

# Ventilation 2023 Study Stalker Colony

Heather Achilles

Melissa Sim-Hollister

# Colony setup – Faces North



Inner cover - entrance : 1/2" x 3/8" with wind block (see below)

Empty super with 3" of polystyrene/foam insulation (R15)

Two of the ten Broodminder sensors

1 1/2" shim with weather Stripping

4 mediums

Lower Entrance – on the East Side 1/2 oval (1/2"x3/8")

Cinder blocks wrapped with Reflectix

Screened Bottom board closed with 1/2" Polystyrene

Reflectix "shingled" over cozy



Hollister Bungie



Wind block on inner cover opening

Bee Cozy over a colony quilt R11.7

# How We'll Show Moisture in the Air

Air is SATURATED



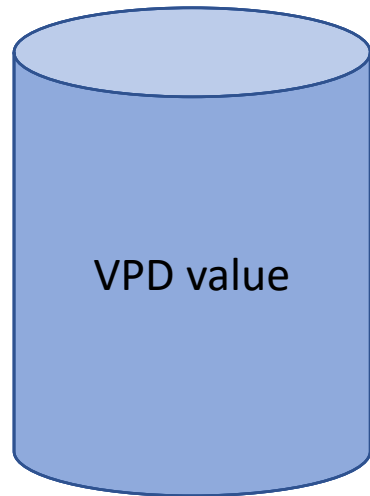
Air is DRY

$VPD = 0.0 \rightarrow 0.18 \text{ g/m}^3$

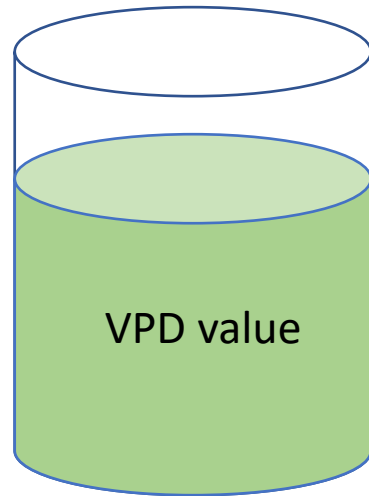
$VPD = 0.19 \rightarrow 0.28 \text{ g/m}^3$

$VPD = 0.29 \rightarrow 1.0 \text{ g/m}^3$

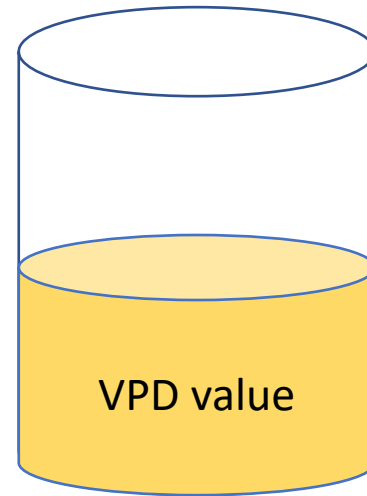
$VPD = 1.00+ \text{ g/m}^3$



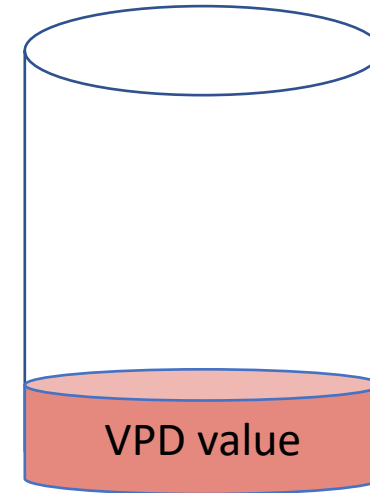
Away from cluster,  
may or may not have  
condensation present



Getting some heat  
from the cluster



Dec-Feb : cluster is close  
to the sensor  
Mar-Apr: cluster is near  
by but not at the sensor



Cluster/brood is at  
the sensor.

Example:

- Summer bees
  - keep brood at 92F & relative humidity of 60% (VPD = 2.05)
- Winter bees :
  - Little or no brood - so temps are lower & relative humidity is often higher → lower VPDs

VPD = Vapor Pressure Deficit (how much room in the air there is for additional moisture)

# Stalker - North Facing

County: Belknap  
Town: Gilmanton  
Bee Race: Northern  
Source: Overwintered colony  
Queen: 2021 queen raised by colony  
Hive Name: Stalker

## Hive details:

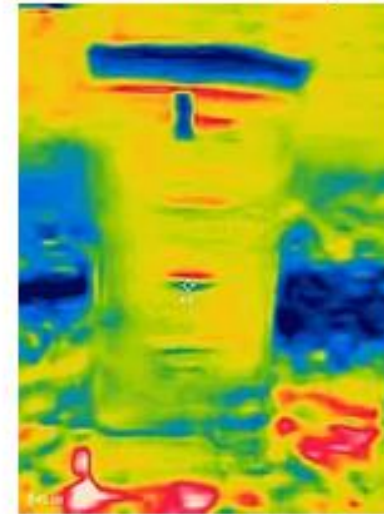
- Faces North
- 10 Frame Langstroth
- Stack: Medium,Medium,Medium,Medium, 1.5" feeding shim
- Winterization:
  - colony quilts + Bee cozy with reflectix covering the top so no snow gets in.
  - upper entrance : 1/2"x3/8" with a wind block
  - lower entrance : 1/2 oval - 1" x3/8" - on east side
  - hive stand base wrapped with Reflectix

## Notes:

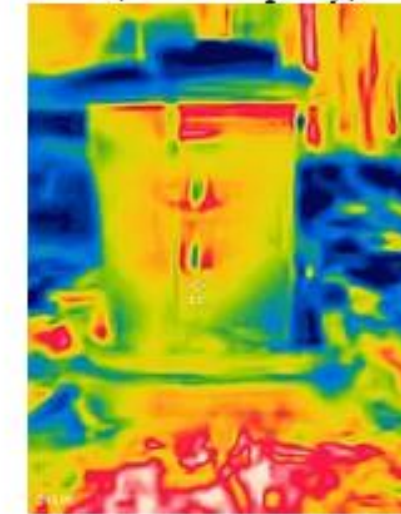
- 11/5/23 : All sensors installed (ignore "custom(7)" data before this date)
- 11/11/23 : reduced lower entrance and have it on east side of colony wrapped base.
- 11/21/2023 : wrapped with colony quilt & cozy at ~ 2pm. Added 3" of insulation above inner cover. Bees were down - could only see a few bees looking down from top.
- 12/16/2023 : ~noon: bees flying - using both upper and lower entrances
- 12/31/23 @ ~ 9:30am - removed ratchet straps didn't open colony
- 1/7/24: 12.5" of snow
- 1/16/24 @ ~ 4pm snowy day - brushed off top of colony and bottom board
- 1/17/24 @ 8am snowy day - brushed off top of colony and bottom board
- 1/22/24 @ 1:30 cleared bees from bottom board (almost about 1/3-1/2c); didn't open colony - but bees came out the top entrance to investigate what was going on.

put a "temp-only" above inner cover - below the insulation. It is on the east side of the hole in the middle of the cover

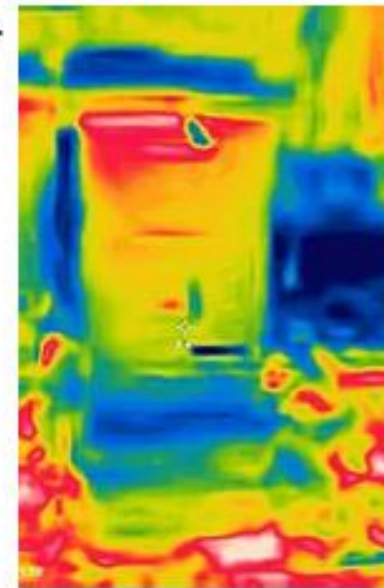
November 21, 2023 @ 6am (~17F in apiary)



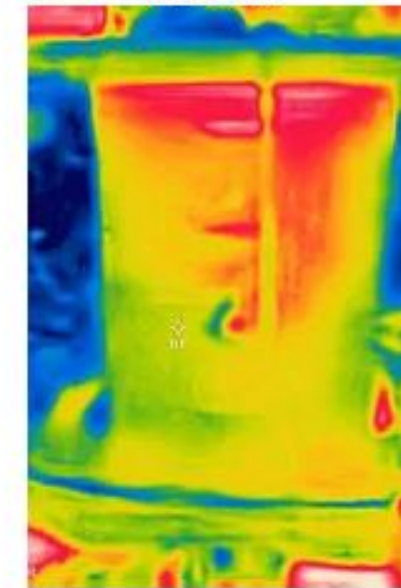
South side



East side



North side



West side

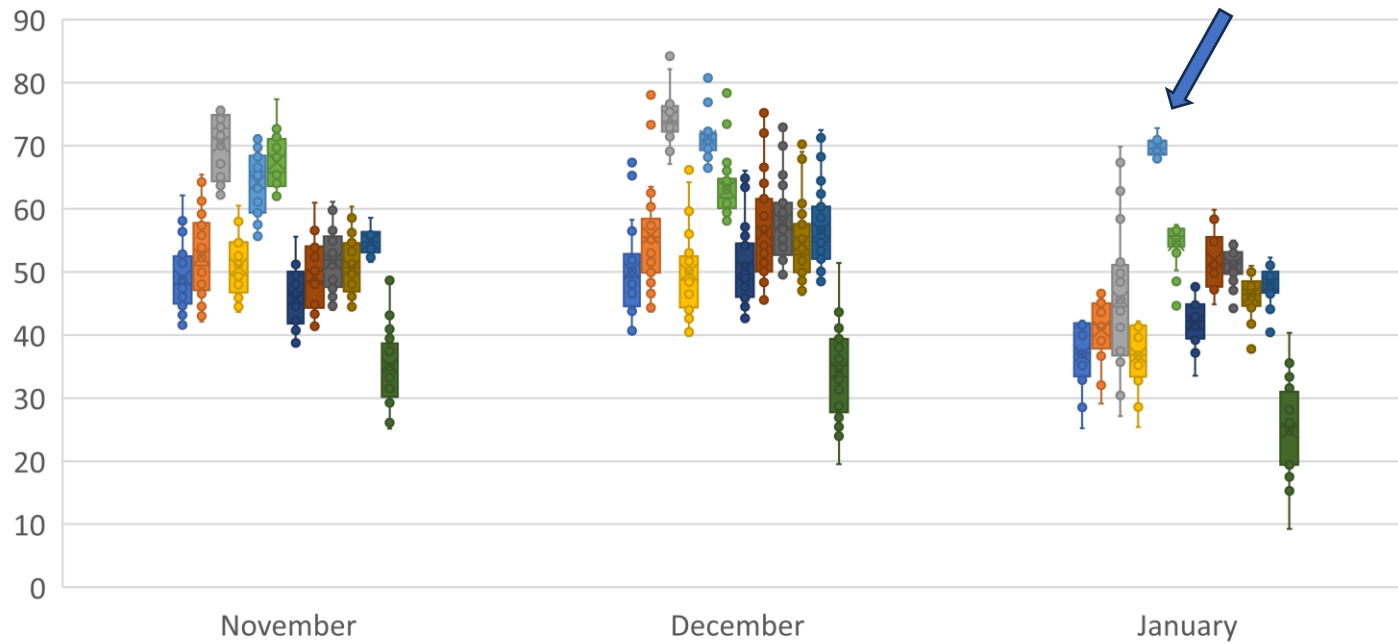


Back of Stalker  
Aka "south side"

# Daily Mean Stats

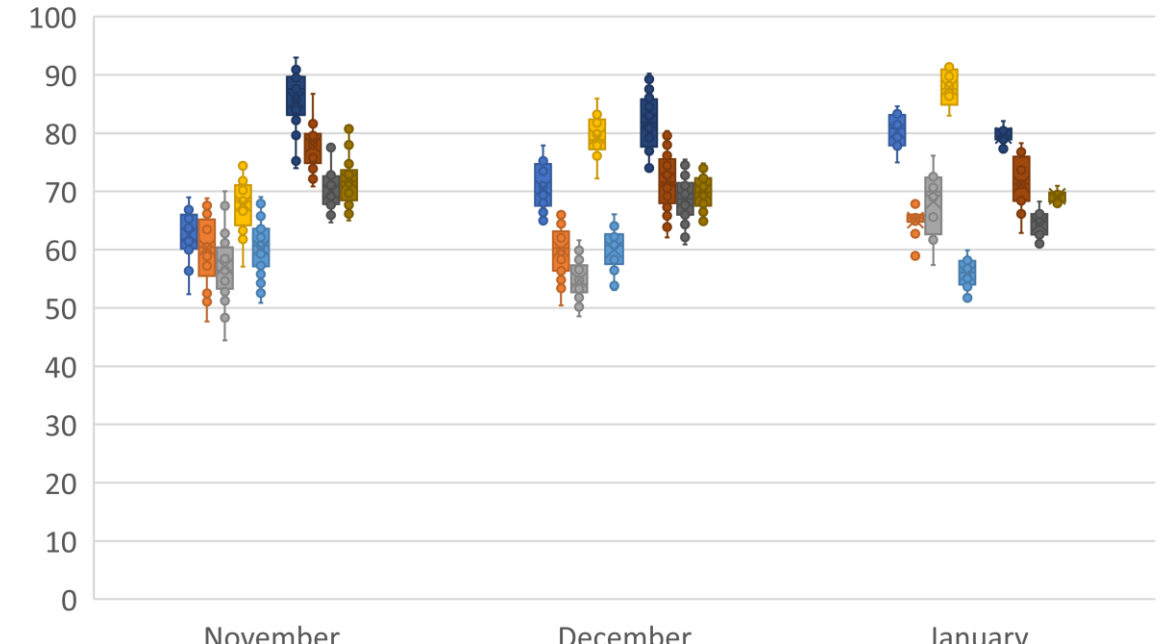
*Bees are clustered by the box3-east sensor*

Sask2 - Daily Mean Temps (11/6-1/21)



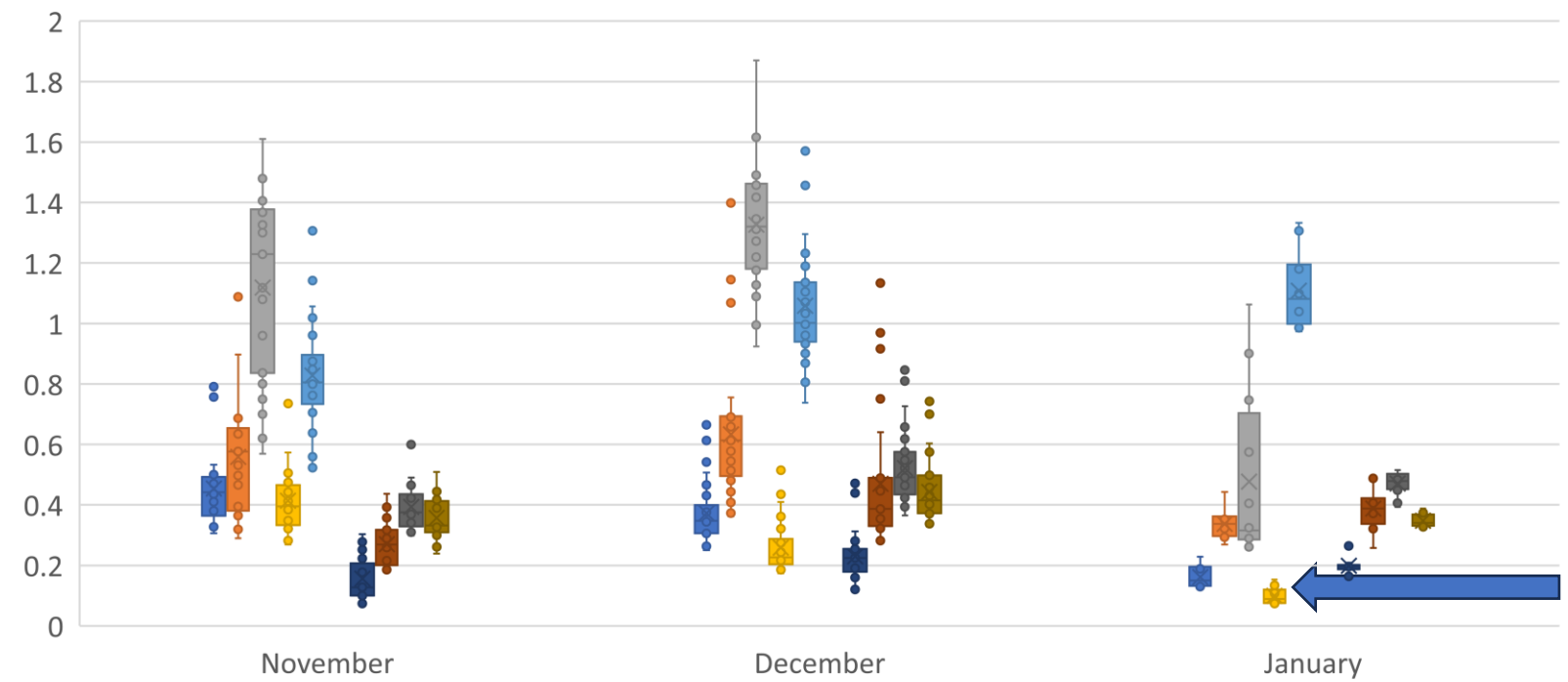
- box2-south
- box2-north
- box2-east
- box2-west
- box3-east
- box3-west
- box4-south
- box4-north
- box4-east
- box4-west
- above-inner-cover
- outdoor

Sask2 - Daily Mean RH (11/6-1/21)



- box2-south
- box2-north
- box2-east
- box2-west
- box3-east
- box3-west
- box4-south
- box4-north
- box4-east
- box4-west

Sask2 - Daily Mean VPD (11/6-1/21)

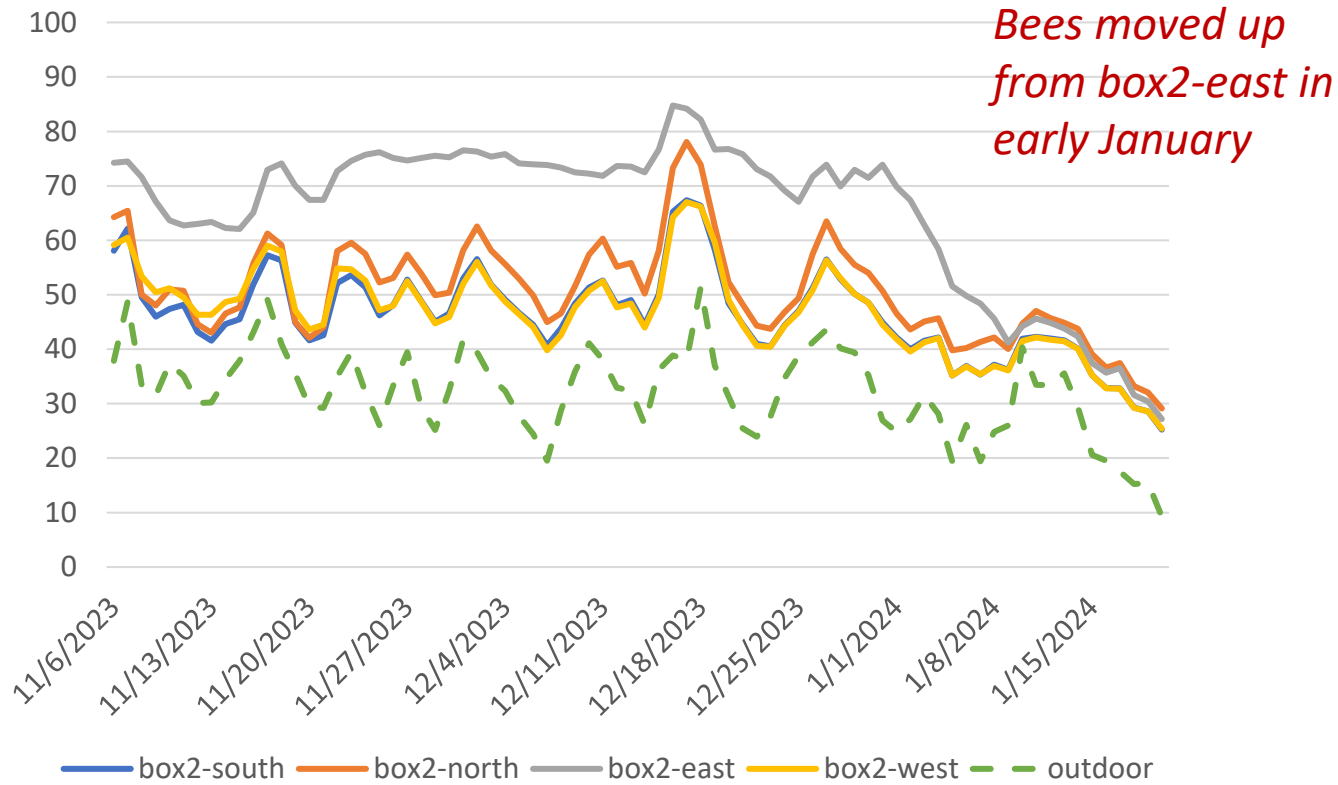


- box2-south
- box2-north
- box2-east
- box2-west
- box3-east
- box3-west
- box4-south
- box4-north
- box4-east
- box4-west

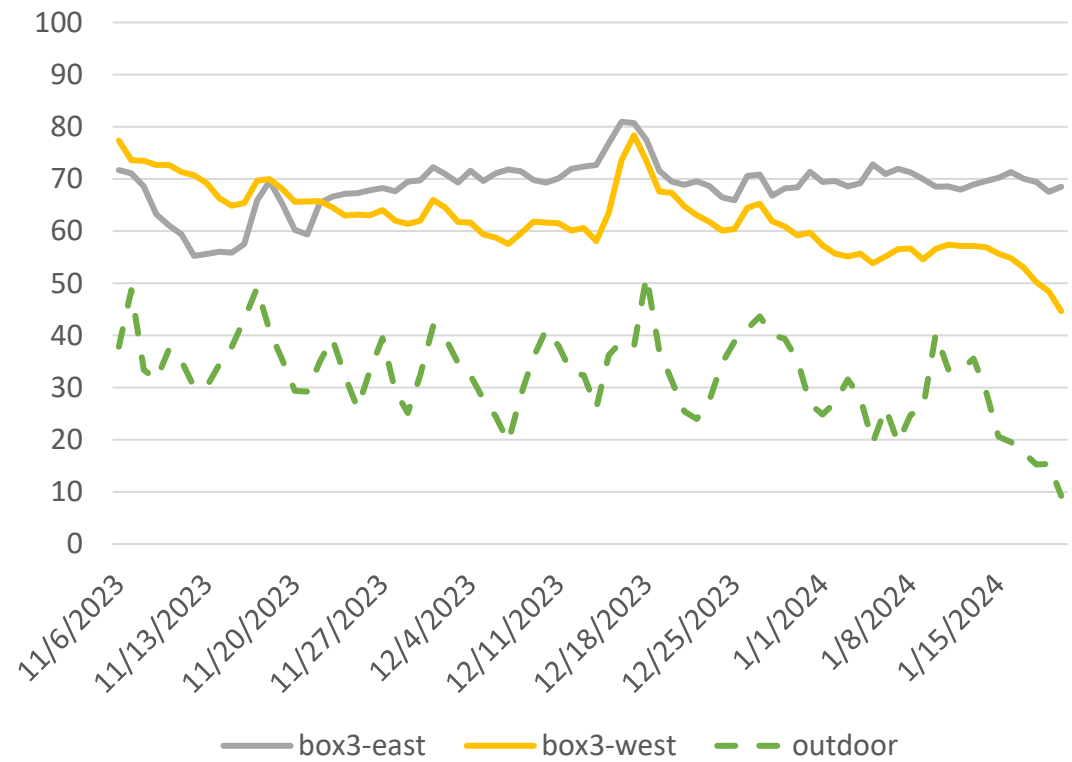
*Box2-west has the least room for moisture in the air followed by box2-south*

# Daily Mean Temp

Box2 Mean Daily Temp

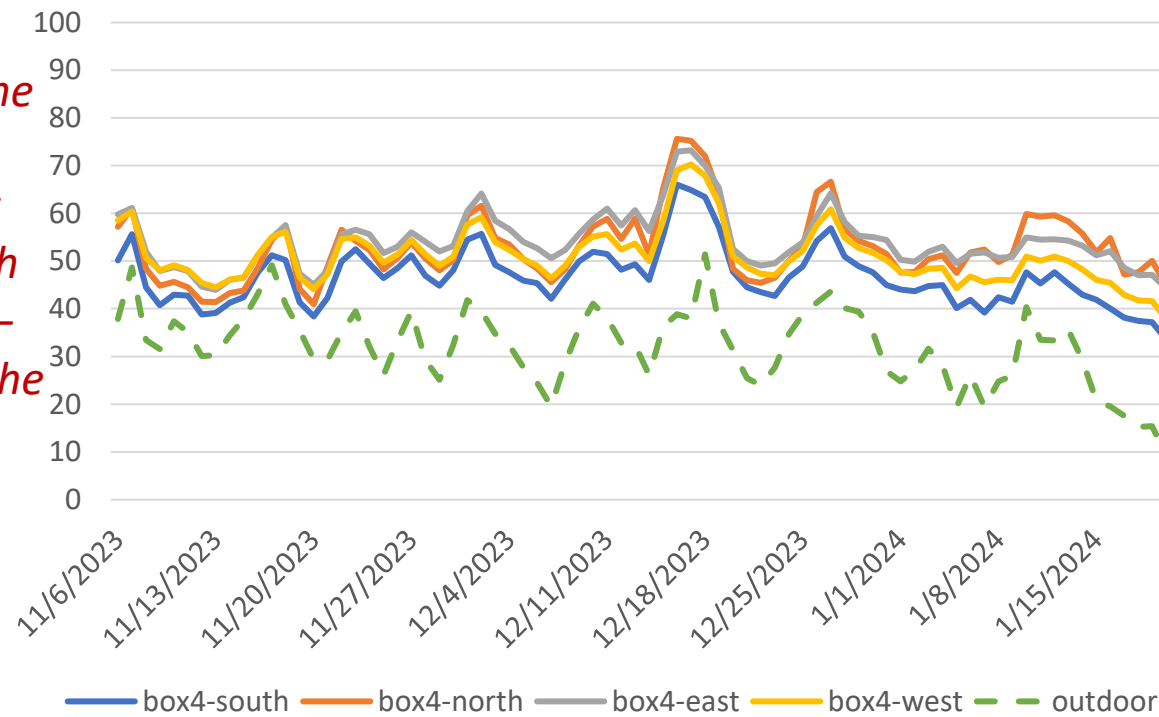


Box3-Mean Daily Temp



Box4-Daily Mean Temp

*Box4 is getting heat from the cluster. The peaks in temp follow peaks in the outdoor temp. Note that box4-south is the coolest of the temps – even though it would get the most solar gain – but it is getting the least heat from the cluster.*

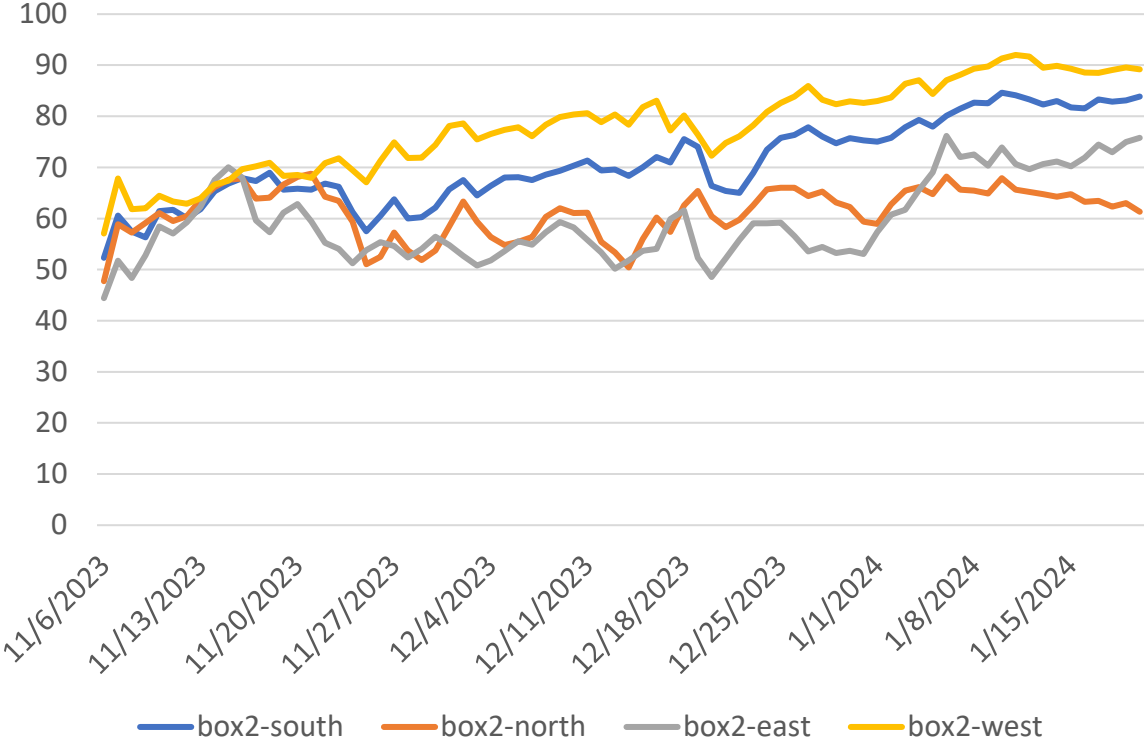


This colony faces north.

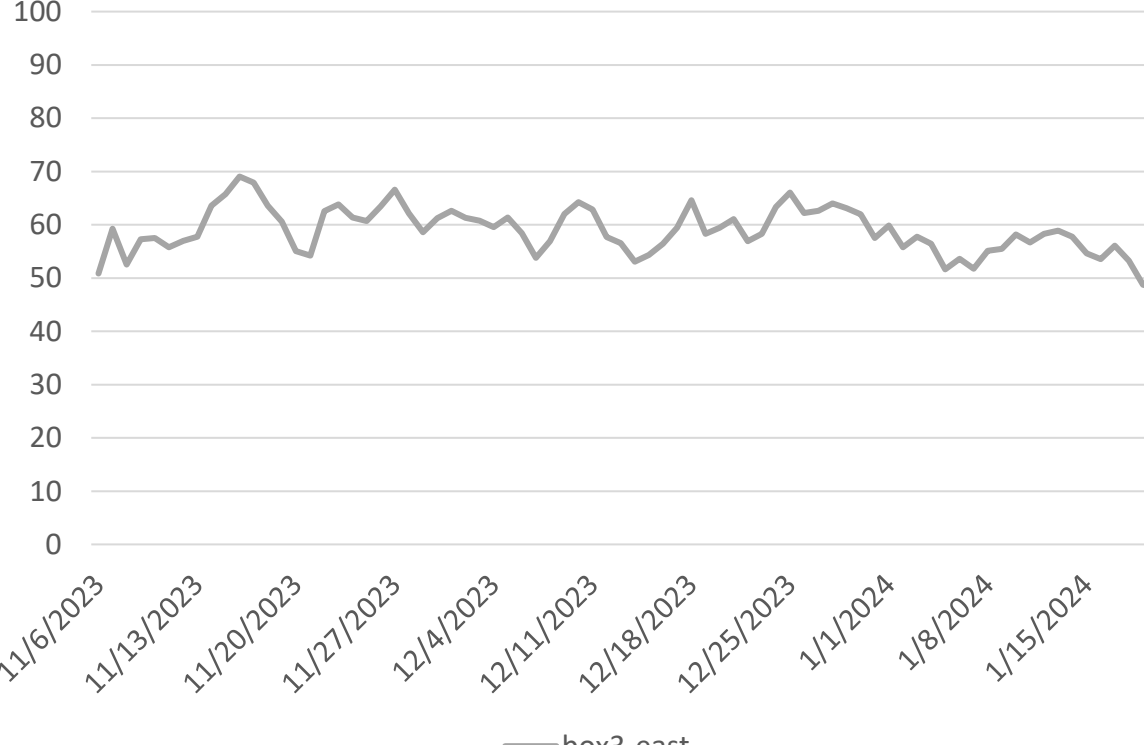
# Daily Mean RH

*Bees moved up from box2-east in early January*

Box 2 Mean Daily RH



Box3-Mean Daily RH



Box4-Daily Mean RH



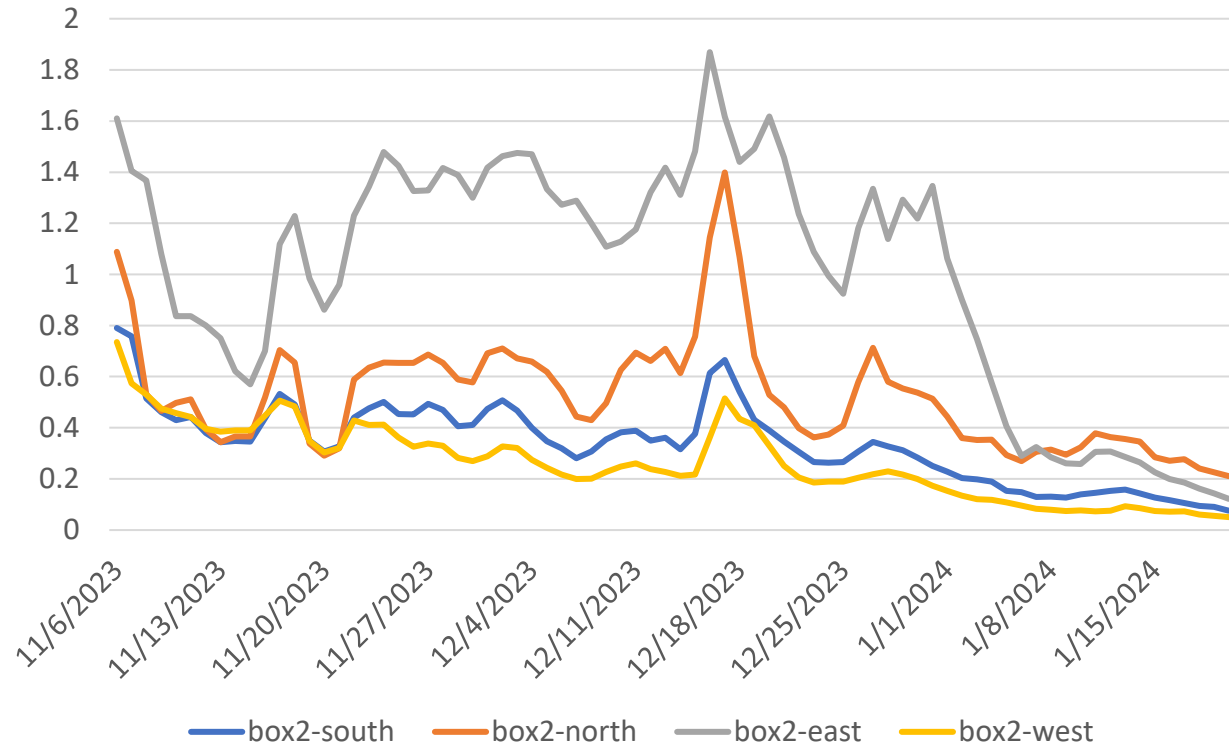
*Box4 is getting heat from the cluster.*

Until early January the bees were clustered between box2 & 3 east. In Early Jan, they moved to in box3-east in the air flow.

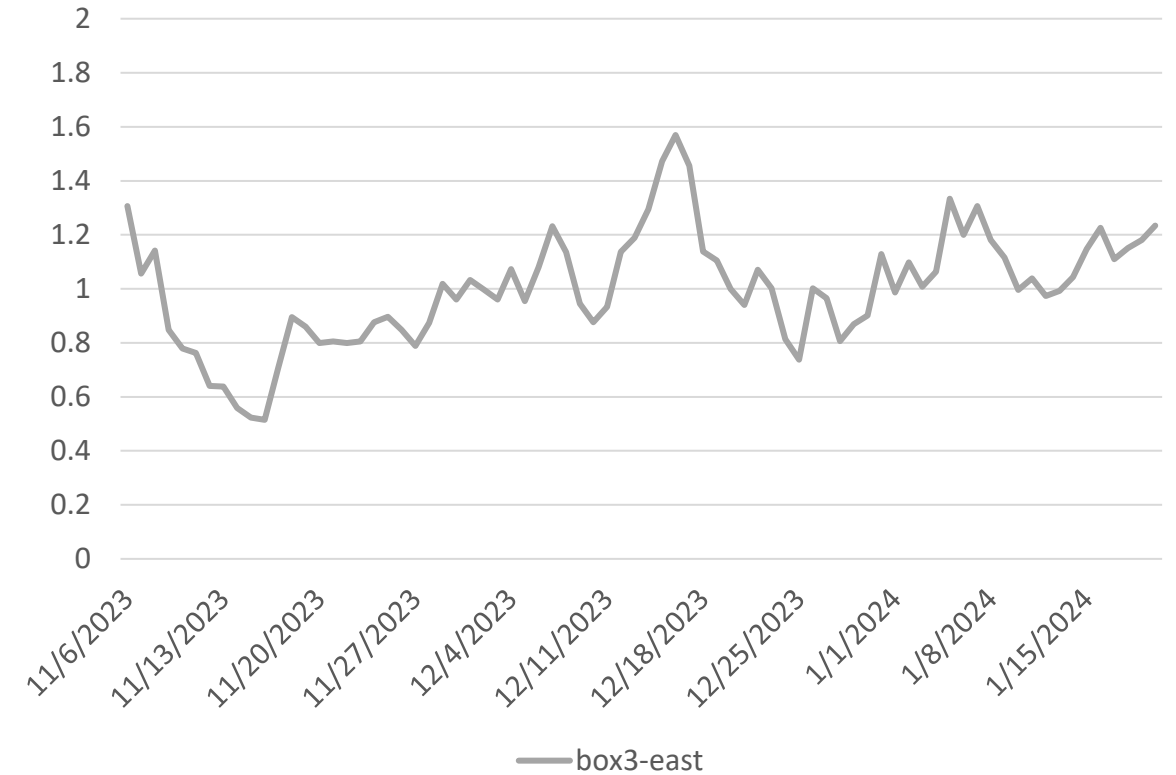
This colony faces north.

# Daily Mean VPD

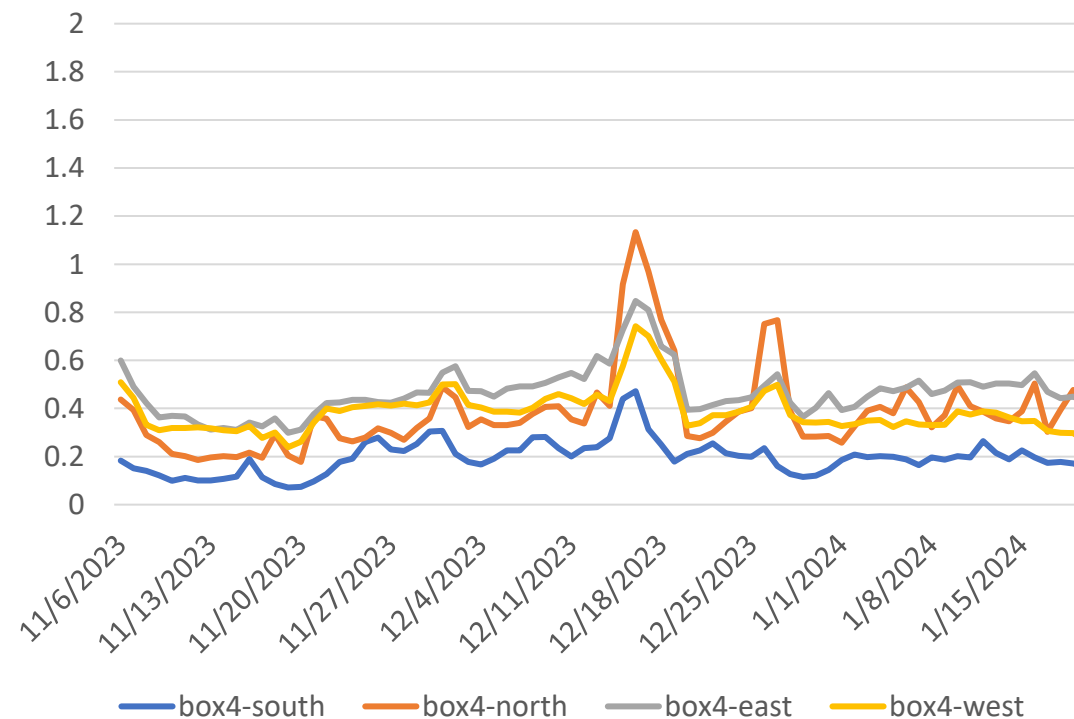
Box2- Mean Daily VPD



Box3-Mean Daily VPD



Box4-Daily MeanVPD



Until early January the bees were clustered between box2 & 3 east. In Early Jan, they moved to in box3-east in the air flow.

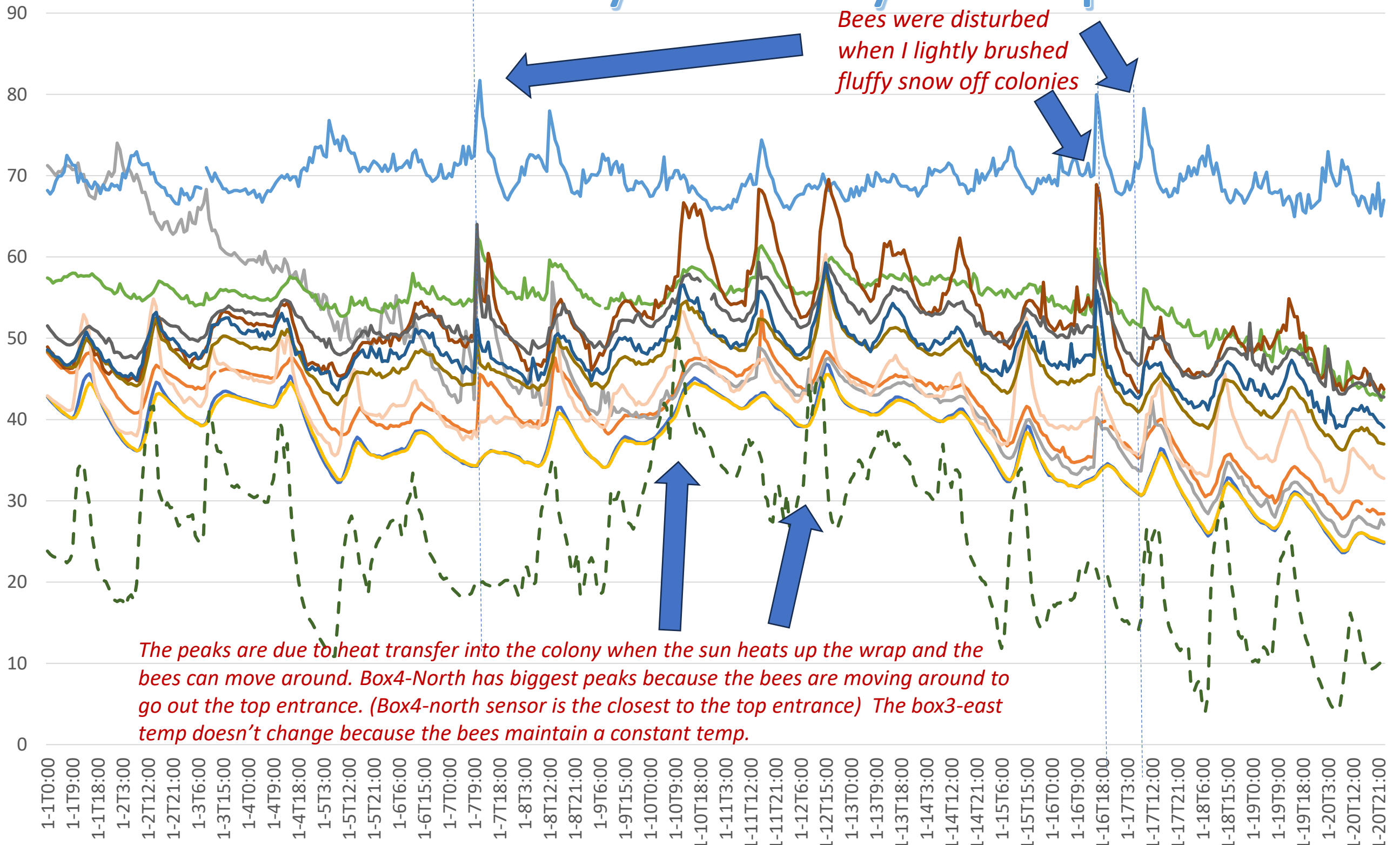
Box4 sensors are getting heat from the cluster.

Note that box4-south is the lowest VPD – this is because it is furthest from the airflow

This colony faces north.



# January Hourly Temps



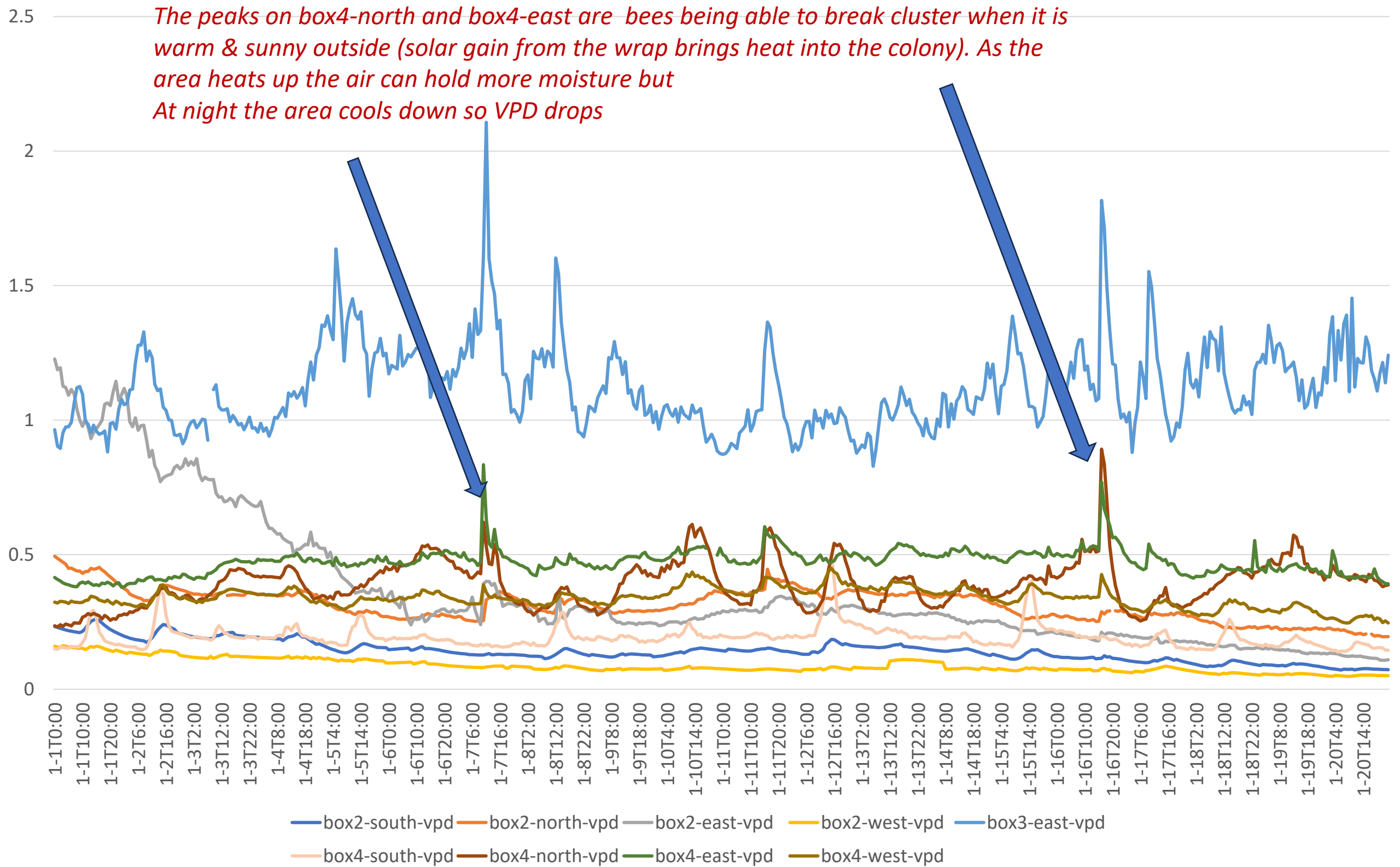
*Bees were disturbed when I lightly brushed fluffy snow off colonies*

*The peaks are due to heat transfer into the colony when the sun heats up the wrap and the bees can move around. Box4-North has biggest peaks because the bees are moving around to go out the top entrance. (Box4-north sensor is the closest to the top entrance) The box3-east temp doesn't change because the bees maintain a constant temp.*

- box2-south-Temp — box2-north-Temp — box2-east-Temp — box2-west-Temp — box3-east-Temp — box3-west-Temp
- box4-south-Temp — box4-north-Temp — box4-east-Temp — box4-west-Temp — outdoor-Temp

# January Hourly VPDs

January - hourly VPDs

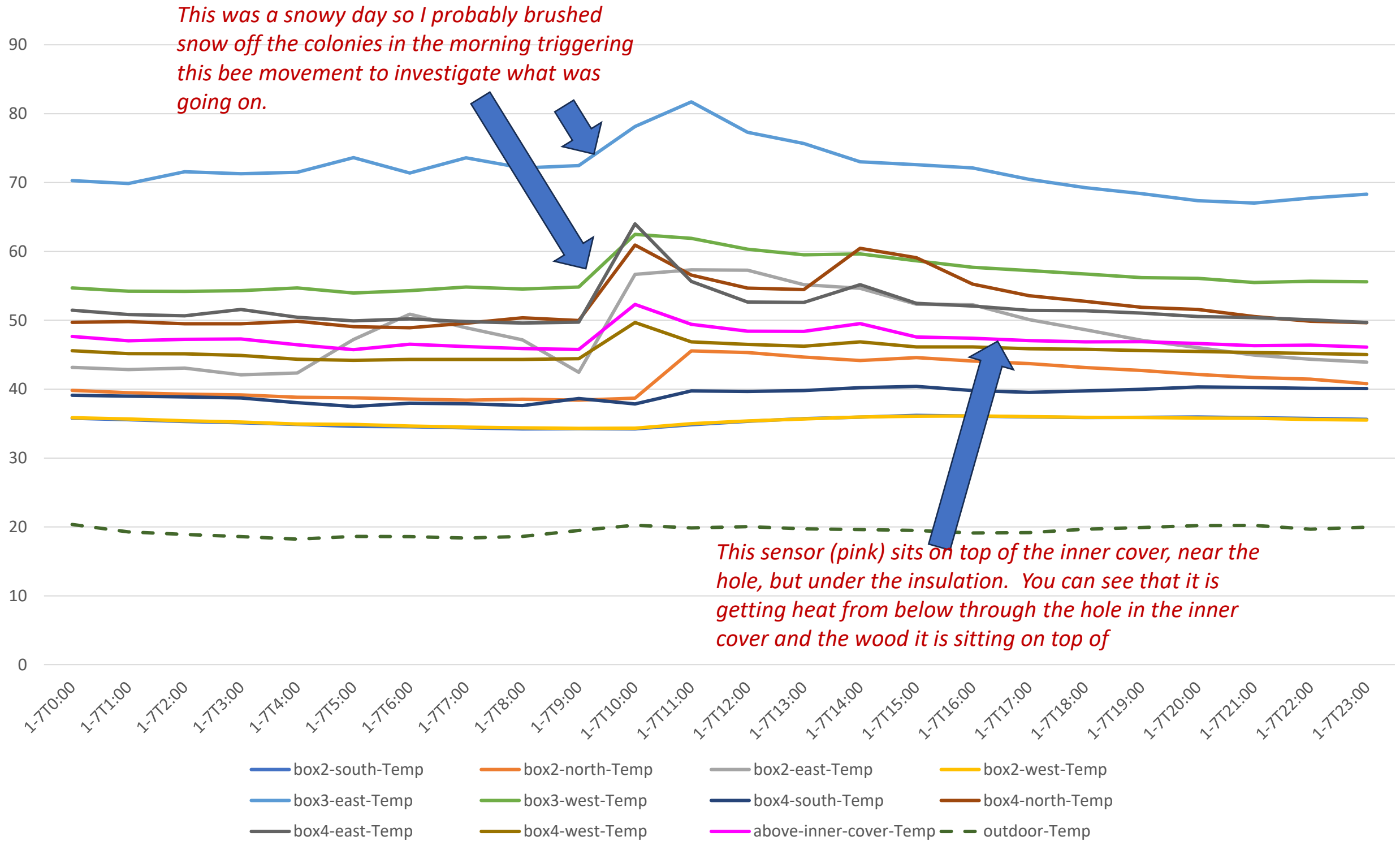


January 1 the bees moved up from box2-east to box 3-east. This can be seen in the switch in vpd values.

Box3 West is a temp only sensor so we don't have VPD values

January 7 at 8am

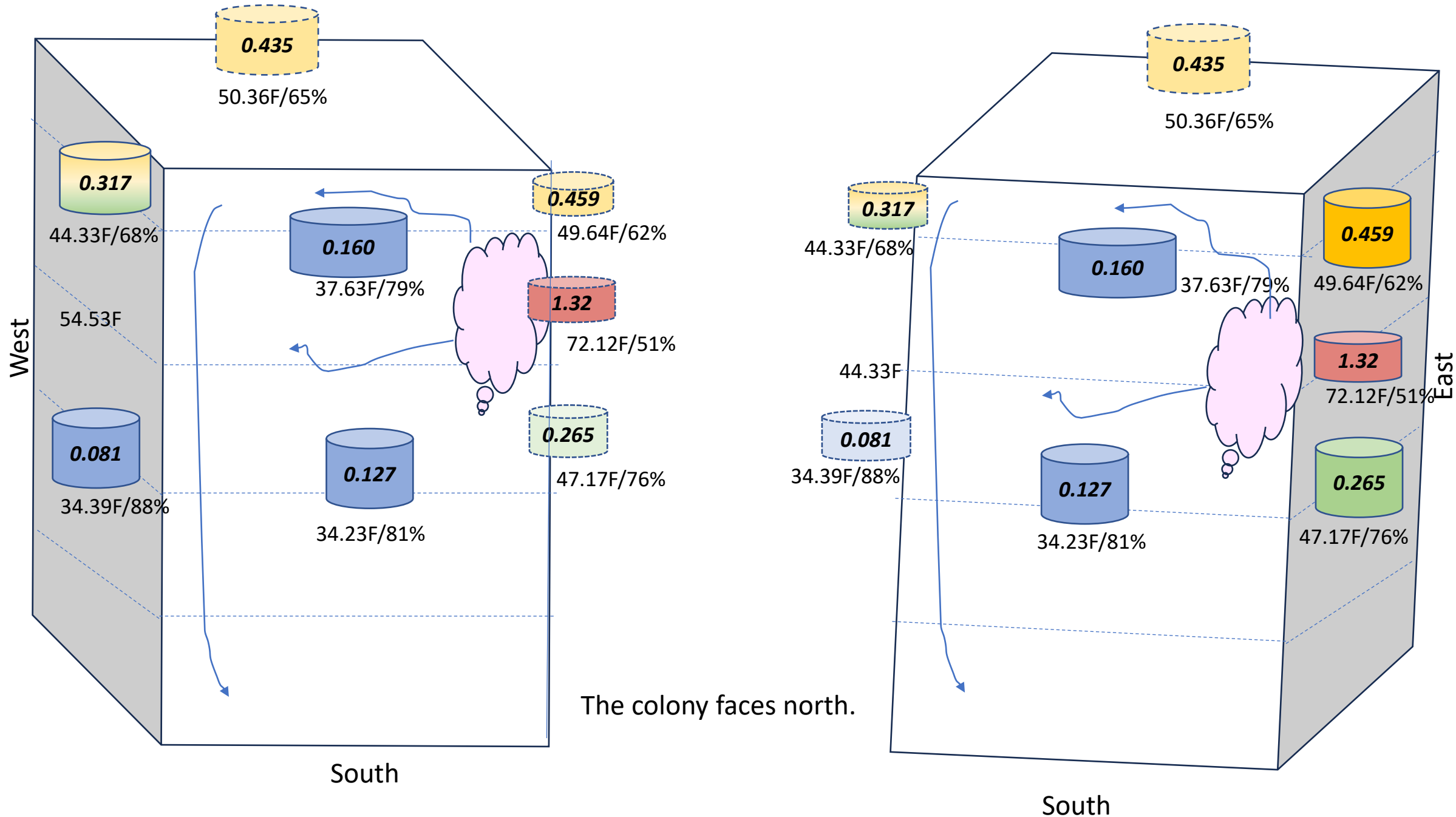
# A closer look at the bees on 1/7



Bees are clustered in box3-east – in the air flow from the lower to upper entrance. The colony faces north.

# Temps/RH/VPD Jan 7, 2024 @ 8am

## View from SW & SE

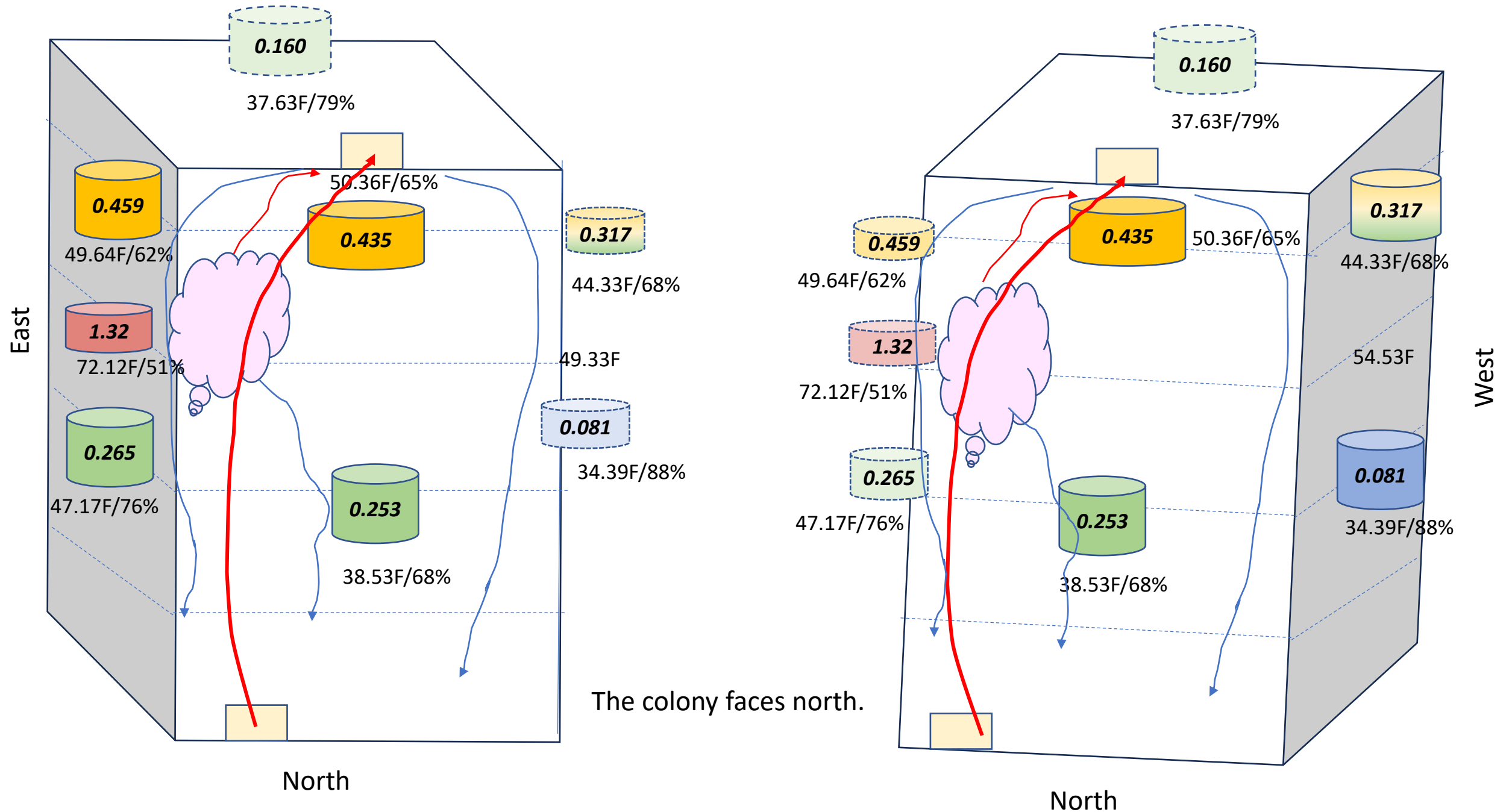


1-7T8:00	box2-south	box2-north	box2-east	box2-west	box3-east	box3-west	box4-south	box4-north	box4-east	box4-west	above inner cover	outdoor
Temp (F)	34.23	38.53	47.17	34.39	72.12	54.53	37.63	50.36	49.6	44.33	45.91	18.62
RH (%)	81	68	76	88	51		79	65	62	68		89.9
VPD (g/m3)	0.127	0.253	0.265	0.081	1.318		0.161	0.435	0.460	0.317		0.034

Does box3-east have brood? Or are the bees just clustering on top of the sensor?

# Temps/RH/VPD Jan 7, 2024 @ 8am

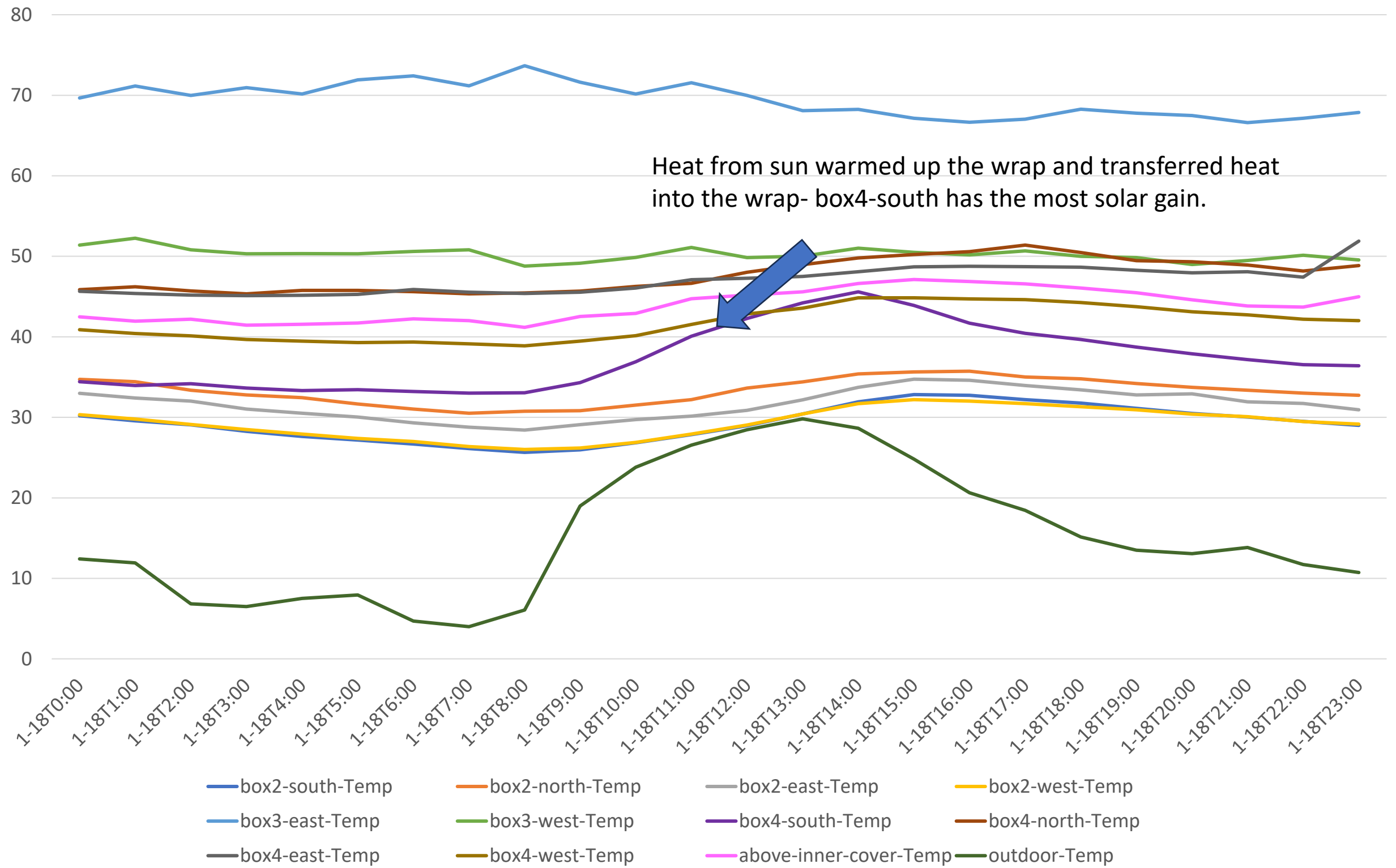
## View from NE & NW



1-7T8:00	box2-south	box2-north	box2-east	box2-west	box3-east	box3-west	box4-south	box4-north	box4-east	box4-west	above inner cover	outdoor
Temp (F)	34.23	38.53	47.17	34.39	72.12	54.53	37.63	50.36	49.6	44.33	45.91	18.62
RH (%)	81	68	76	88	51		79	65	62	68		89.9
VPD (g/m3)	0.127	0.253	0.265	0.081	1.318		0.161	0.435	0.460	0.317		0.034

January 18 at 7am  
Outside temp ~4F

# Jan 18 hourly temps.

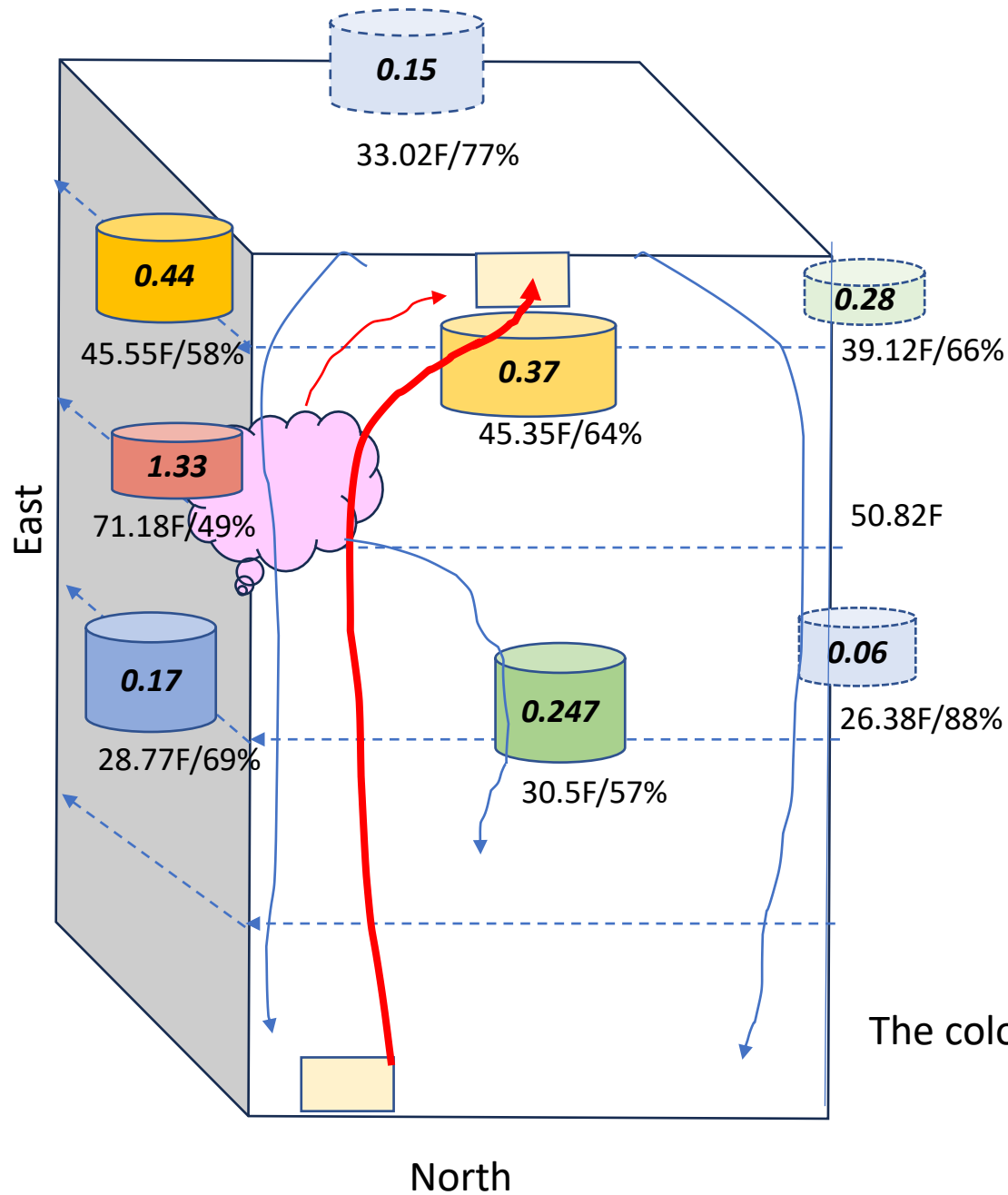


Bees located in box 3 east pushing heat to box 3 west and box 4 north and box 4 east

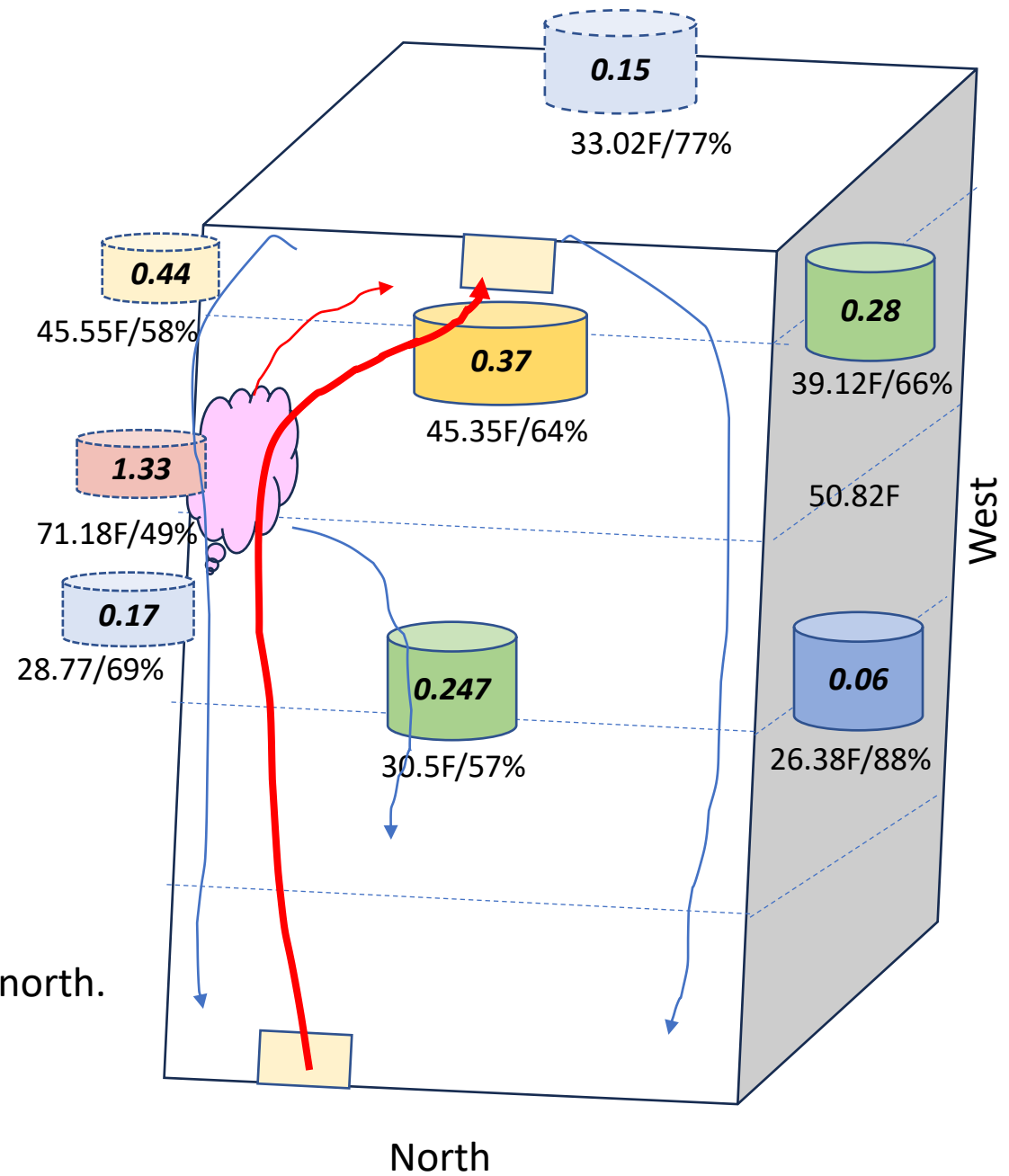


# Temps/RH/VPD Jan 18, 2024 @ 7am

## View from NW & NE



The colony faces north.



1-18T7:00	box2-south	box2-north	box2-east	box2-west	box3-east	box3-west	box4-south	box4-north	box4-east	box4-west	Above inner cover	outdoor
Temp (F)	26.13	30.5	28.77	26.38	71.18	50.82	33.02	45.35	45.55	39.12	42	4
RH (%)	82	57	69	88	49		77	64	58	66		72.5
VPD (g/m3)	0.09	0.247	0.17	0.06	1.33		0.15	0.37	0.44	0.28		0.06