

Ventilation 2023 Study Sask3 Colony

Heather Achilles

Melissa Sim-Hollister

Colony setup



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



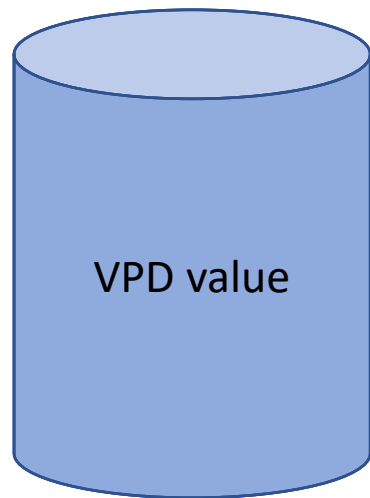
Air is DRY

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

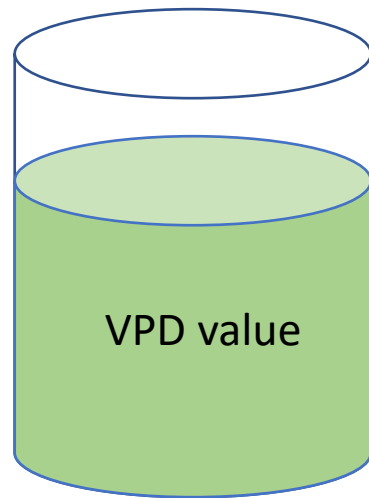
$VPD = 0.19 \rightarrow 0.28 \text{ g/m}^3$

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

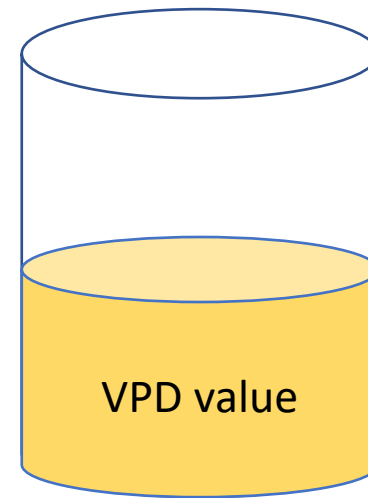
$VPD = 1.00+ \text{ g/m}^3$



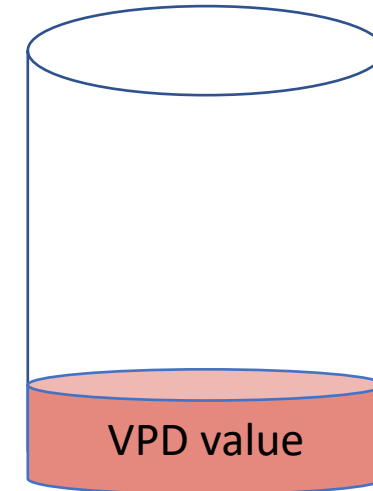
Away from cluster,
may or may not have
condensation present



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)

Sask3

County: Belknap
Town: Gilmanton
Bee Race: Saskatraz
Source: Overwintered colony (2021 package)
Queen: 2021 queen superceded in August 2022
Hive Name: Sask3

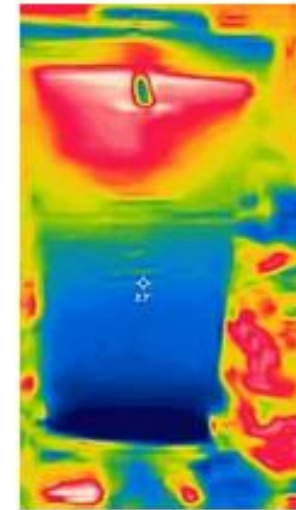
Hive details:

- 10 Frame Langstroth
- Stack: Medium,Medium,Medium,Medium, 1.5" feeding shim
- Winterization:
 - Colony Quilt + 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

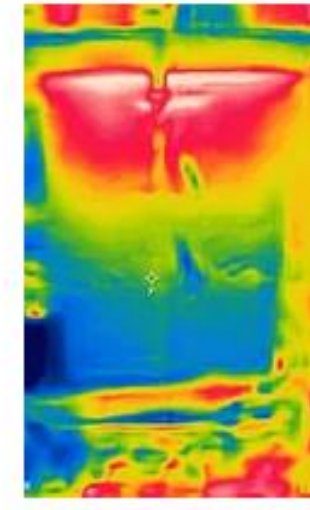
Notes:

- 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 completely covering the top bars
- 12/13/2023 @ ~7:15am : added 1 lb sugar brick in middle of shim - bees continue to completely cover the top bars. Also, checked bottom board - no dead bees.
- 12/16/2023 @ ~ noon : bees flying - 99% using upper entrance but a few were using the lower one
- 12/31/23 @ ~ 9:30am - removed ratchet straps didn't open colony. added 3/4 lb sugar brick in same spot as the one on 12/13 - which was gone.
- 1/3/24 : cleared bottom board - almost no bees
- 1/7/24: 12.5" of snow
- 1/9/24 - quick check - sugar brick about 1/2 gone.
- 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 none); bees were clustered on top of the rails, in the feeding shim and hanging on the inner cover - covered front to back and side to side. added 1 lb sugar brick in in the north east corner - it was the only place I could put it with out all the bees coming out of the colony

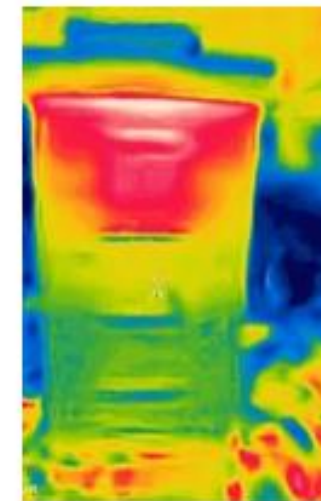
November 21, 2023 @ 6am (~17F in apiary)



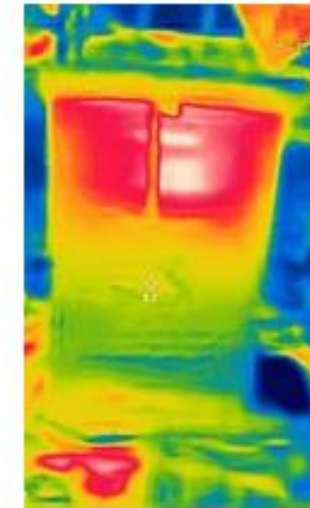
South Side



East Side



North Side



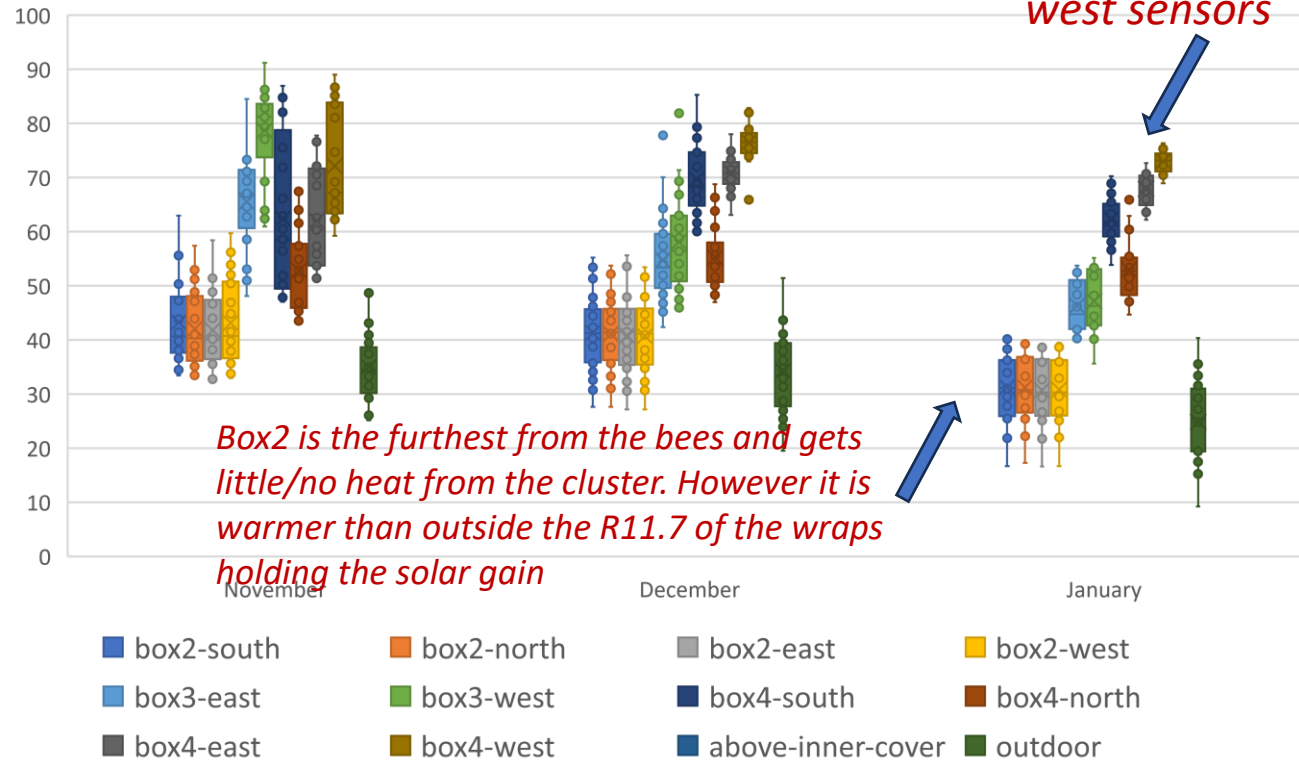
West Side



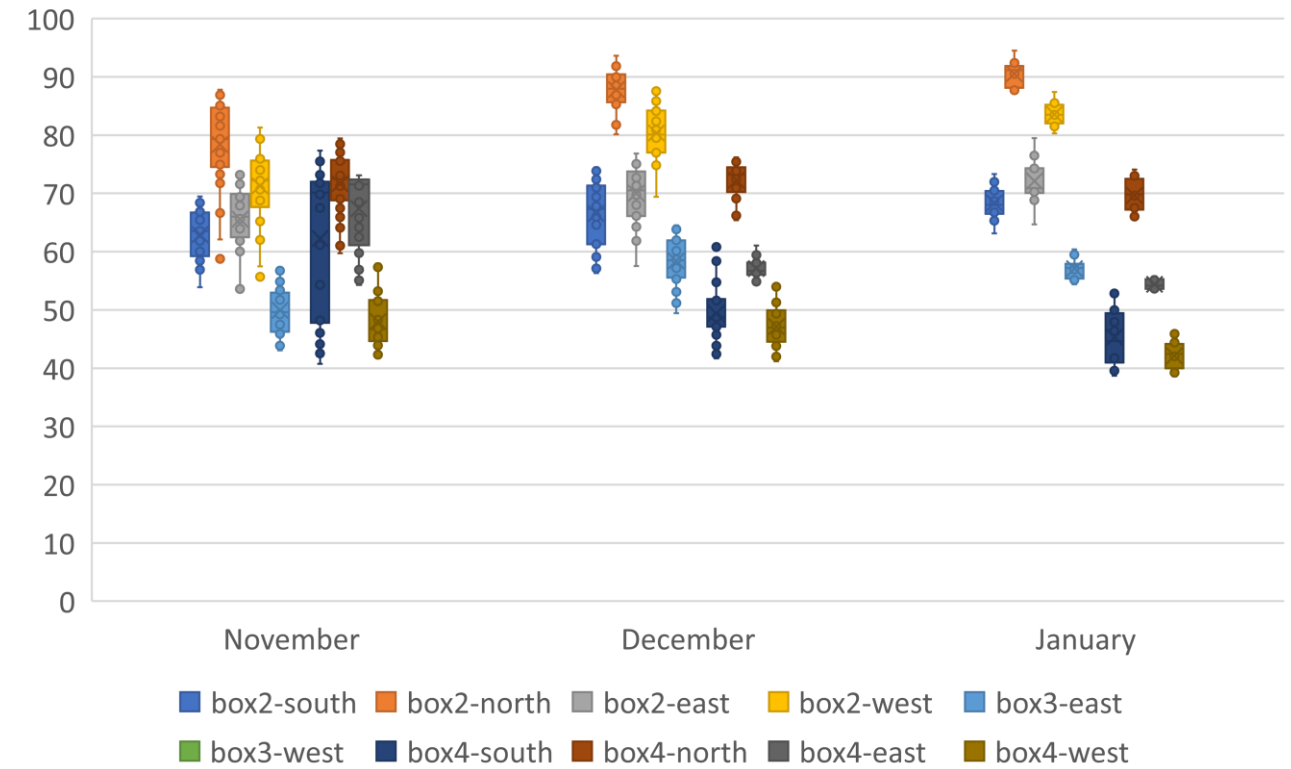
Daily Mean Stats

*Bees are clustered by the
between the box4-east and
west sensors*

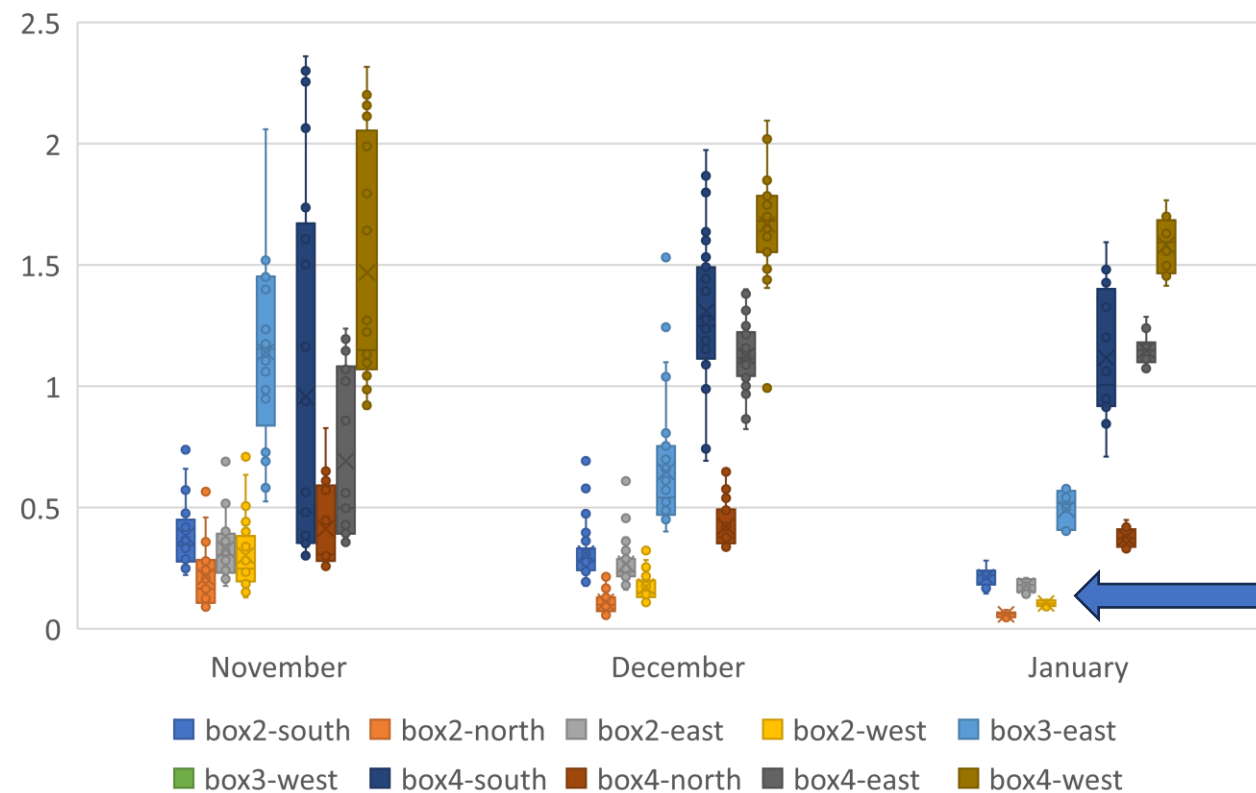
Sask2 - Daily Mean Temps (11/6-1/21)



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

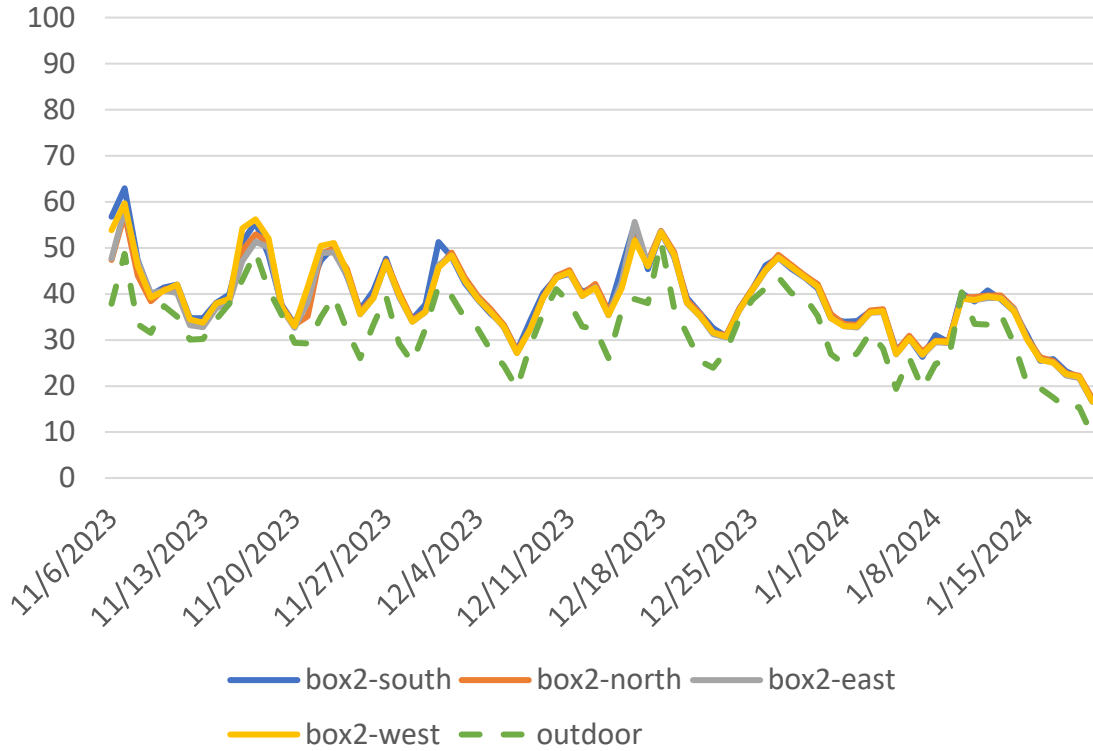


Sask2 - Daily Mean VPD (11/6-1/21)

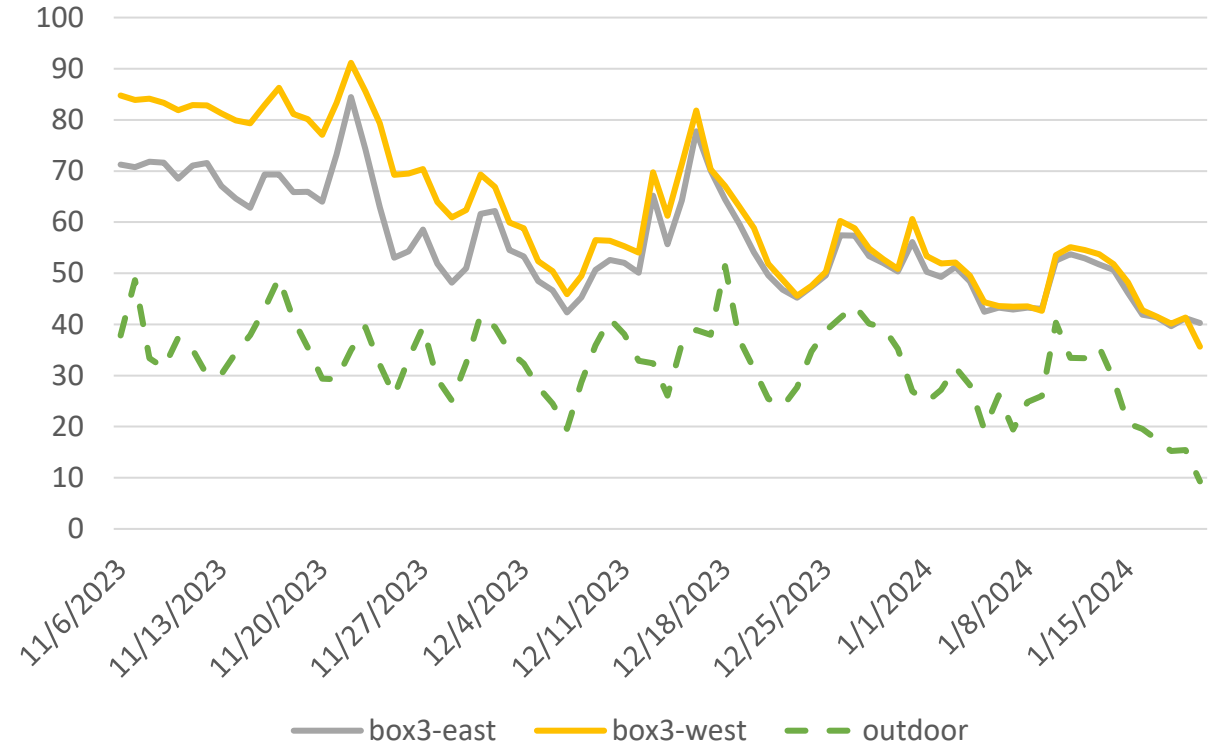


Daily Mean Temp

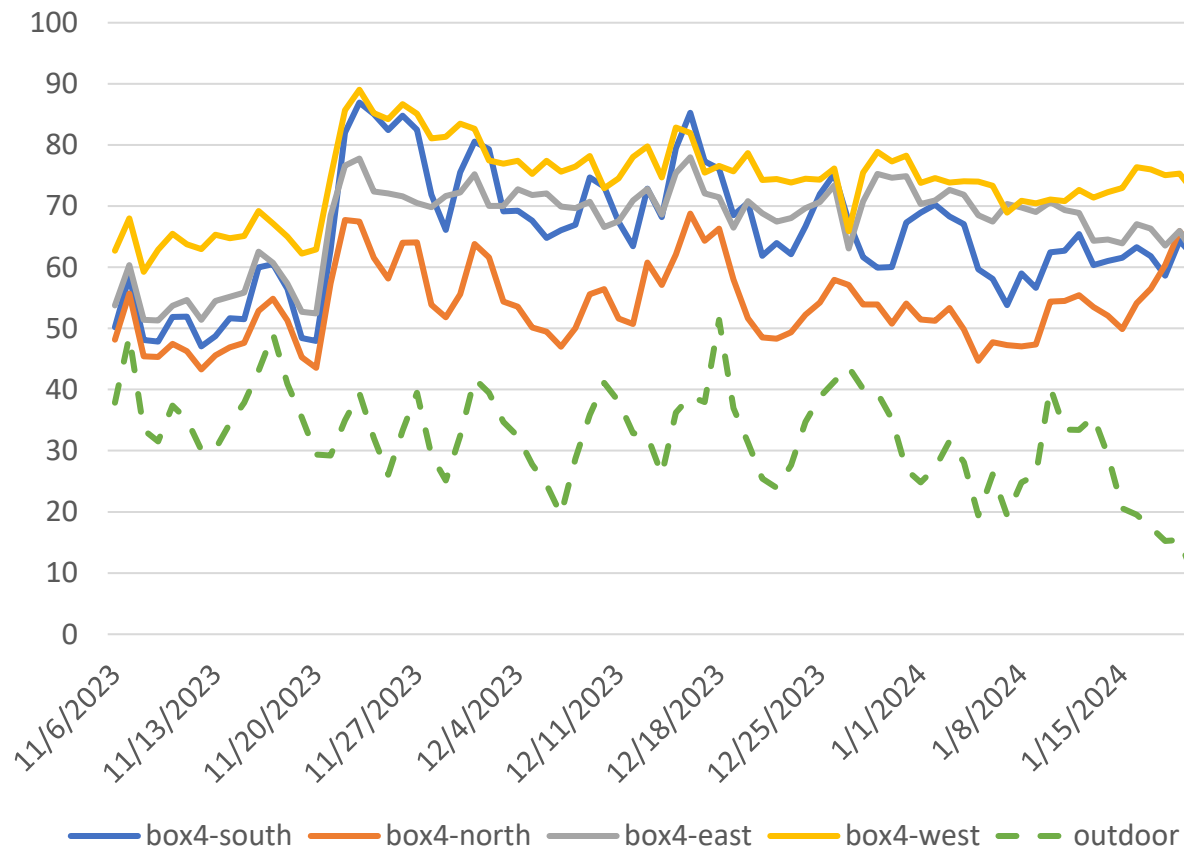
Box2 Mean Daily Temp



Box3-Mean Daily Temp



Box4-Daily Mean Temp

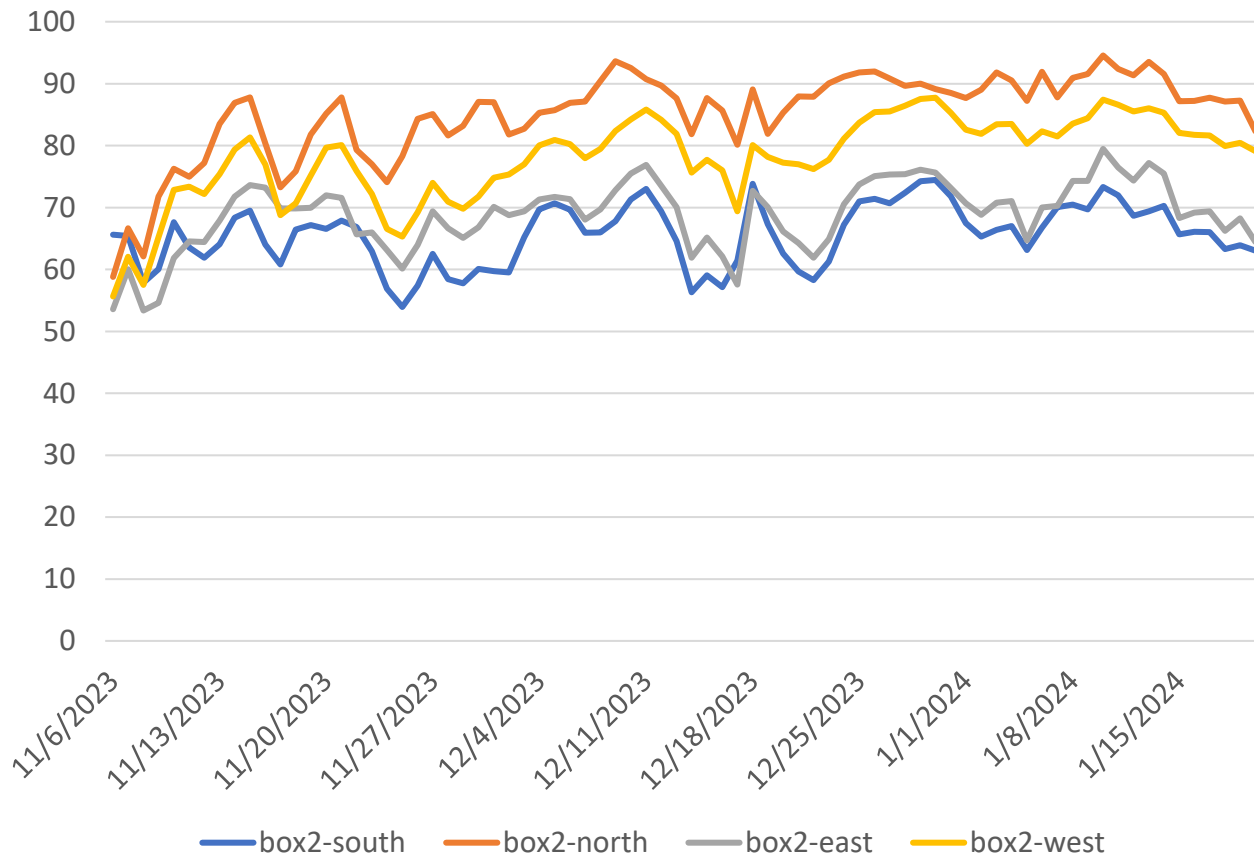


Bees have been in box4 since mid November. They cluster between box4-east and west when it gets colder.

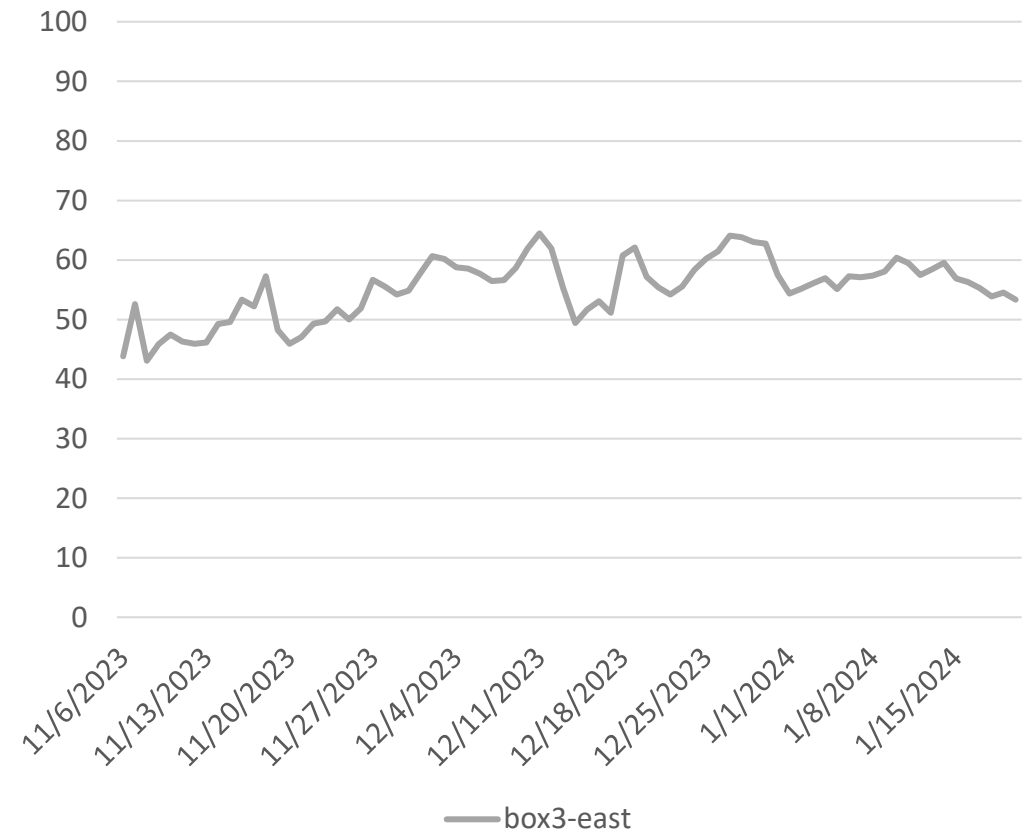
At a check on 1/21 – the bees were also clustered on top of the box4-north sensor.

Daily Mean RH

Box 2 Mean Daily RH



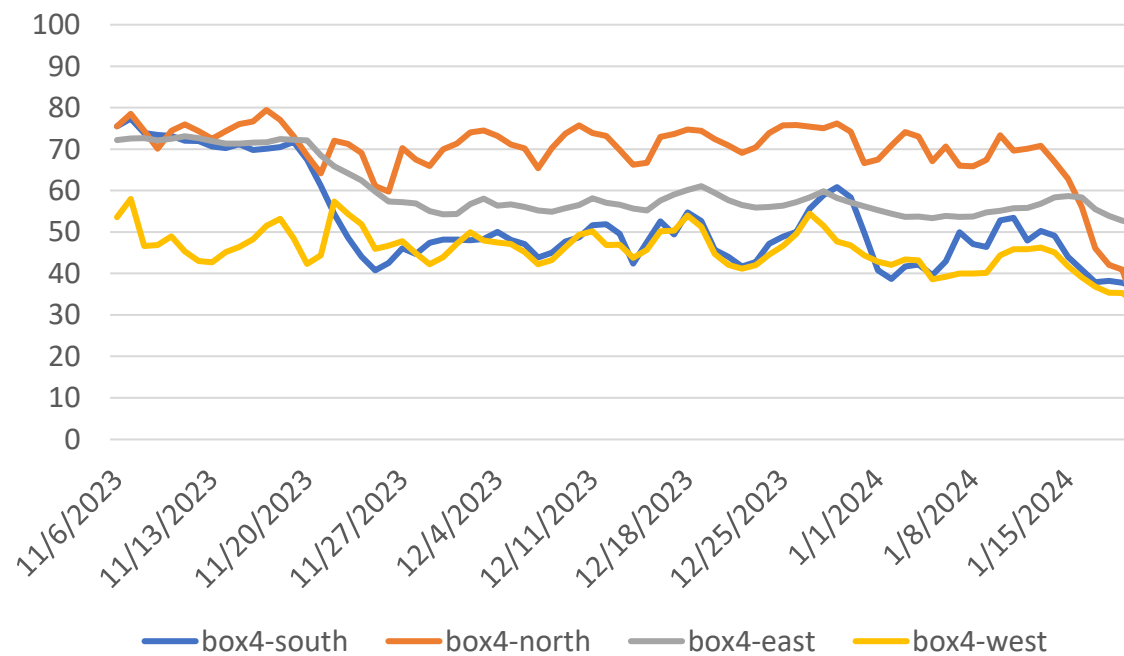
Box3-Mean Daily RH



Bees have been in box4 since mid November. They cluster between box4-east and west when it gets colder.

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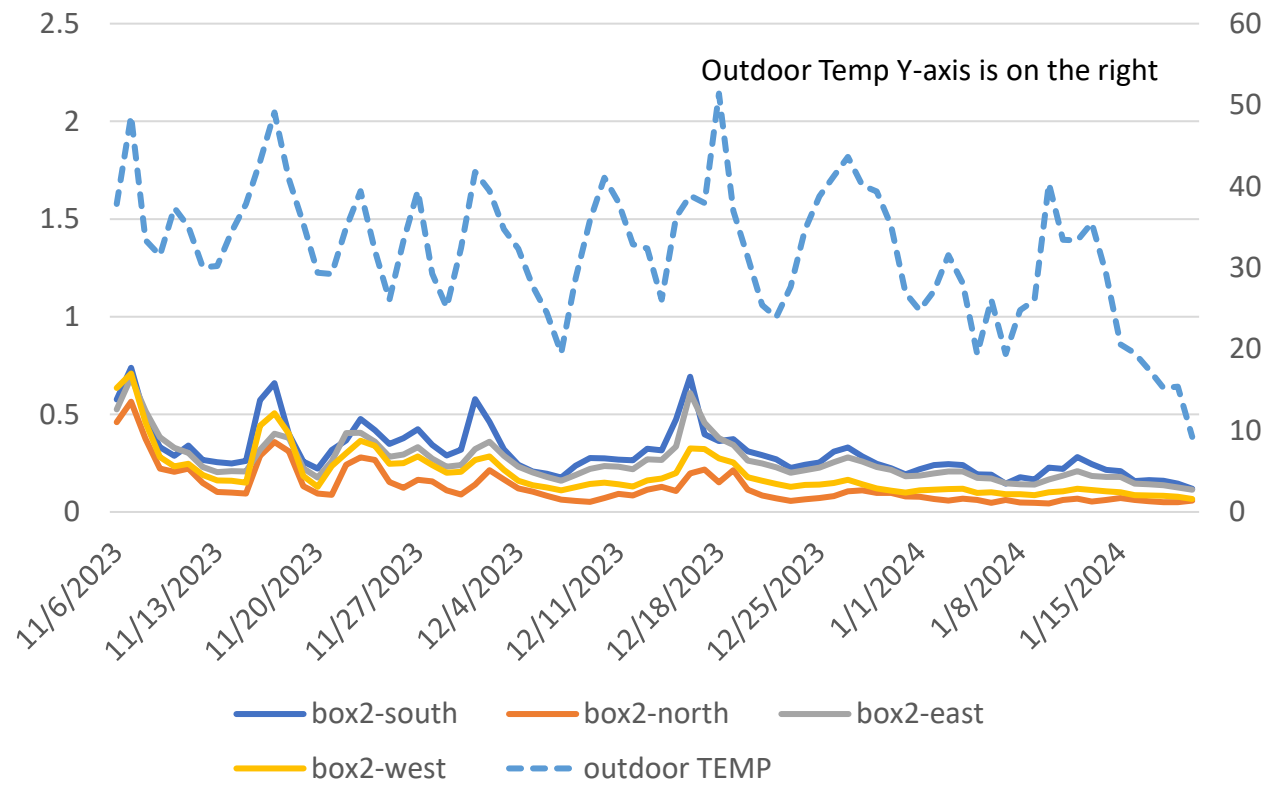
Box4-Daily Mean RH



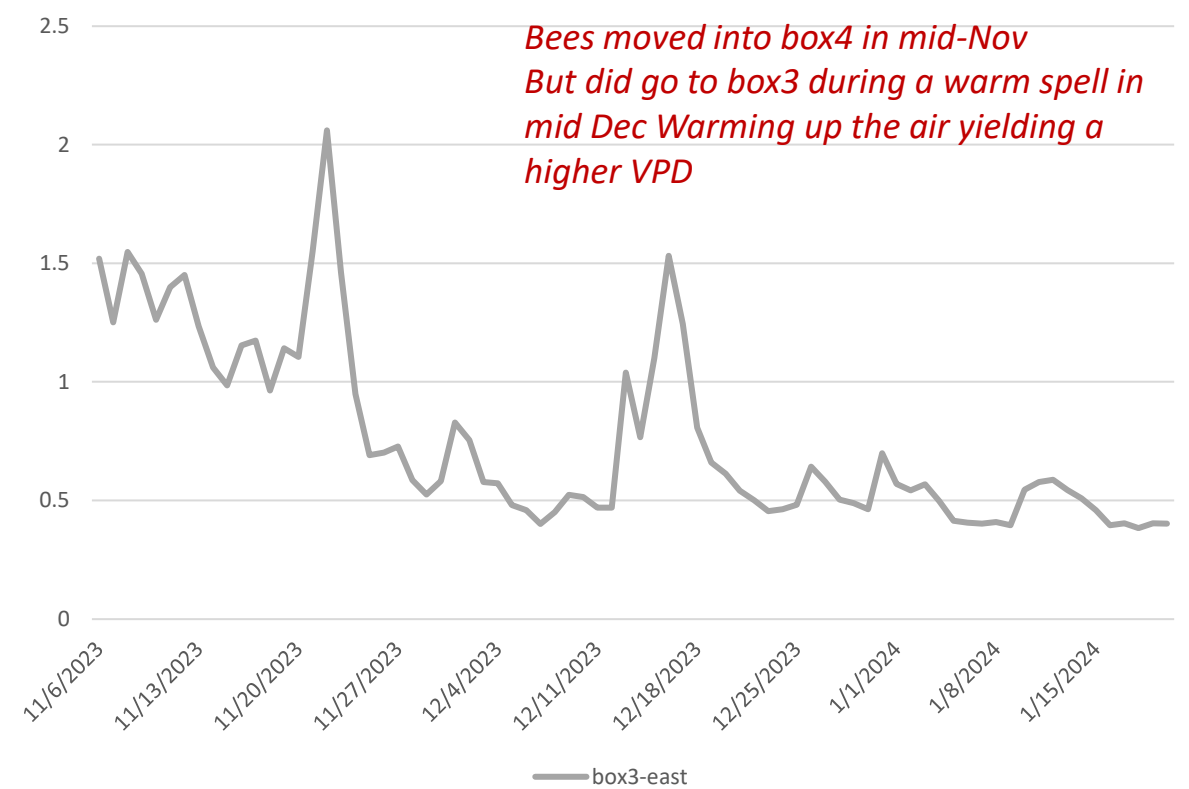
Bees moved toward the north sensor as it got cold. The warmer air means a higher saturation level so the RH drop

Daily Mean VPD

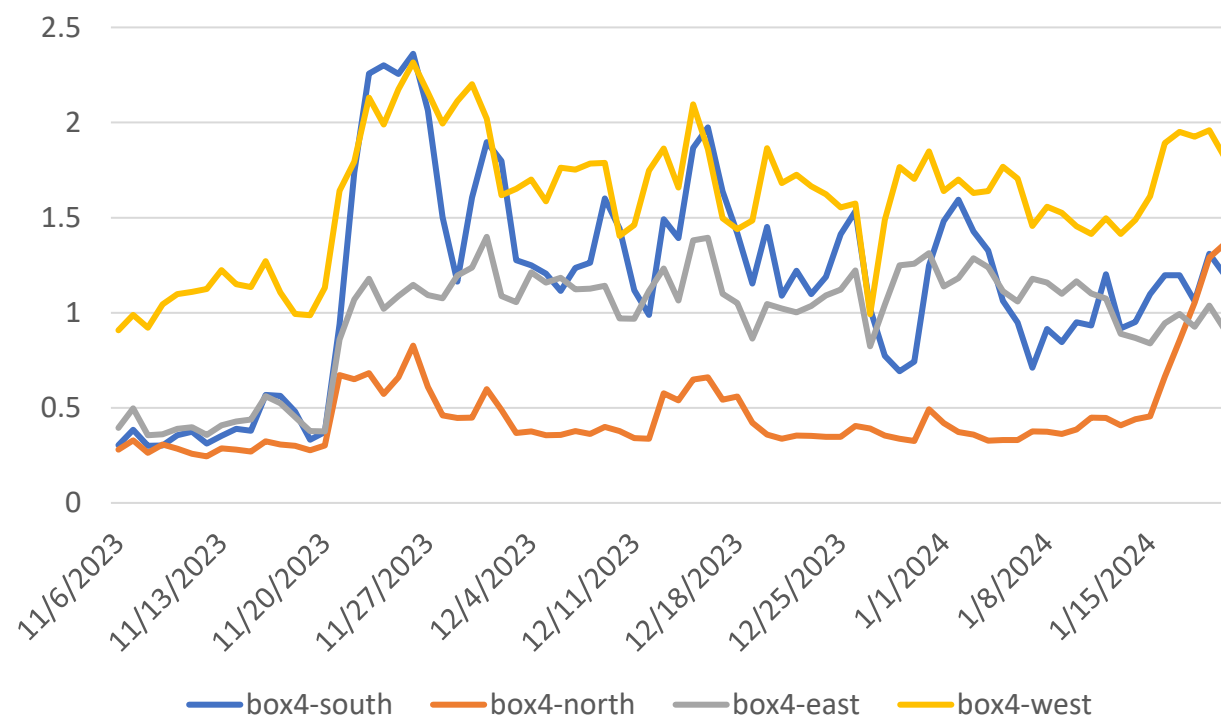
Daily Mean VPD (and outdoor Temp)



Box3-Mean Daily VPD



Box4-Daily Mean VPD



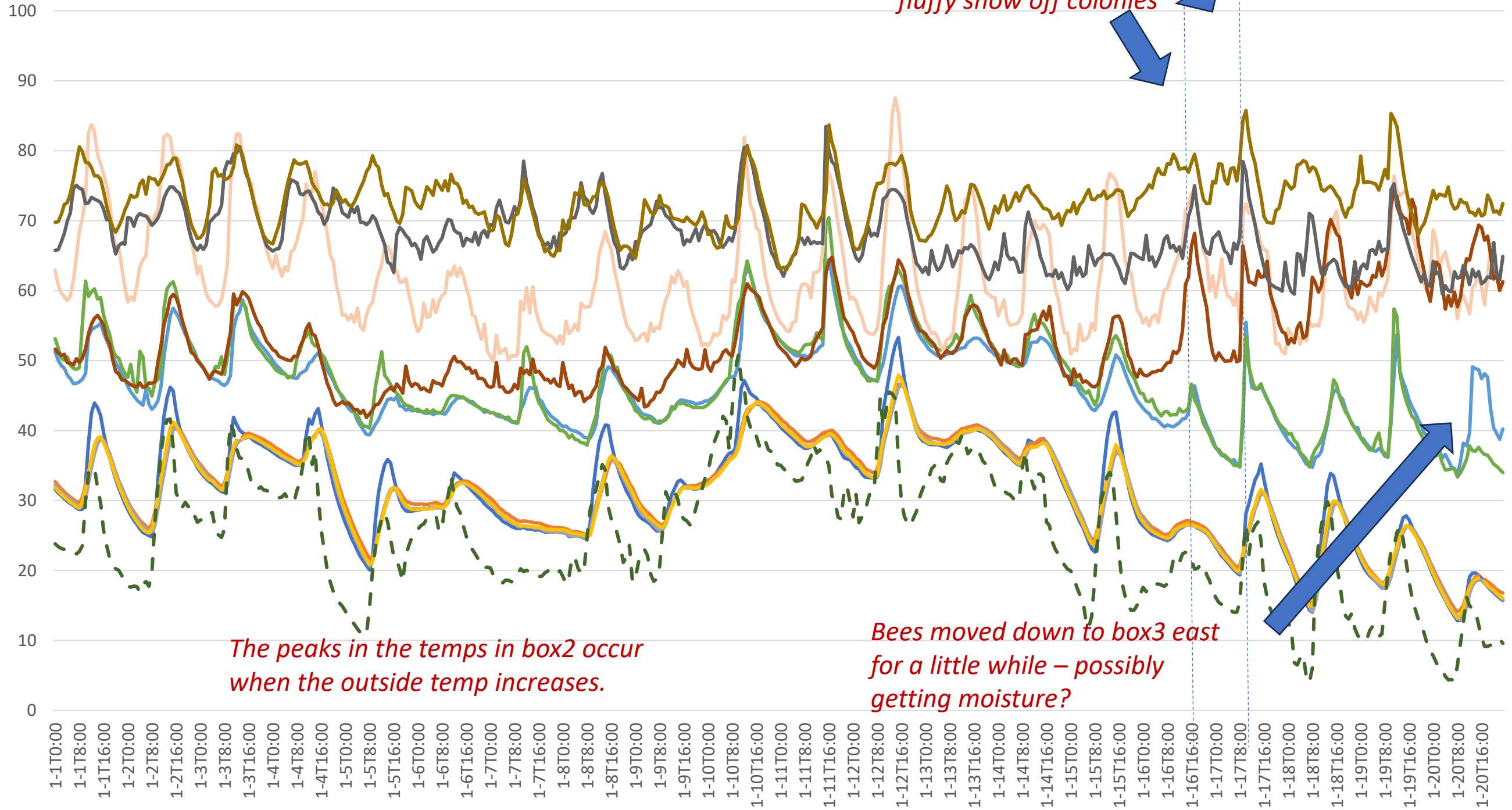
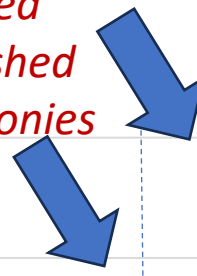
Bees have been in box4 since mid November. They cluster between box4-east and west when it gets colder.

At a check on 1/21 – the bees were also clustered on top of the box4-north sensor. – the warmer air allows more moisture.

January Hourly Temps

January - hourly Temps

Bees were disturbed when I lightly brushed fluffy snow off colonies

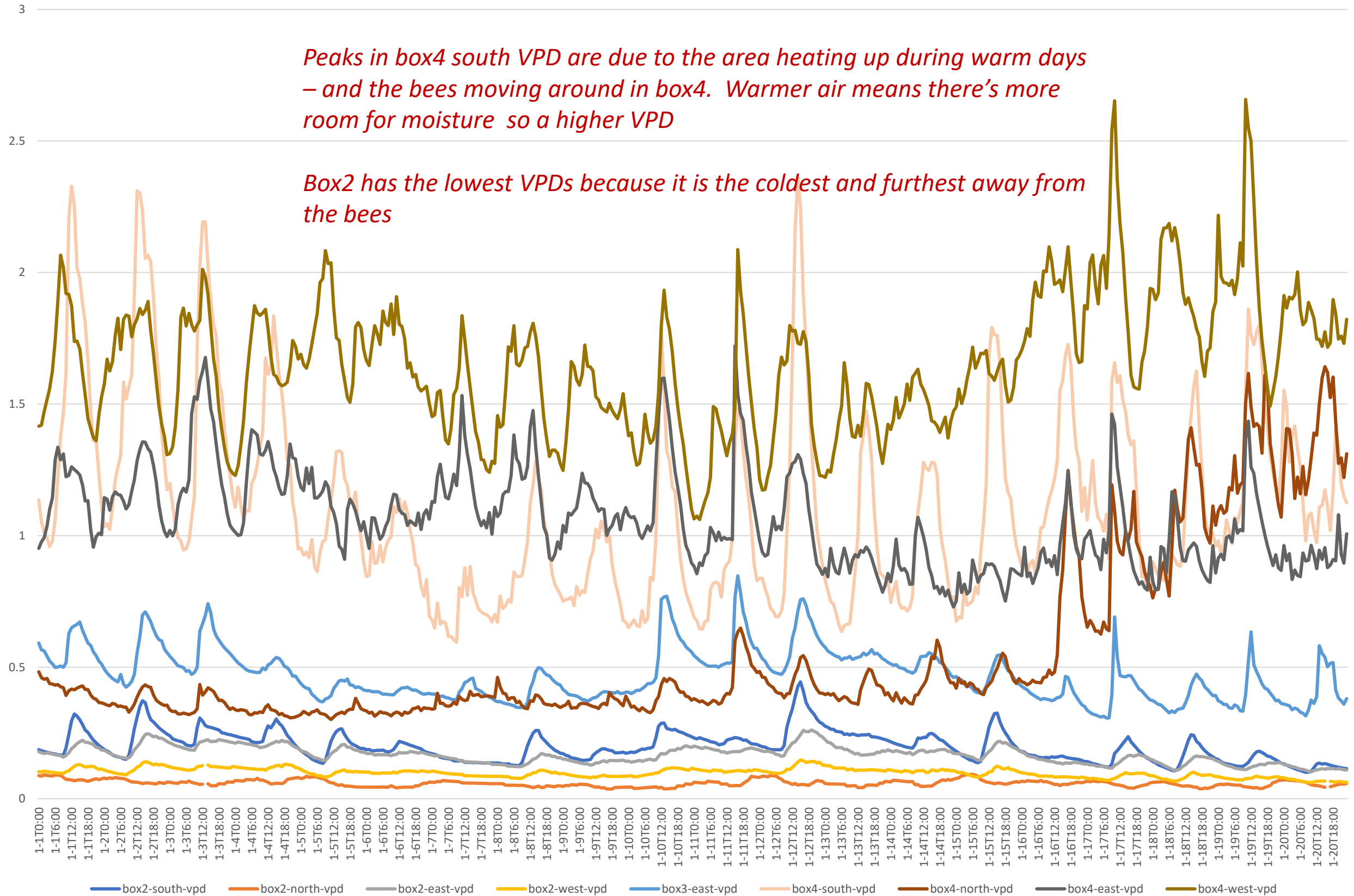


The peaks in the temps in box2 occur when the outside temp increases.

Bees moved down to box3 east for a little while – possibly getting moisture?

- 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

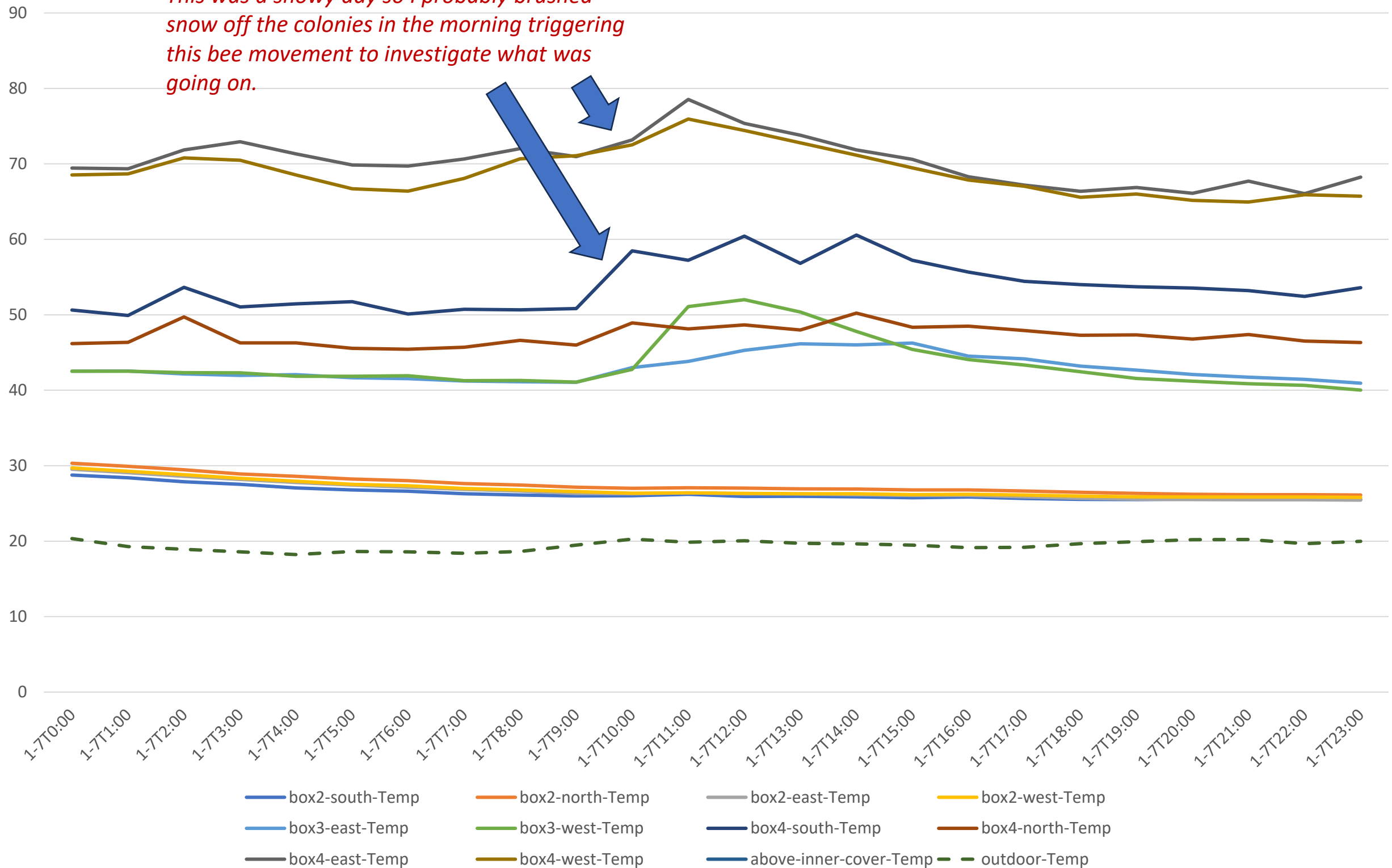


Box3 West is a temp only sensor so we don't have VPD values

January 7 at 8am

A closer look at the bees on 1/7

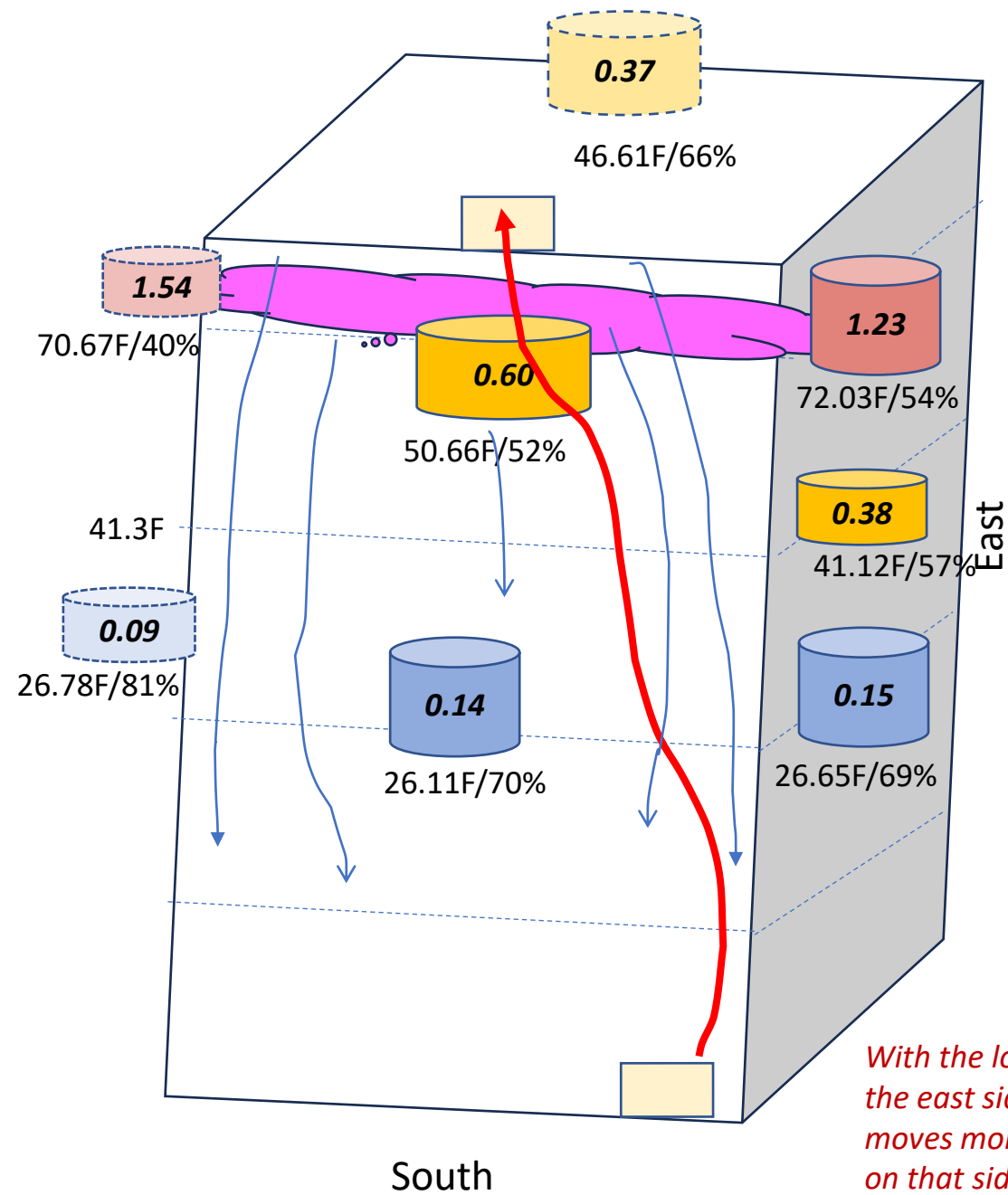
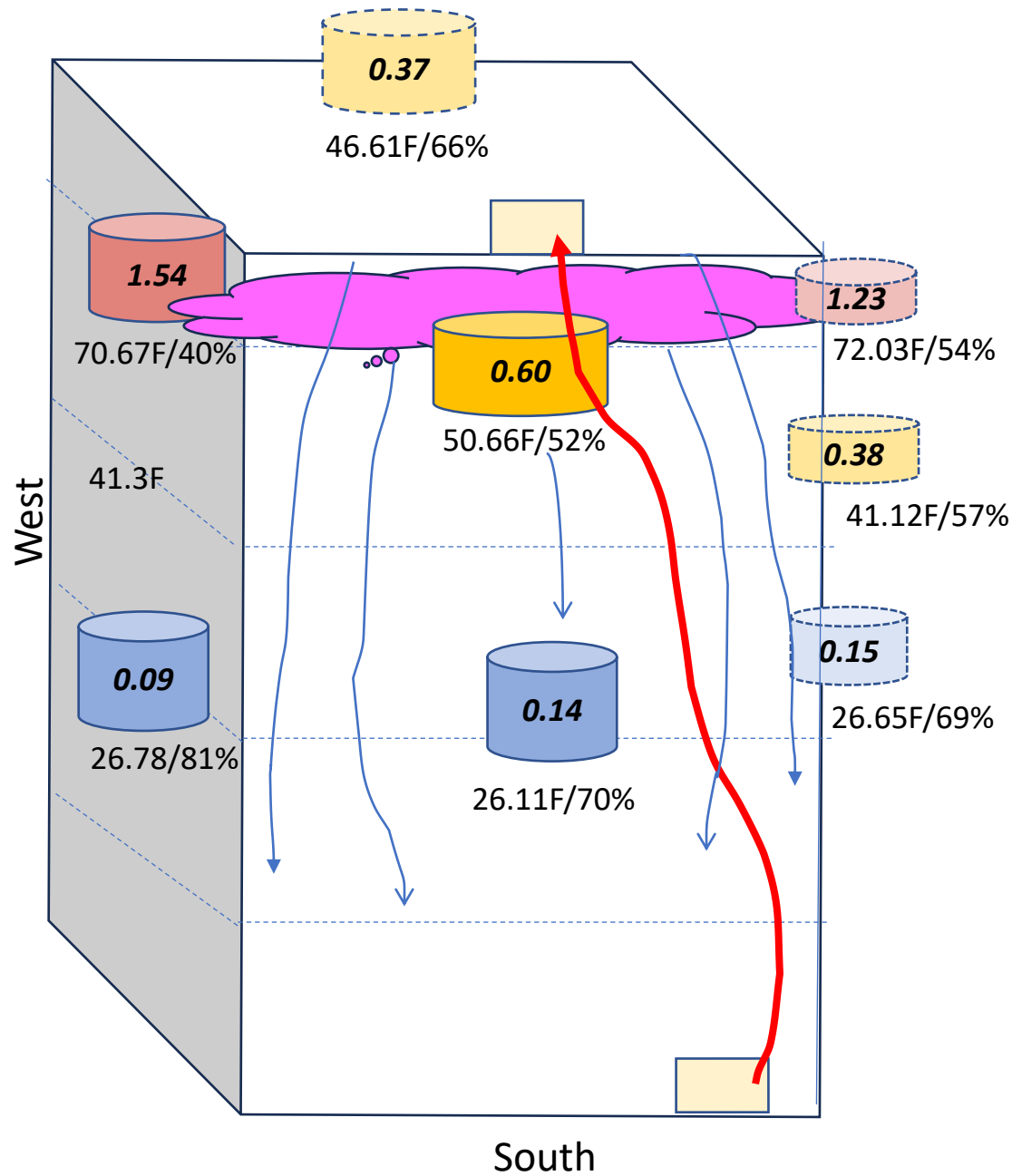
This was a snowy day so I probably brushed snow off the colonies in the morning triggering this bee movement to investigate what was going on.



Bees are clustered in box4-east & west – in the air flow from the lower to upper entrance.

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

View from SW & SE

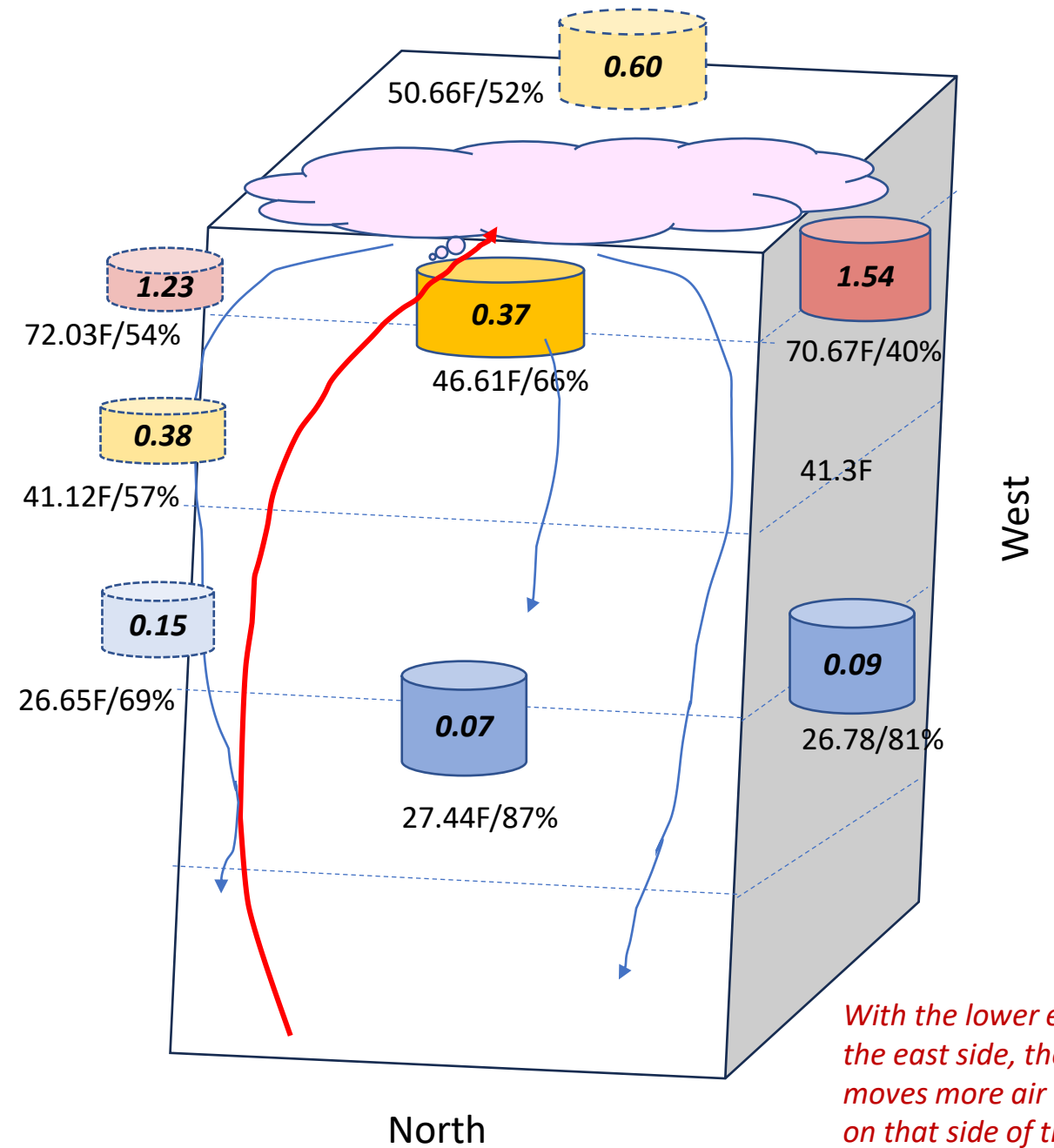
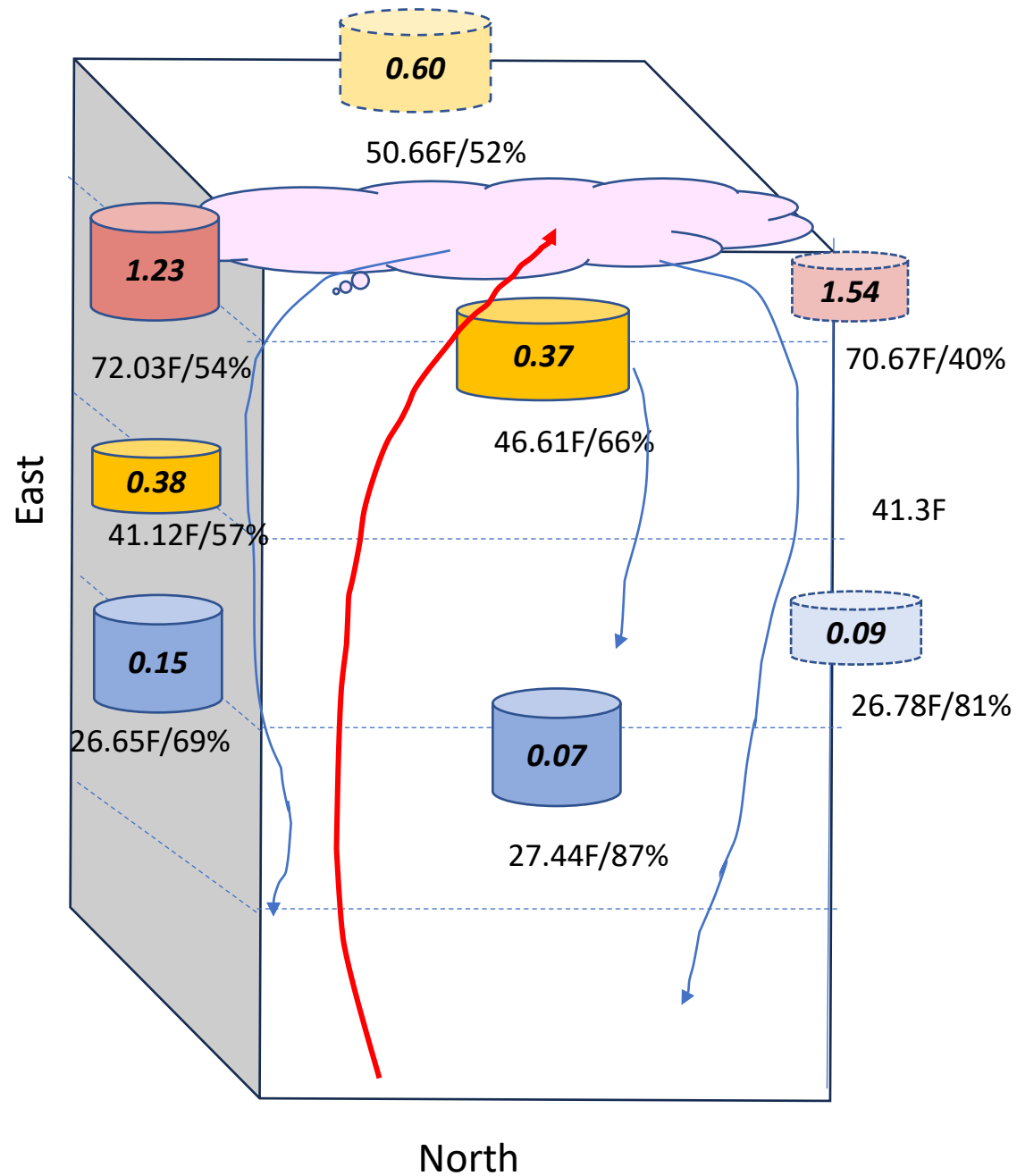


With the lower entrance on the east side, the ventilation moves more air & moisture on that side of the colony and therefore VPDs are higher than on the west side.

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)	26.11	27.44	26.65	26.78	41.12	41.3	50.66	46.61	72.03	70.67	18.62	18.62
RH (%)	70	87	69	81	57		52	66	54	40		
VPD (g/m3)	0.14	0.07	0.15	0.09	0.38		0.60	0.37	1.23	1.54		

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

View from NE & NW

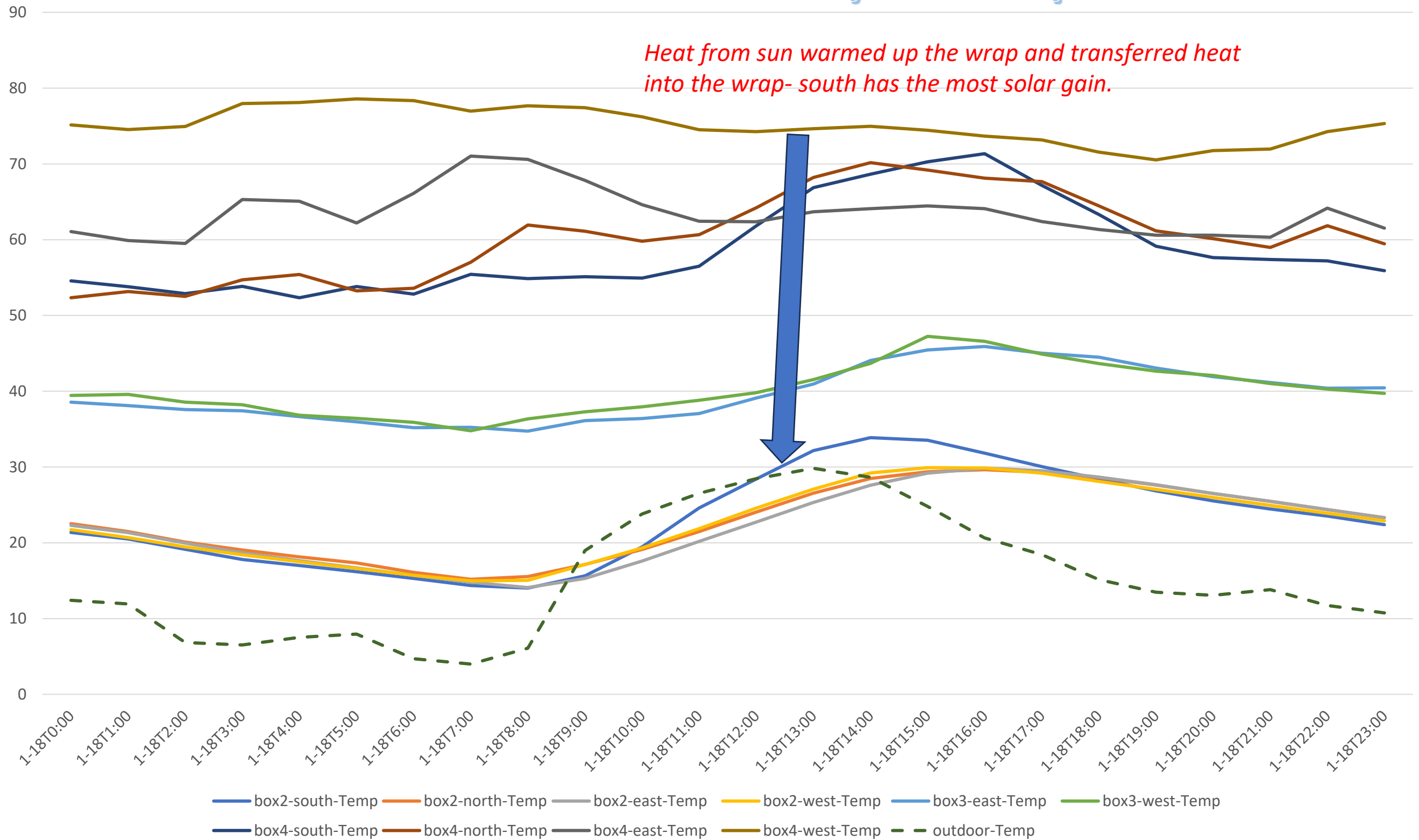


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Temp (F)	26.11	27.44	26.65	26.78	41.12	41.3	50.66	46.61	72.03	70.67	18.62
RH (%)	70	87	69	81	57		52	66	54	40	
VPD (g/m3)	0.14	0.07	0.15	0.09	0.38		0.60	0.37	1.23	1.54	

January 18 at 7am
Outside temp ~4F

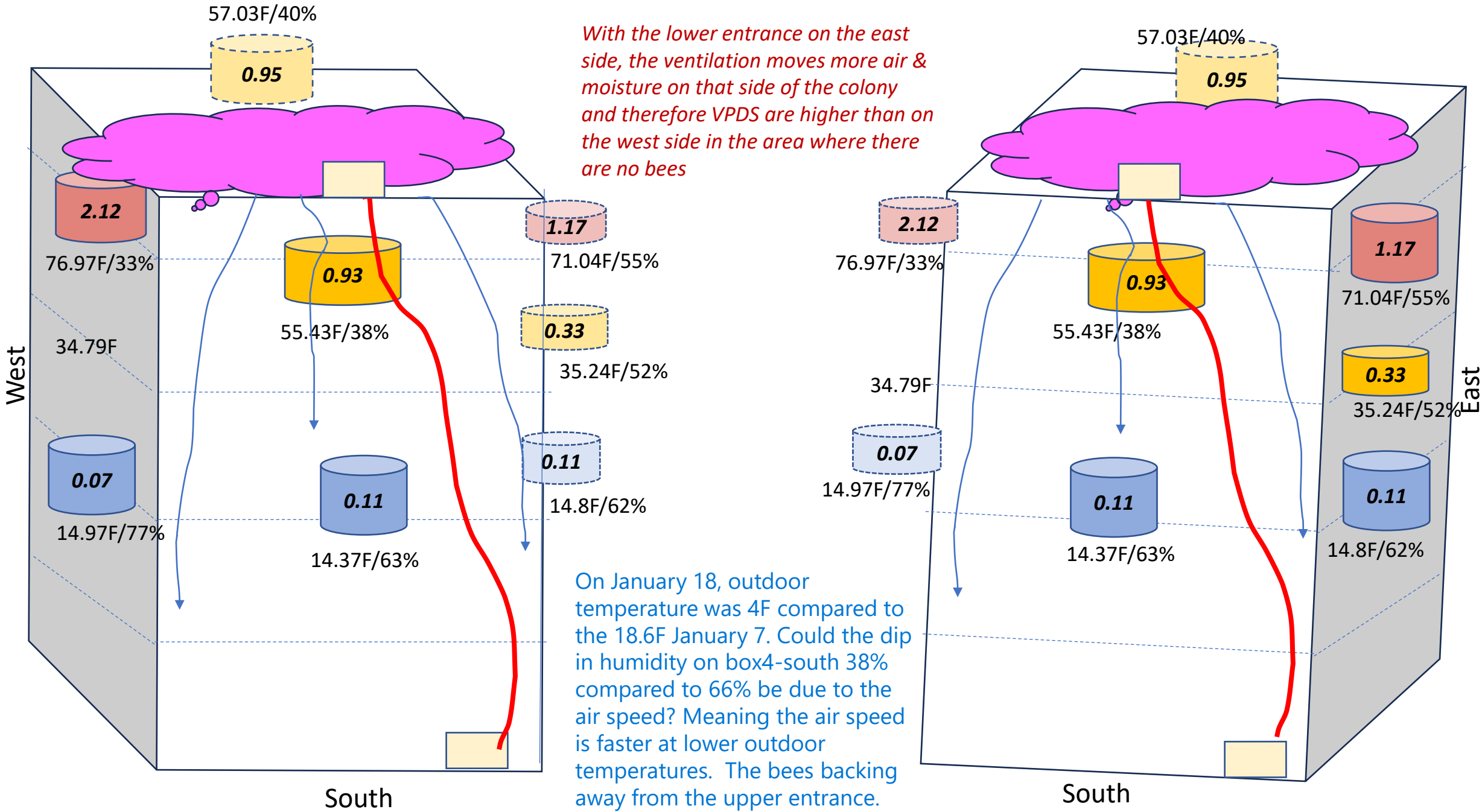
Jan 18 hourly temps.



2 boxes hold 8.5 degrees of heat with the hive wrapped with an R-11.7 Then by 8 AM the outside temperatures start to increase, and the wrap heat cycle starts again.

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

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	outdoor
Temp (F)	14.37	15.18	14.8	14.97	35.24	34.79	55.43	57.03	71.04	76.97	4
RH (%)	63	81	62	77	52		38	40	55	33	
VPD (g/m3)	0.11	0.06	0.11	0.07	0.33		0.93	0.95	1.17	2.12	