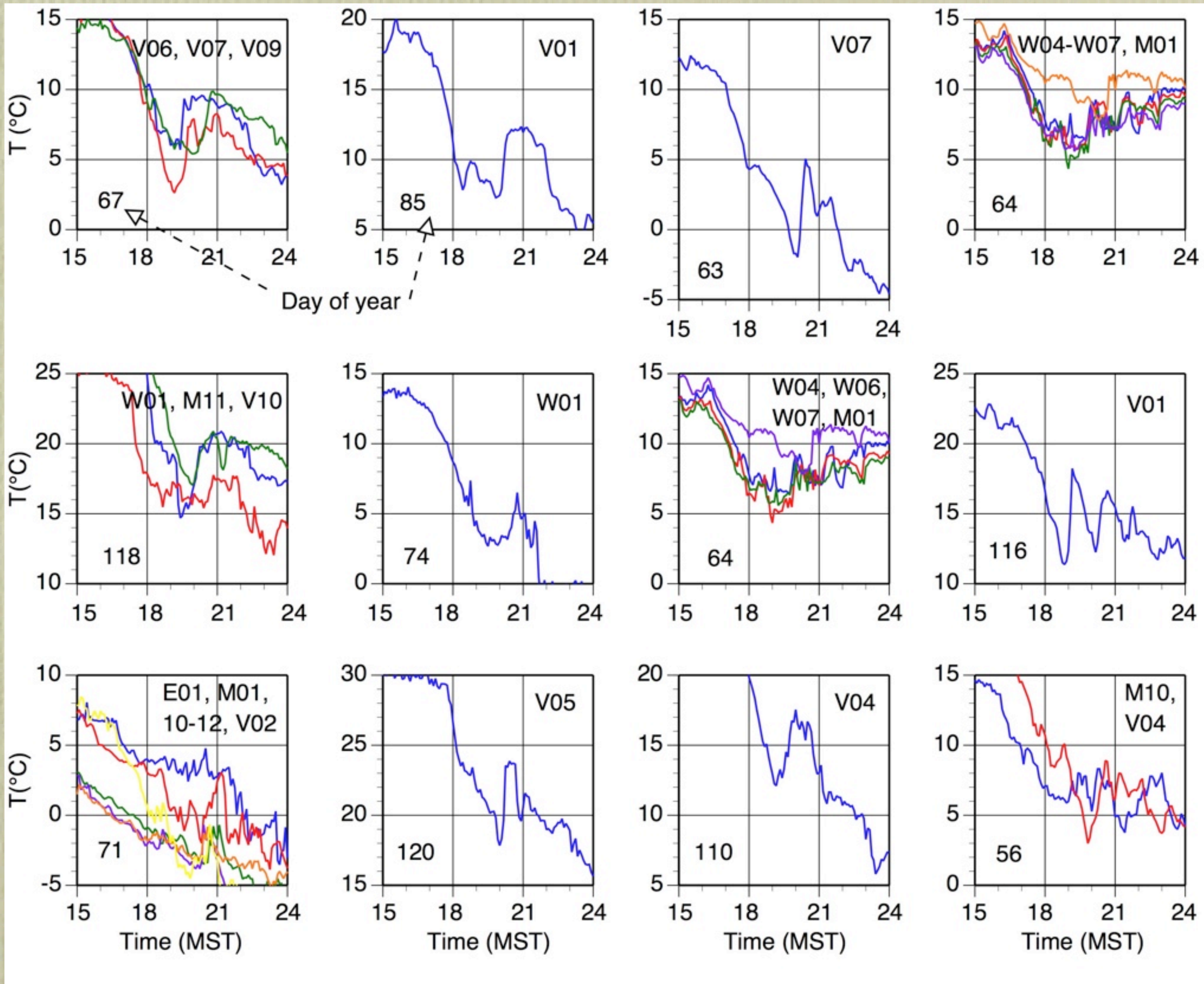
- An unusual diurnal signal was seen in the HOBO temperature time series at many sites and on many days.
- In early evening the temperatures fell, but then recovered again before continuing their nighttime fall.
- These evening ‘notches’ in the temperature curves have been investigated using the HOBO and ISFF tower data.

Notches



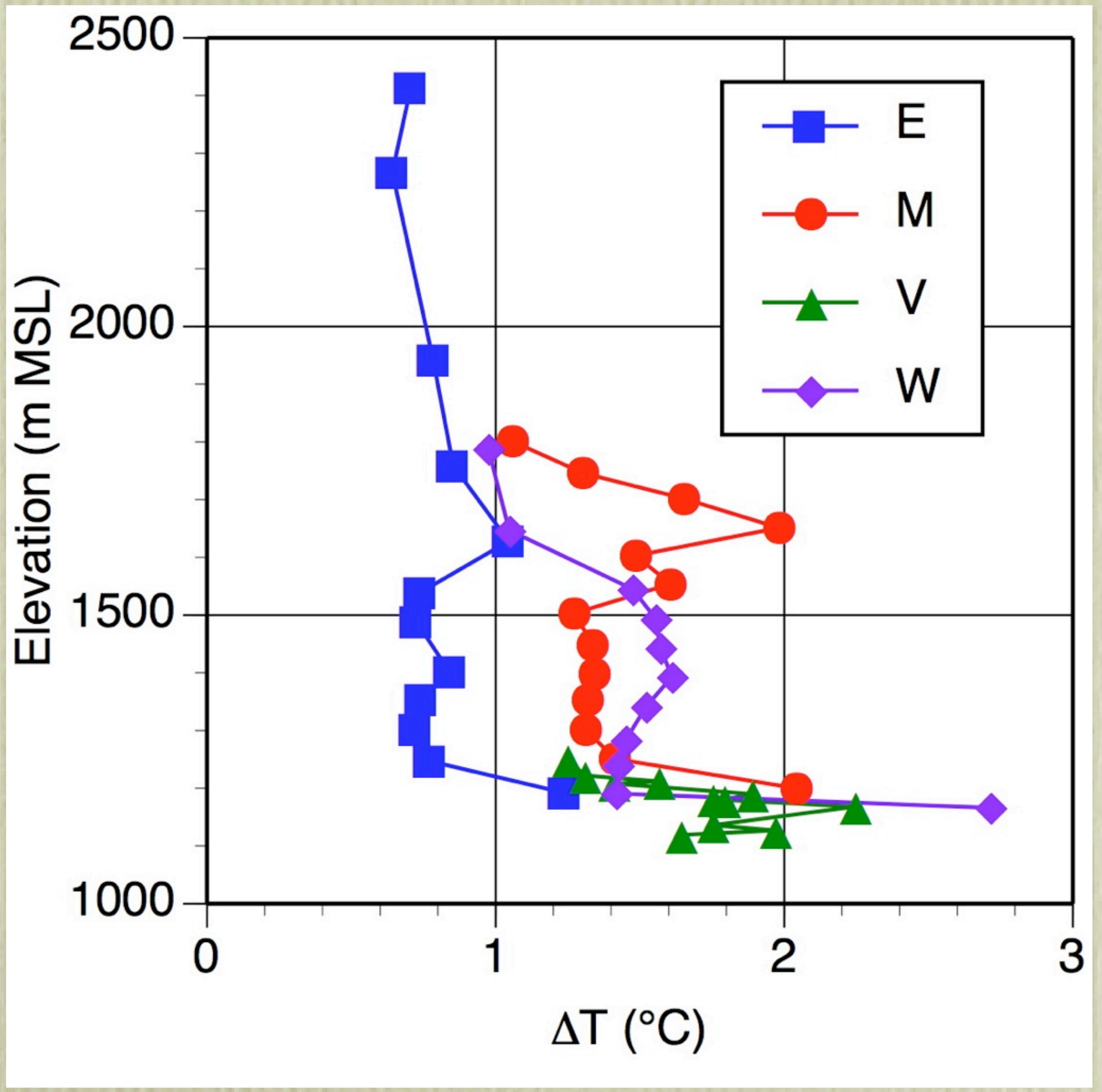
Temperature time series at W01 near South tower, illustrating a ‘notch’. Notches are characterized by their integrated area A, their width Δt, and their temperature drop ΔT.

We determined the frequency, the sites affected by, and the characteristics of the notches. We used the ISFF towers to investigate the causes of the notches.

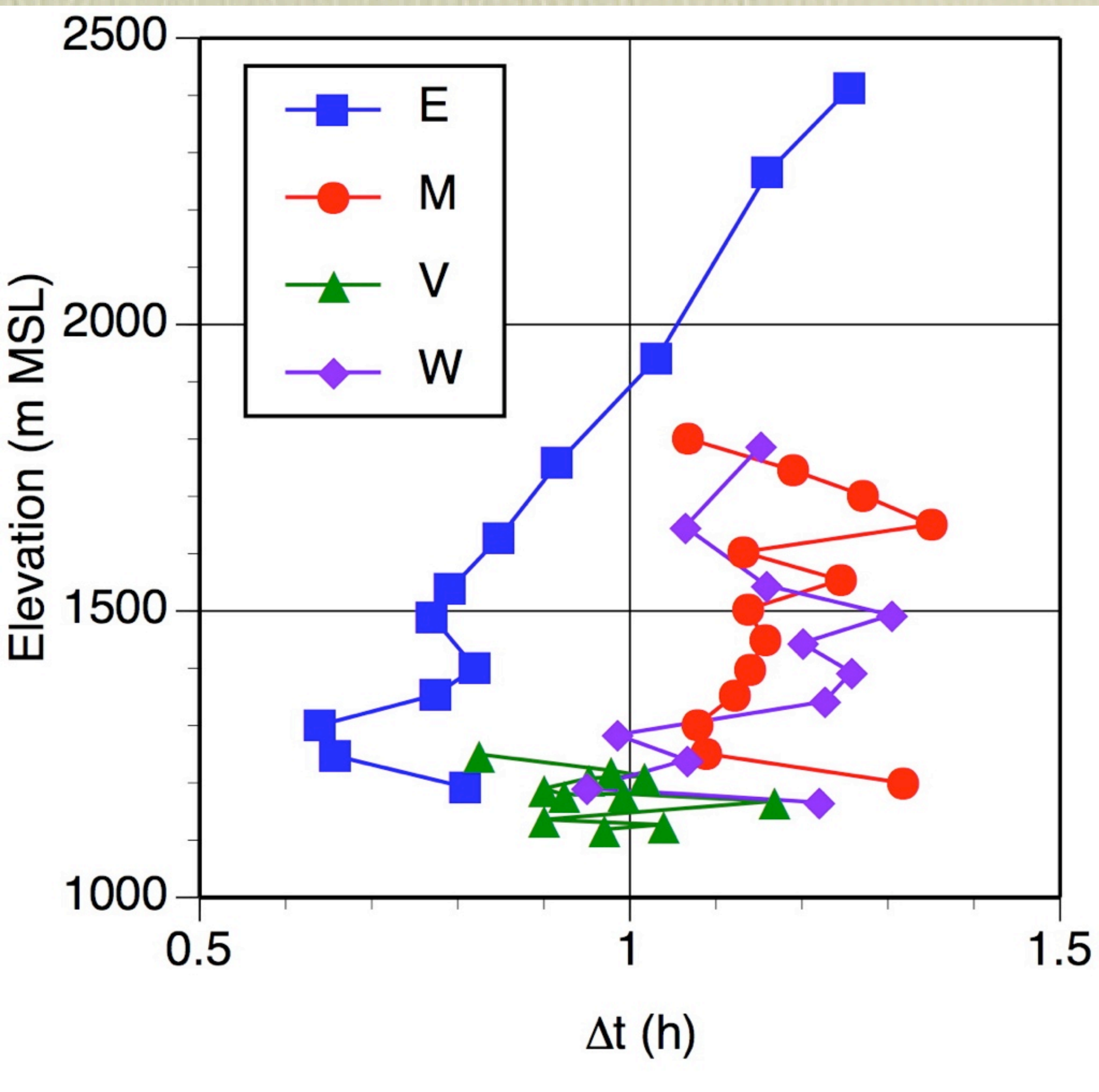


V06, V07, V09
67
V01
85
V07
63
W04-W07, M01
64
Day of year
W01, M11, V10
118
W01
74
W04, W06, W07, M01
64
V01
116
E01, M01, 10-12, V02
71
V05
120
V04
110
M10, V04
56
T (°C)
Time (MST)

HOBOs

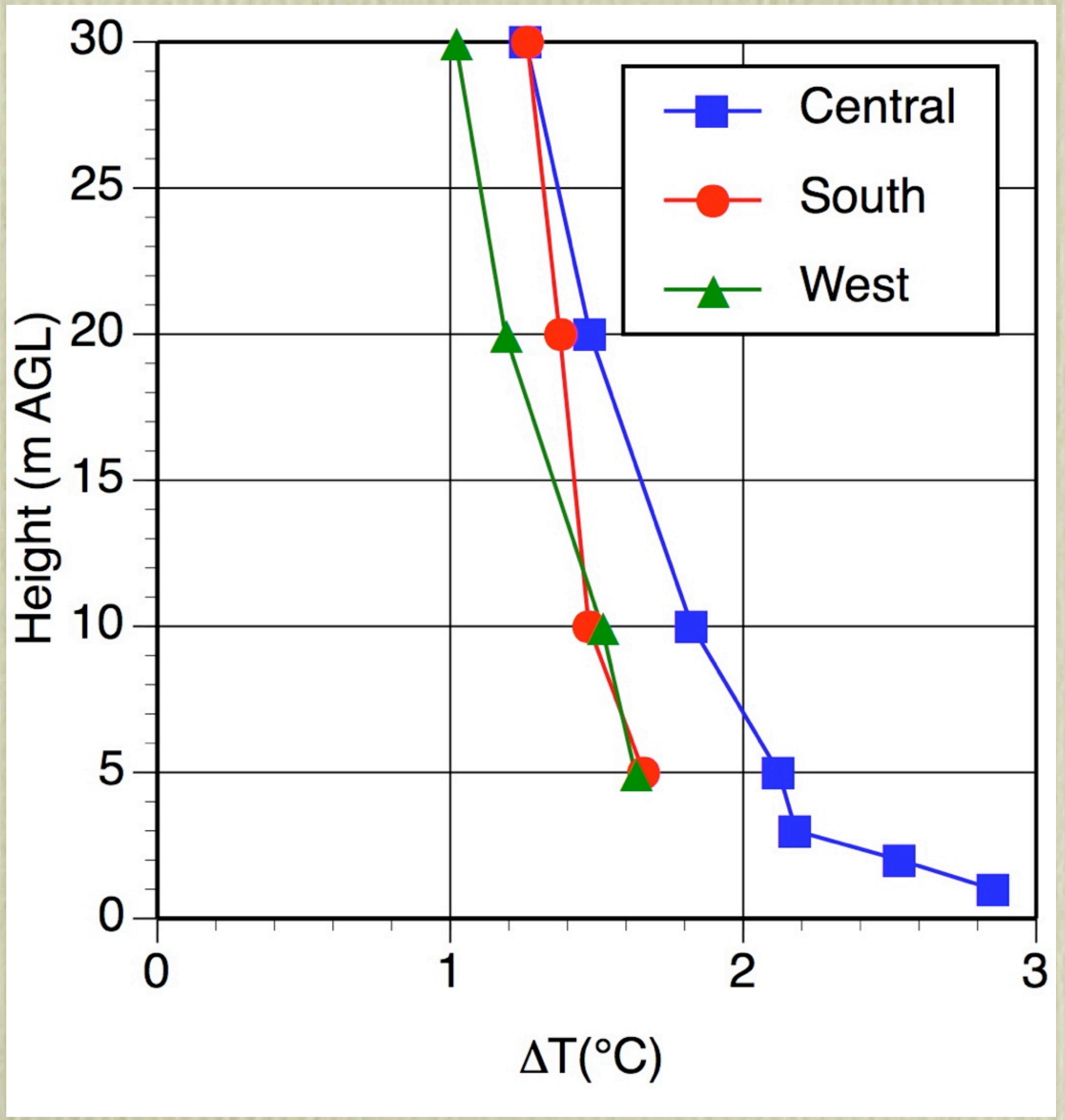


2500
2000
1500
1000
Elevation (m MSL)
0
1
2
3
ΔT (°C)
E
M
V
W

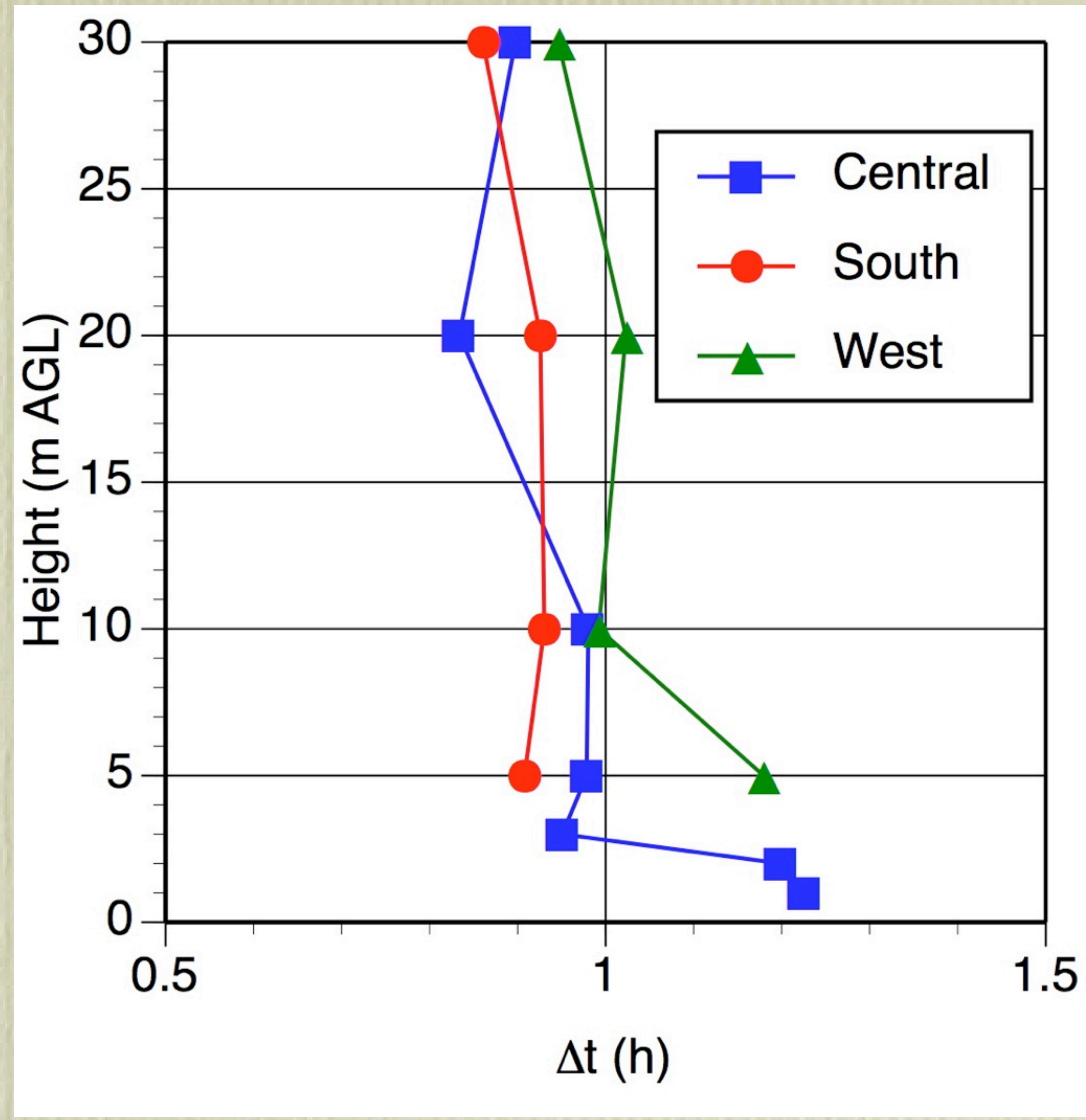


2500
2000
1500
1000
Elevation (m MSL)
0.5
1
1.5
Δt (h)
E
M
V
W

Towers



Central
South
West
Height (m AGL)
ΔT(°C)



Central
South
West
Height (m AGL)
Δt (h)

Initial hypothesis

(e)

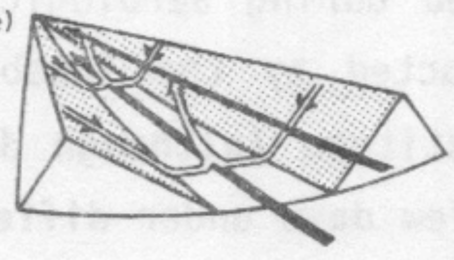


Figure 5: Air flow in the evening. The downslope winds are beginning. The valley wind is decreasing. The pressure drop is still in the up-valley direction. Temperature: it is slightly warmer in the valley than it is over the plain. Changes in temperature (until the situation shown in Figure 6) the valley is cooling rapidly; the plain is cooling only slightly.

(f)

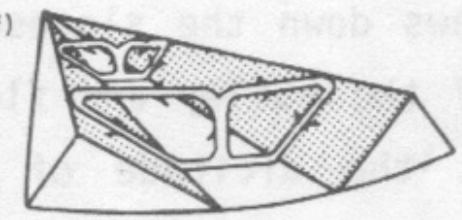


Figure 6: Air flow from late evening through the first half of the night. Downslope winds are present. The system is in a state of transition from valley wind to mountain wind. Pressure drop: zero. Temperature (until the situation shown in Figure 7): valley continues to cool rapidly.

(g)

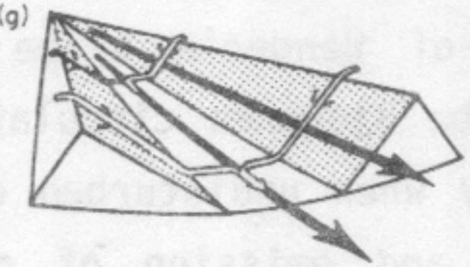


Figure 7: Air flow at night. Mountain wind is present along with the downslope winds. The pressure drop is in the down-valley direction. Temperature: valley is cold, plain is relatively warm. Changes in temperature (until the situation shown in Figure 8): valley is cooling; plain is cooling slightly but is warm relative to the valley.

(h)

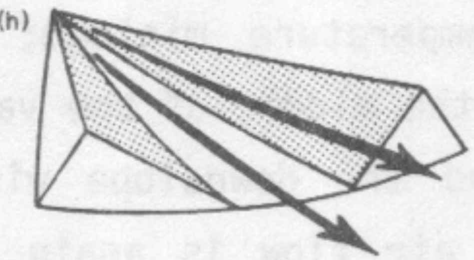
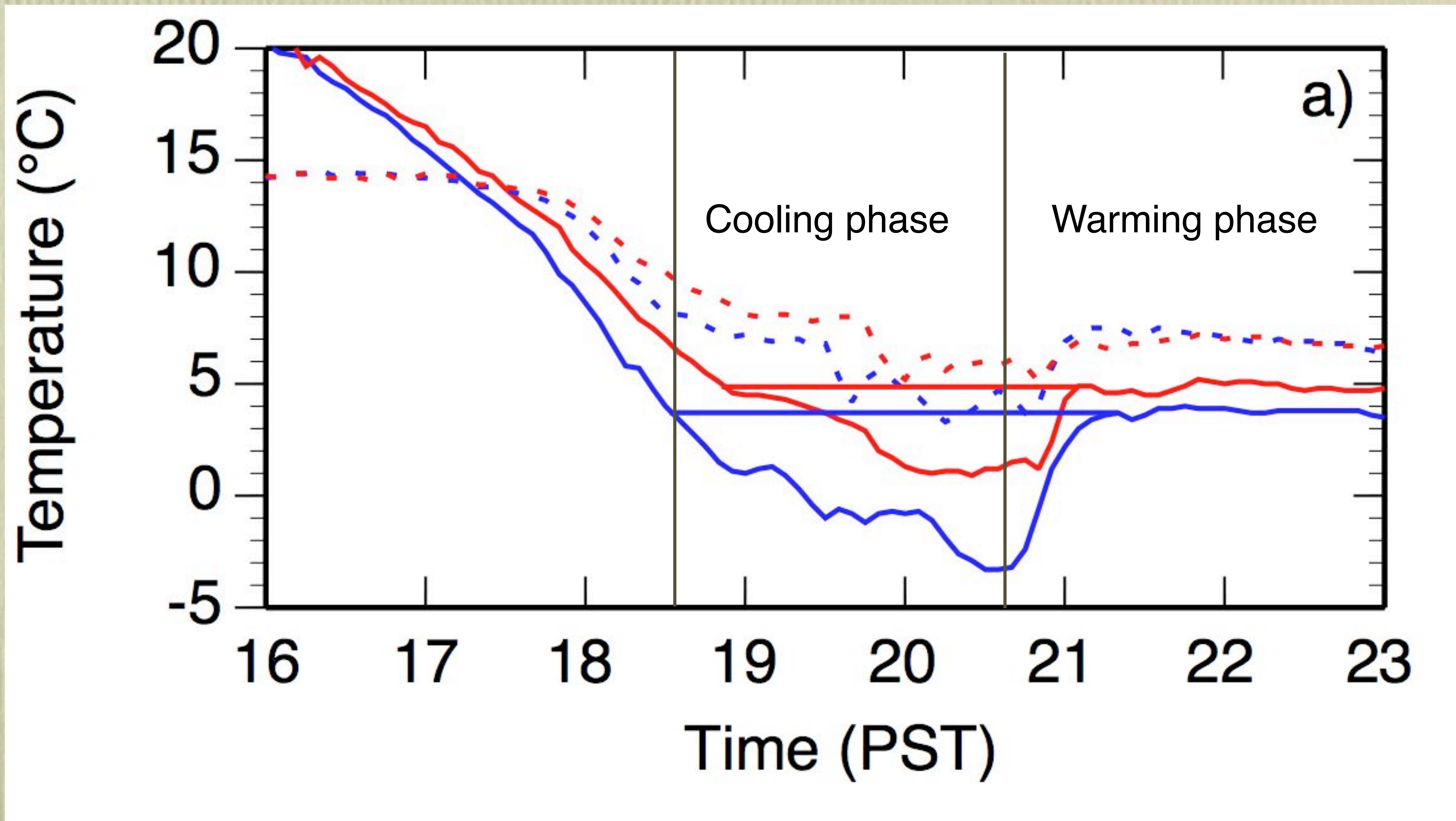
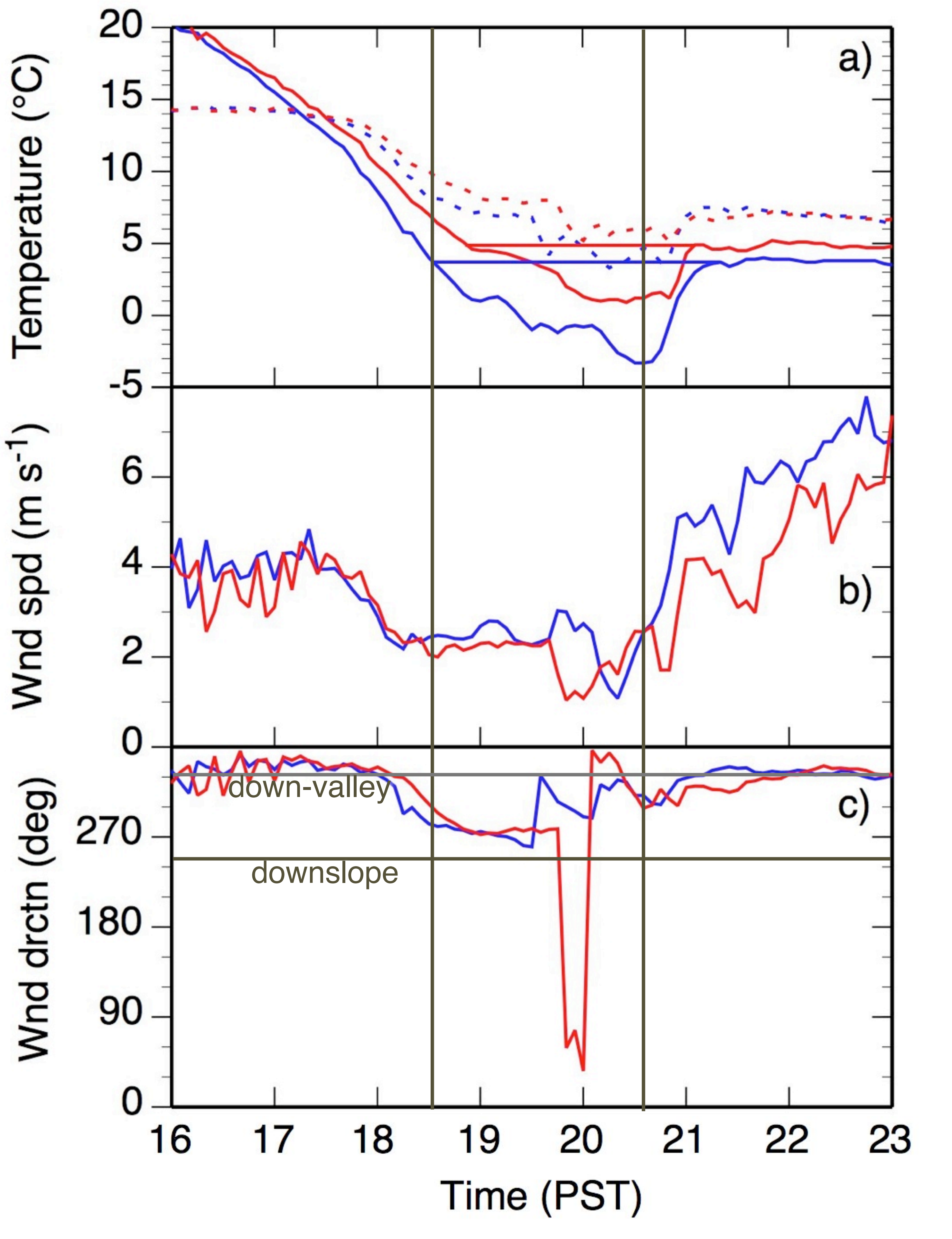
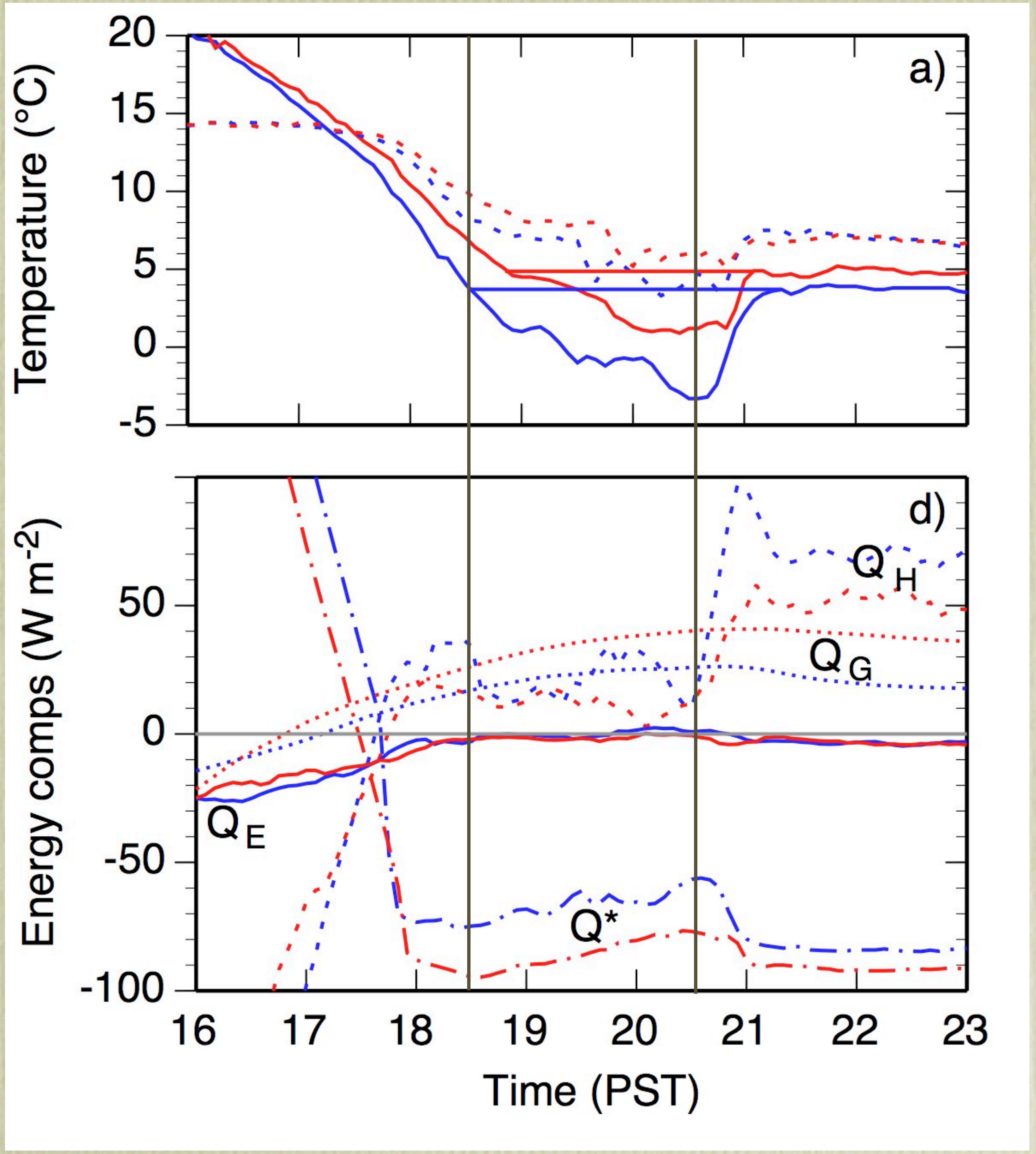


Figure 8: Air flow from night until morning. The downslope winds have died out. The mountain wind extends to the sides of the slopes. The pressure drop is in the down-valley direction. Temperature: cold in the valley, warmer over the plain. Changes in temperature (until the situation shown in Figure 1): there are only slight changes in the valley and over the plain.

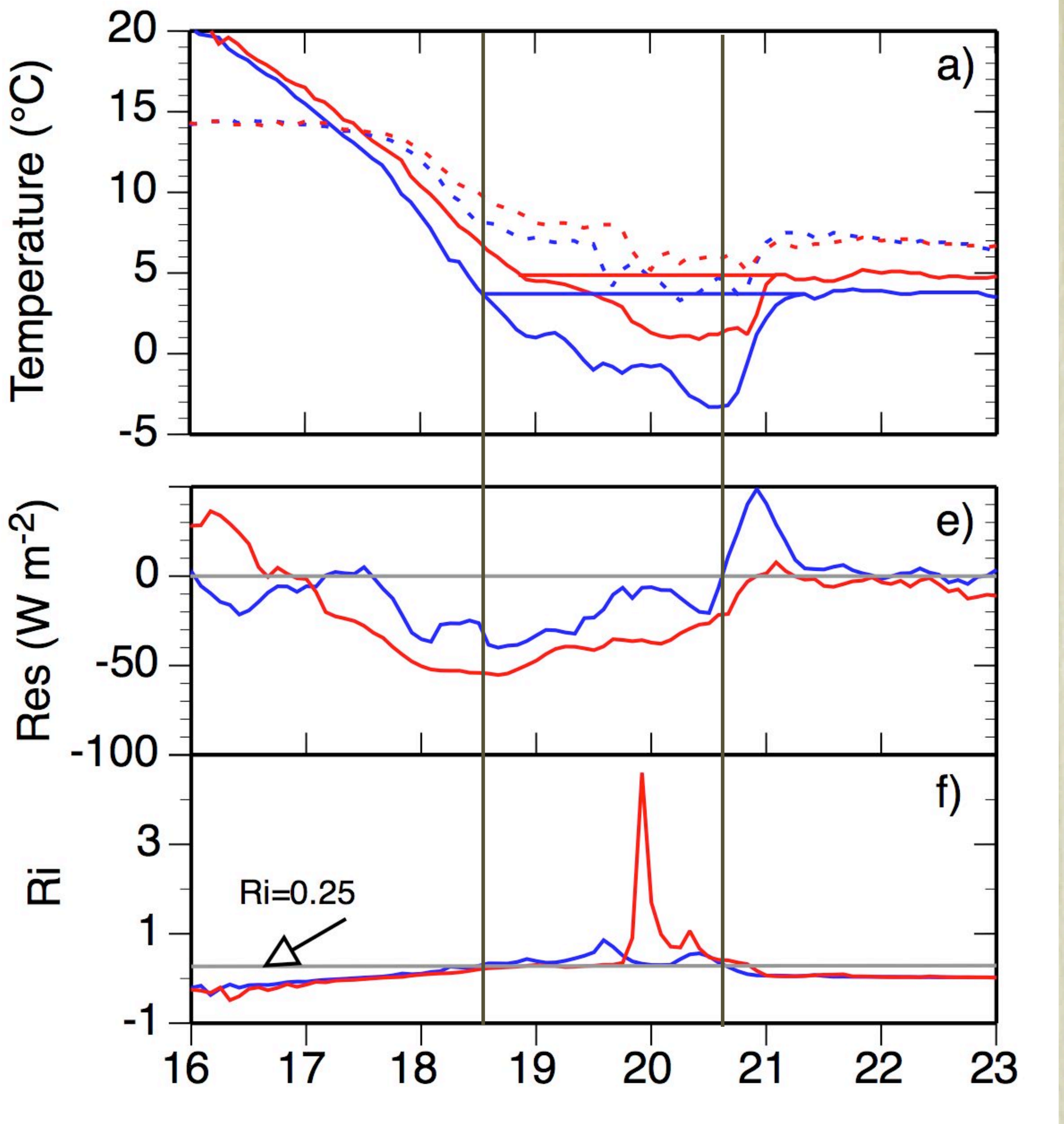
Defant 1949, 1951


a)
Cooling phase
Warming phase
Temperature (°C)
20
15
10
5
0
-5
16
17
18
19
20
21
22
23
Time (PST)


a)
b)
c)
Temperature (°C)
Wnd spd (m s-1)
Wnd drctn (deg)
down-valley
downslope
Time (PST)
20
15
10
5
0
-5
6
4
2
0
270
180
90
0
16
17
18
19
20
21
22
23

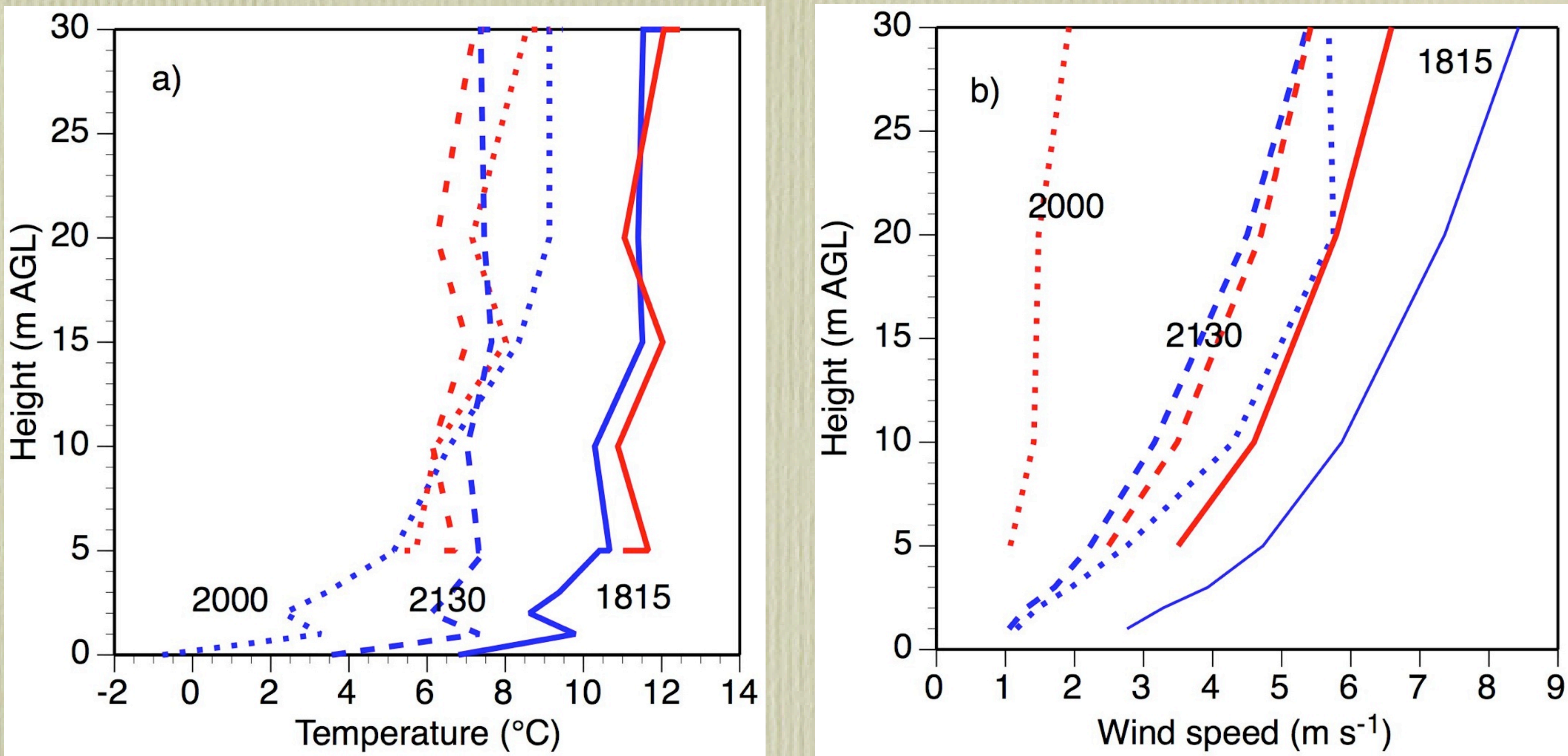


20
15
10
5
0
-5
Temperature (°C)
a)
Energy comps (W m-2)
d)
Q H
Q G
Q E
Q*
50
0
-50
-100
16
17
18
19
20
21
22
23
Time (PST)



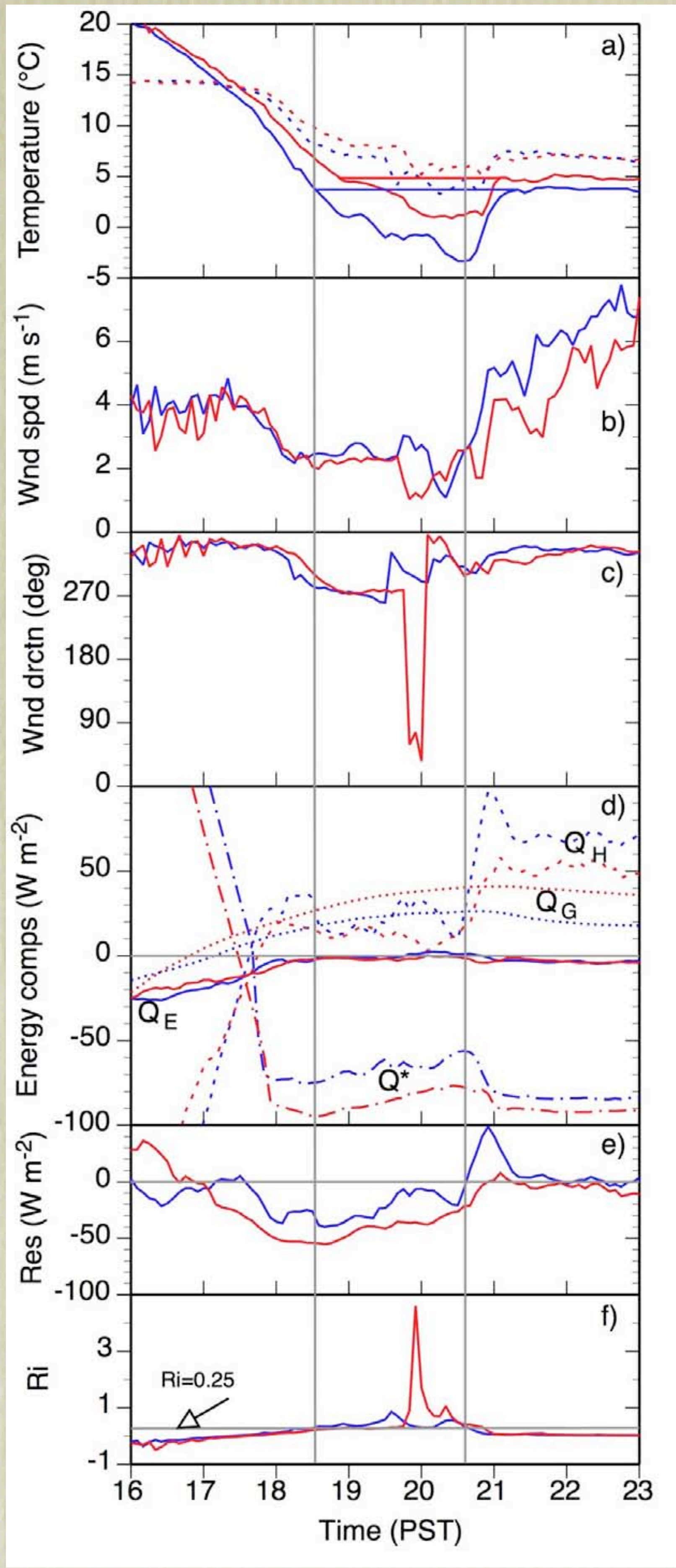
a)
e)
f)
Temperature (°C)
Res (W m-2)
Ri
Ri=0.25
20
15
10
5
0
-5
0
-50
-100
3
1
-1
16
17
18
19
20
21
22
23

Temperature and wind profiles
17 April 2006



What causes Notches?

- **Cooling phase**
  - surface energy budget reversal
  - T deficit (stable)layer
  - background winds decrease
  - winds turn d-s, (laminar) turb suppressed
- **Warming phase**
  - background winds increase
  - shear increases, Ri ⇒ Ricr, mixing out
  - destabilization
  - sensible heat flux increases
  - nighttime cooling ensues



Acknowledgments

- Notch analysis: Maura Hahnenberger
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