

# Ventilation 2023 Study

## Sask2 Colony

Heather Achilles

Melissa Sim-Hollister

# Colony setup



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

Two of the ten Broodminder sensors

Cinder blocks wrapped with Reflectix

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

1 1/2" shim with weather Stripping

4 mediums

Lower Entrance 1/2 oval (1/2"x3/8")

Screened Bottom board closed with 1/2" Polystyrene

Reflectix "shingled" over cozy



Hollister Bungie

Bee Cozy over a colony quilt R 11.7



Wind block on inner cover opening

# How We'll Show Moisture in the Air

Air is SATURATED



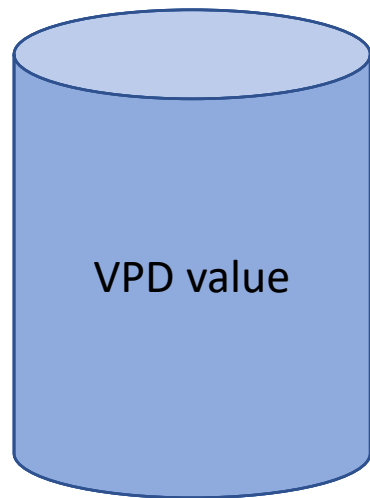
Air is DRY

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

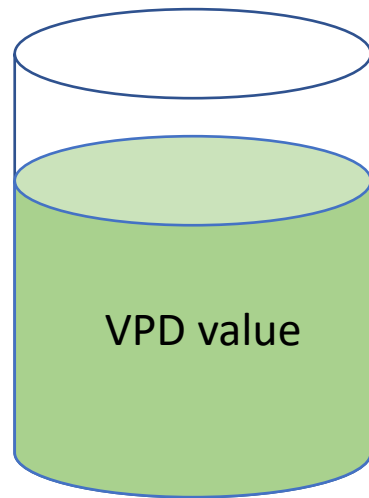
$VPD = 0.19 \rightarrow 0.28 \text{ g/m}^3$

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

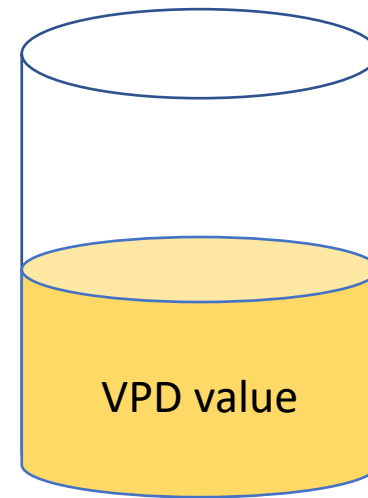
$VPD = 1.00+ \text{ g/m}^3$



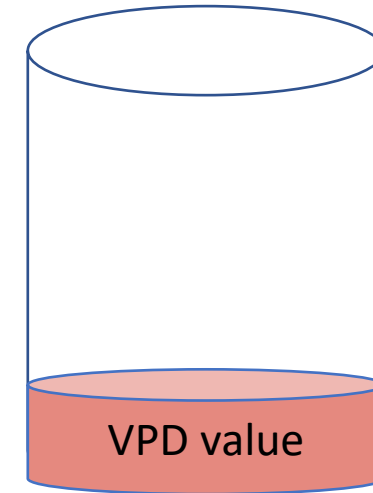
Away from cluster,  
may or may not have  
condensation present



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)

# Sask2

County: Belknap  
Town: Gilmanton  
Bee Race: Saskatraz  
Source: Overwintered colony (2021 package)  
Queen: 2021  
Hive Name: Sask2

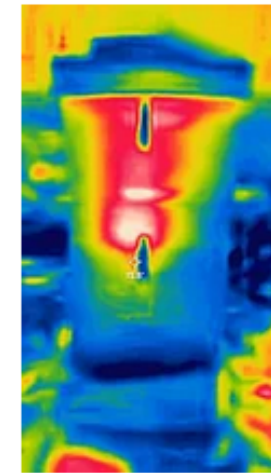
## Hive details:

- 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

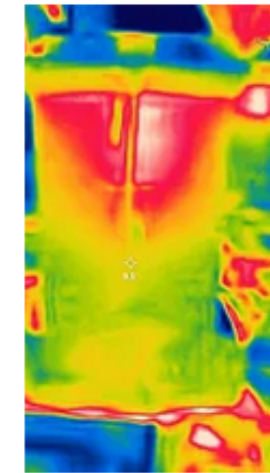
## Notes:

- 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. Some bees were at the top -
- 12/16/23 : bees flying at noon - using both entrances
- 12/31/23 @ ~ 9:30am - removed ratchet straps didn't open colony
- 1/3/24 @ 11:30 ish checked bottom boards - almost no bees
- 1/7/2024 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 peaked in and there were a few bees around box4-south sensor; cleared bees from bottom board (1/4-1/3 c); went to another colony - came back and the top rails were full of bees; added 1 lb sugar brick in center of shim

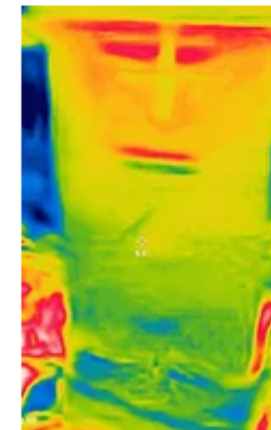
November 21, 2023 @ 6am (~17F in apiary)



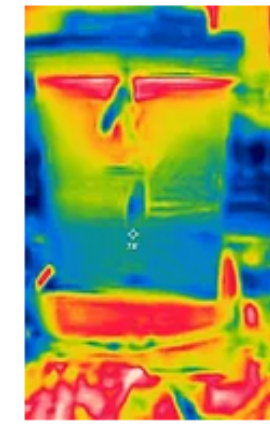
South side



West side



North side

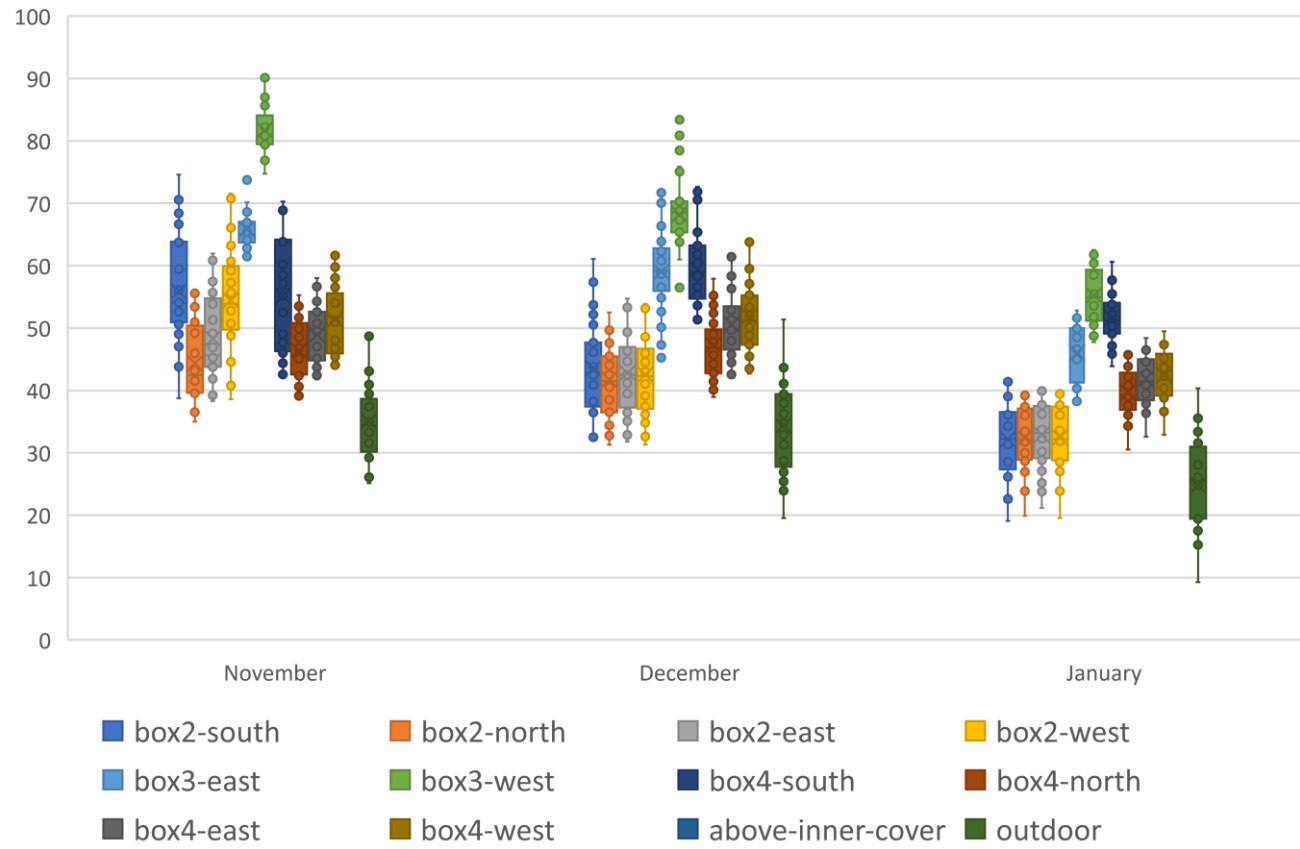


East side

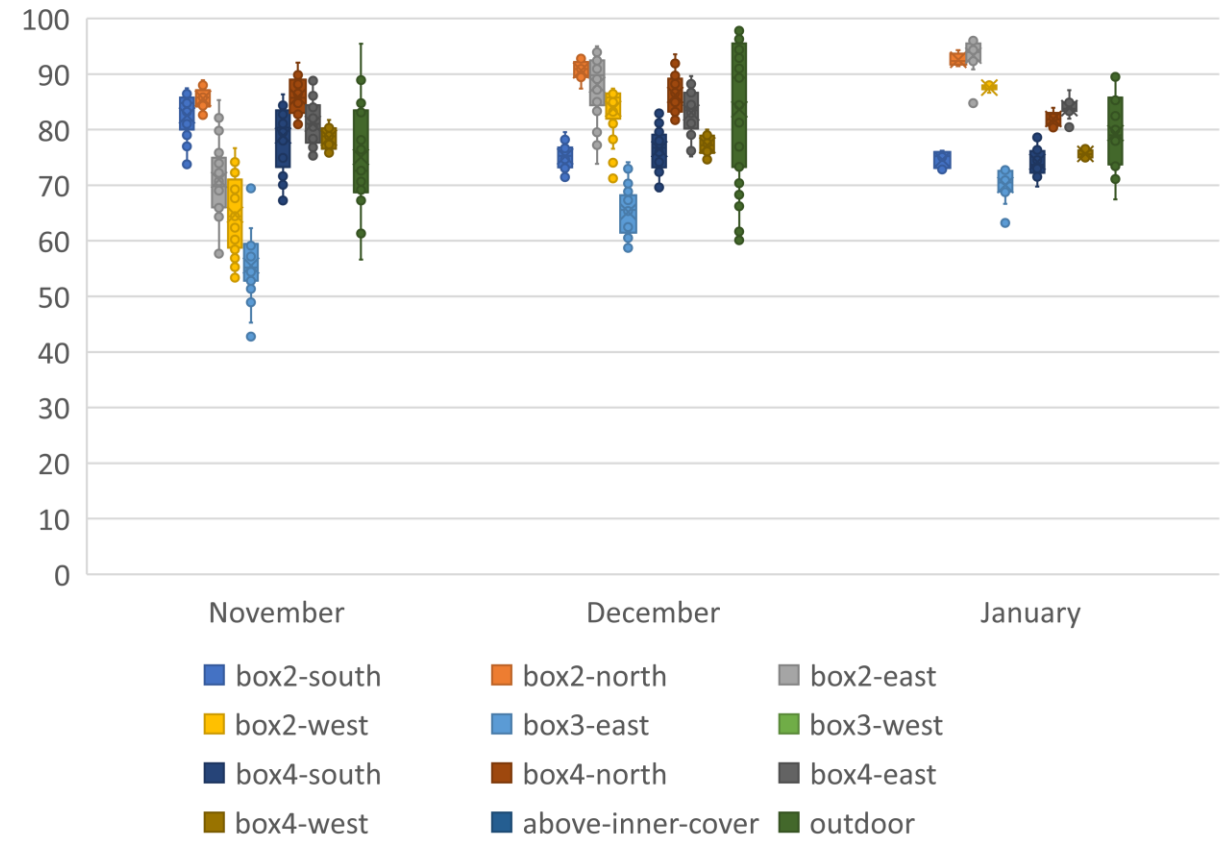


# Daily Mean Stats

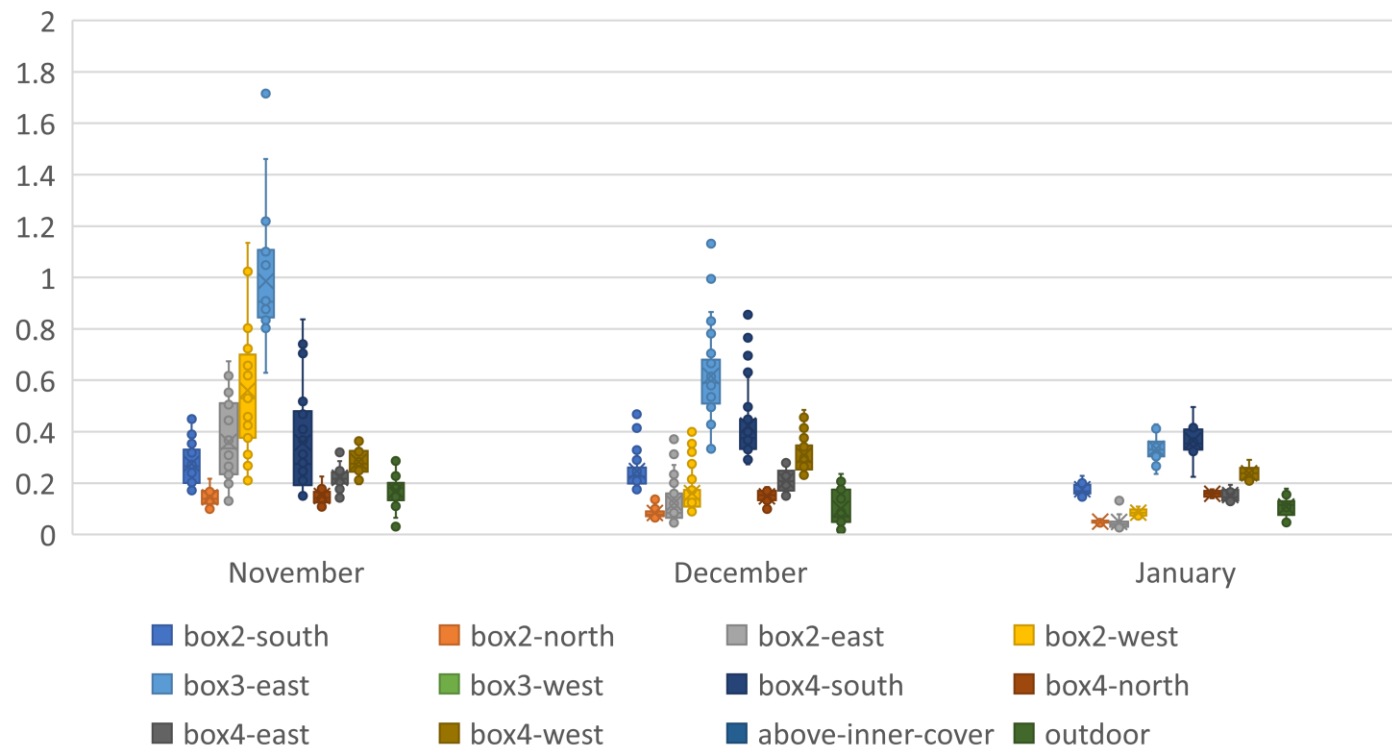
Sask2 - Daily Mean Temps (11/6-1/21)



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



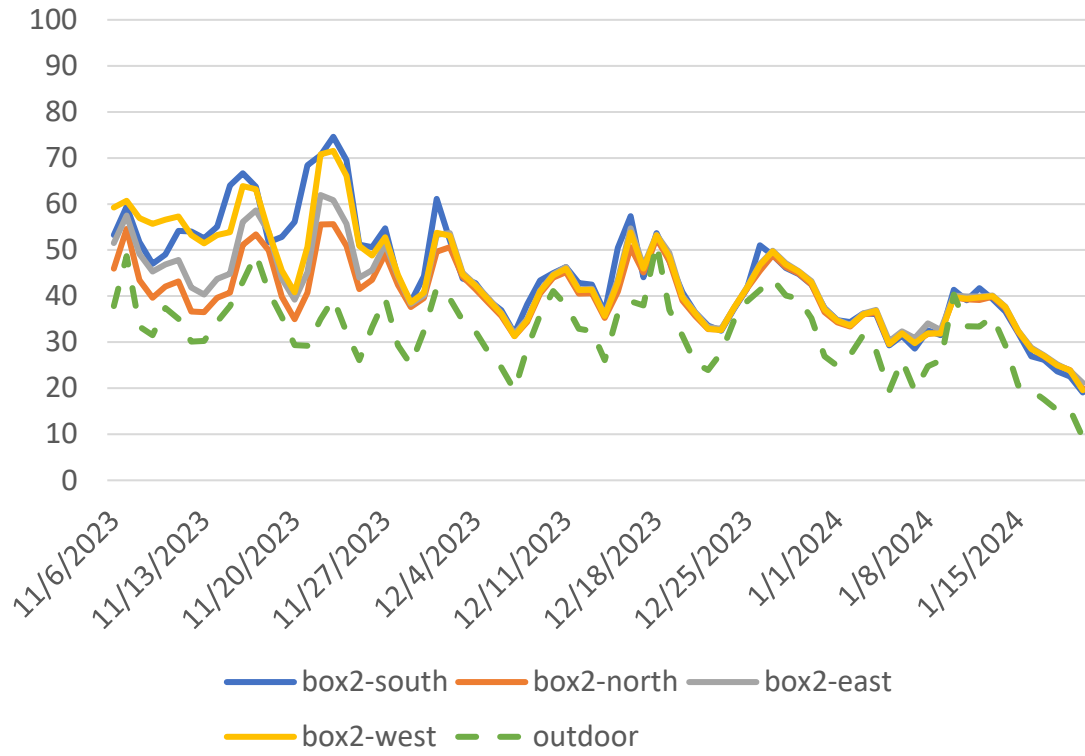
Sask2 - Daily Mean VPD (11/6-1/21)



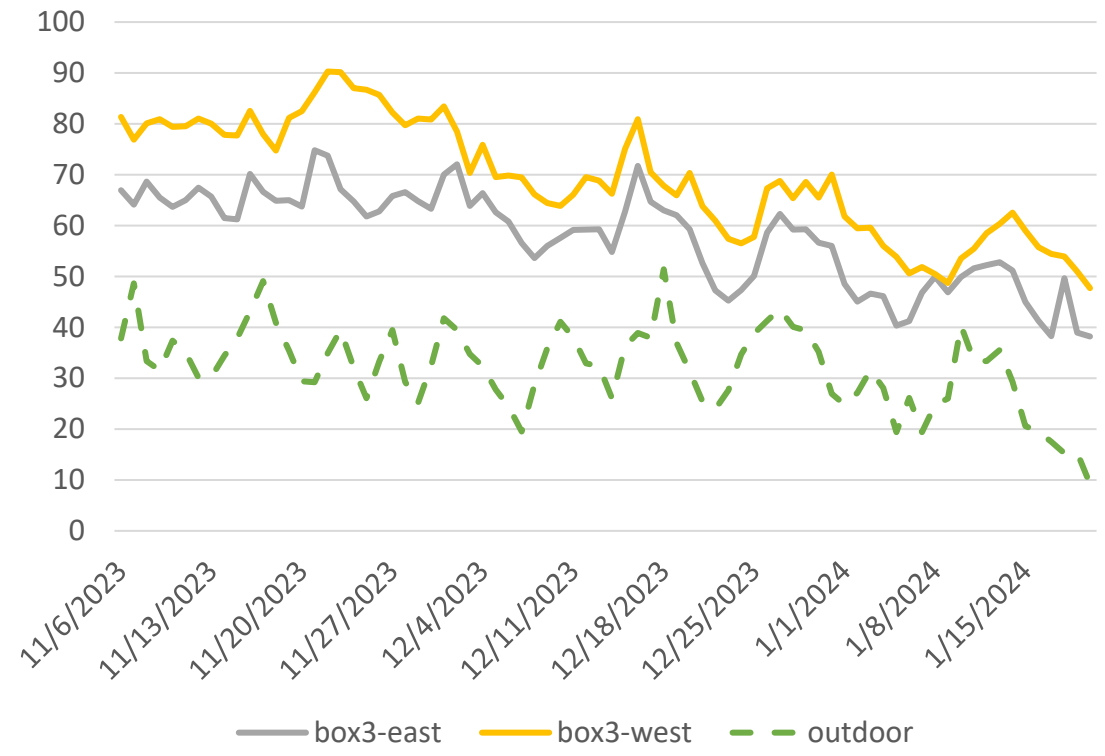
January: Bees are clustering between Box3-east, box3-west and box4-south

# Daily Mean Temp

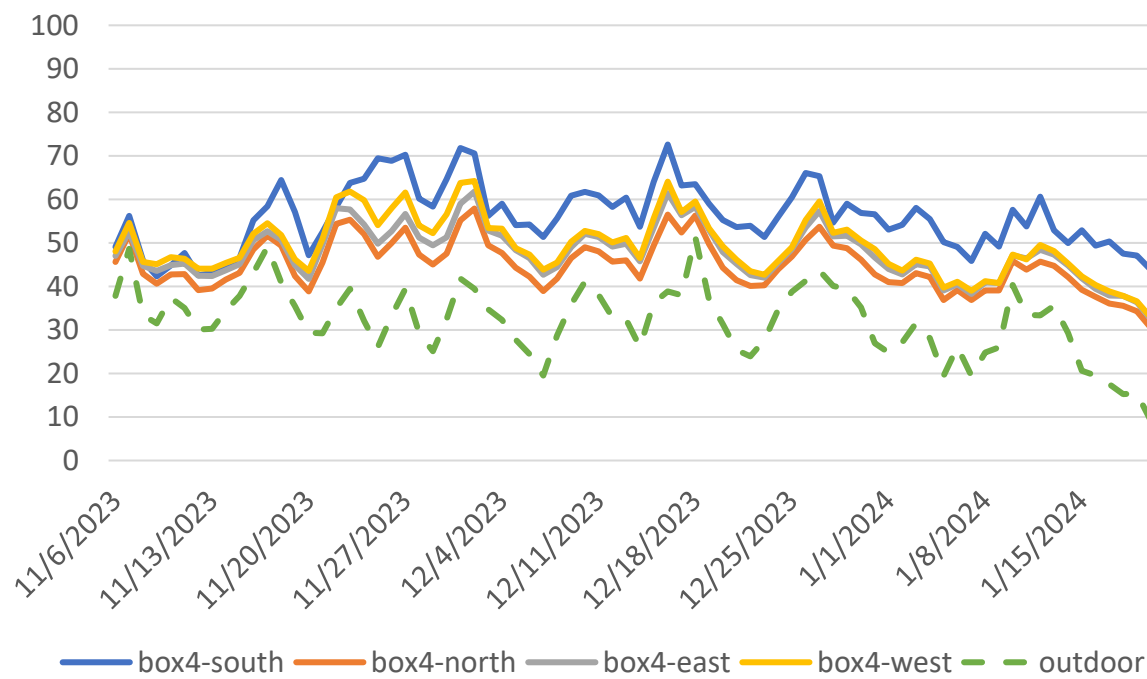
Sask2-Box2 Mean Daily Temp



Box3-Mean Daily Temp

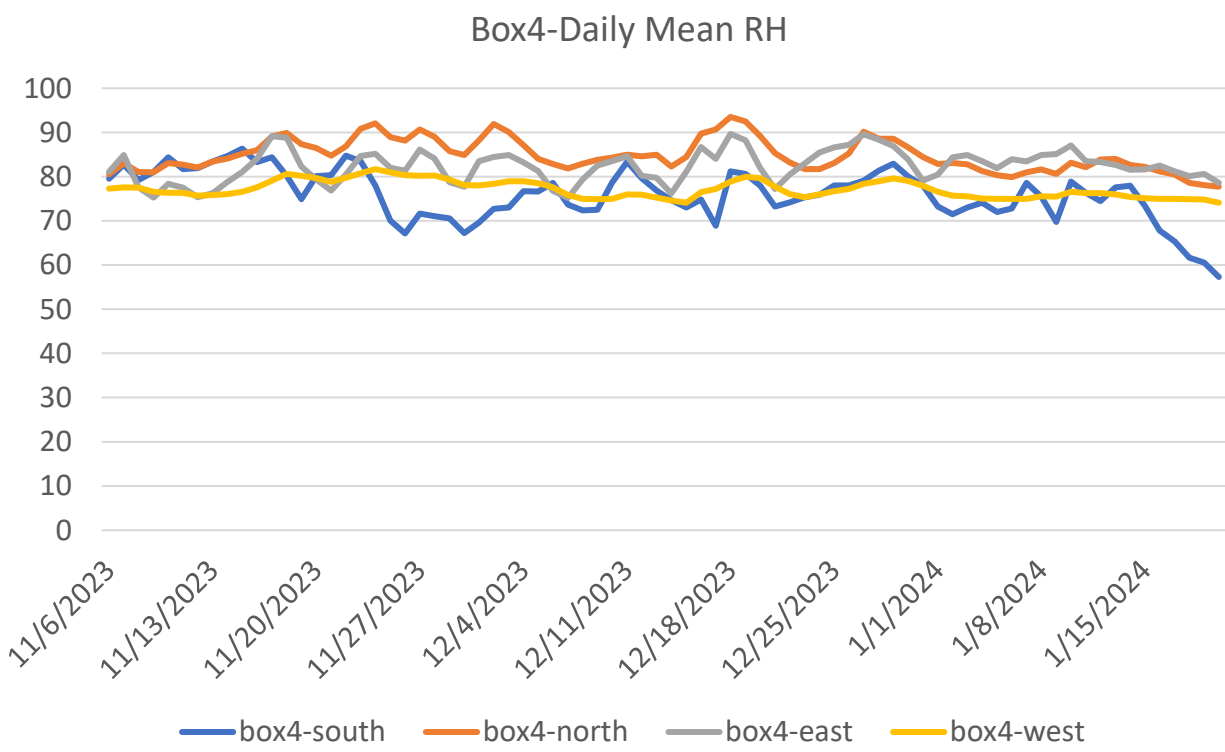
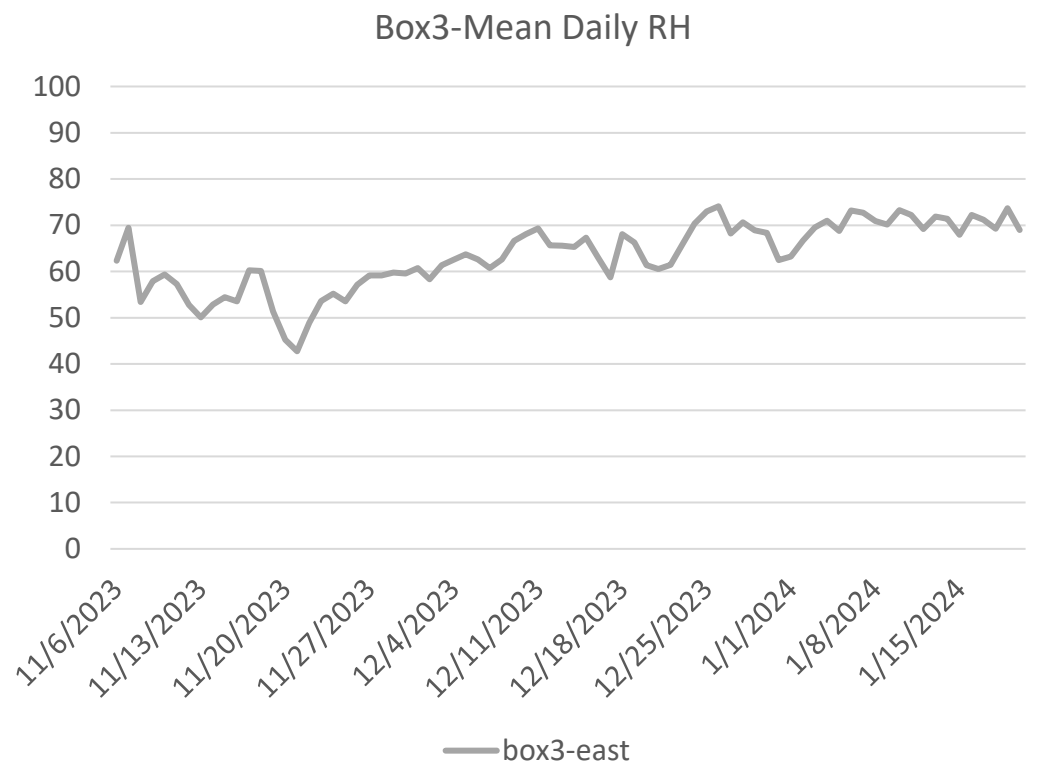
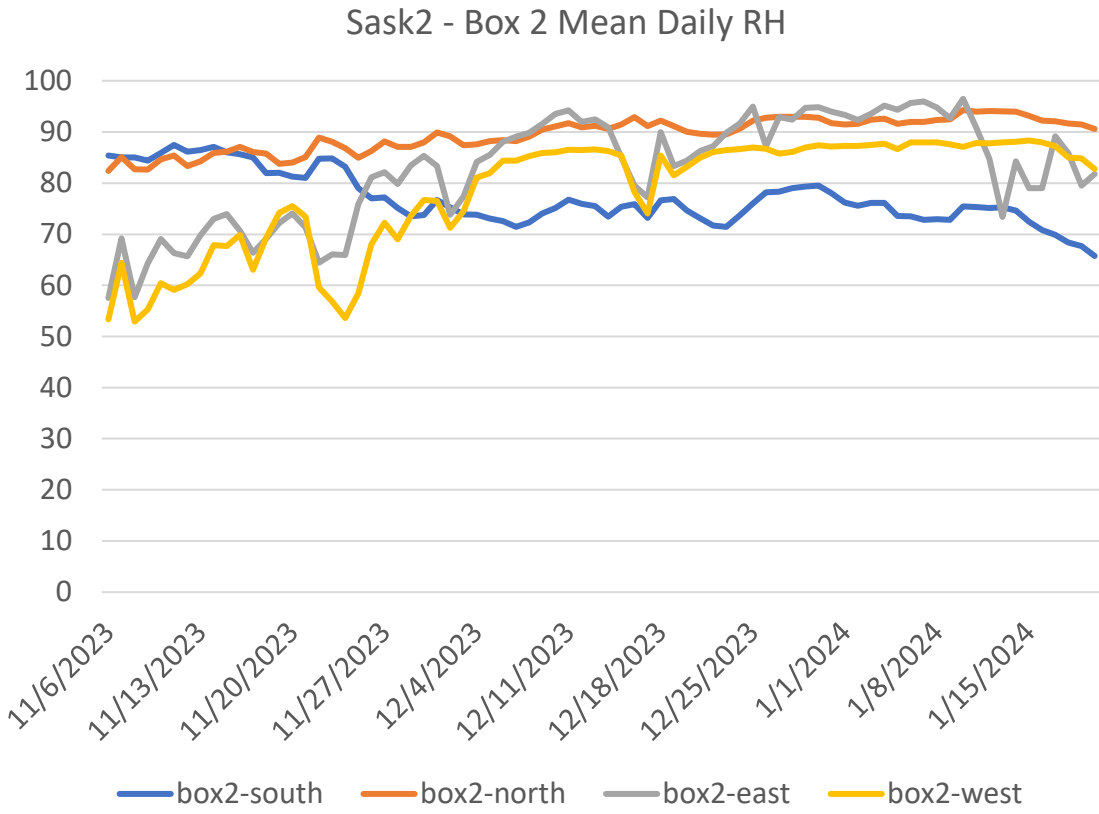


Box4-Daily Mean Temp



Bees are clustering  
between  
Box3-east, box3-west  
and box4-south

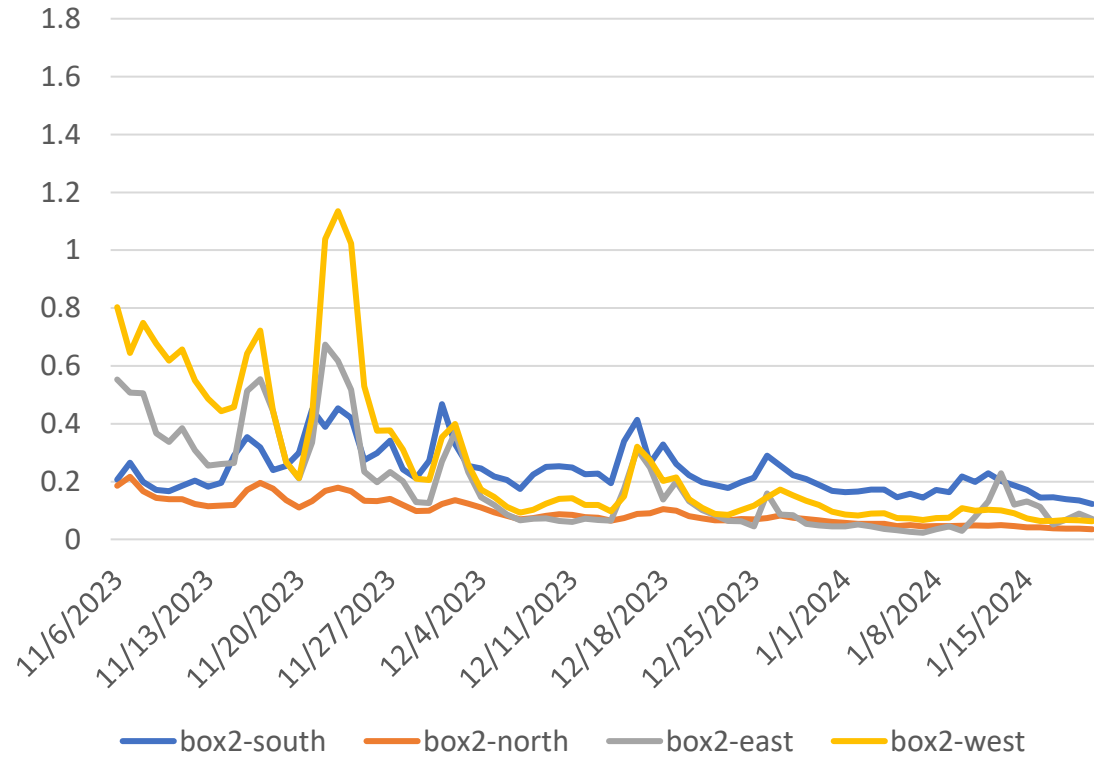
# Daily Mean RH



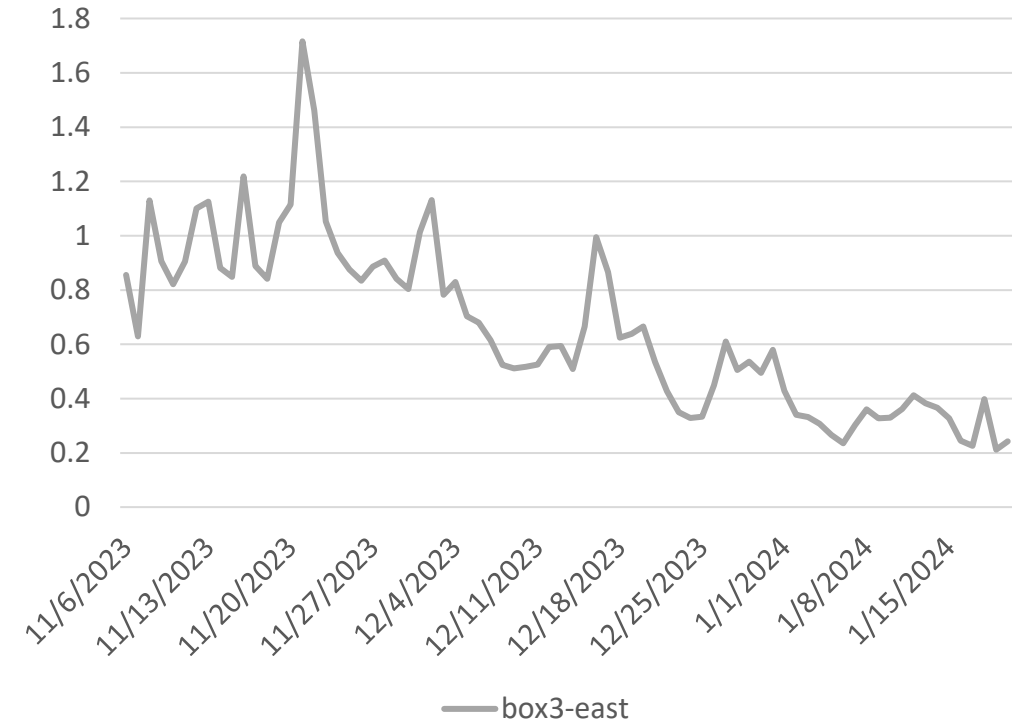
Note Box2 south humidity value lower at the end of the January (~ 65%). This value is then evaluated with the temperature chart on previous page (20F) to give the VPD on the next page (0.15) to figure the location of the bees. Bees located in box3-east, box-3 west and box4 south.

# Daily Mean VPD

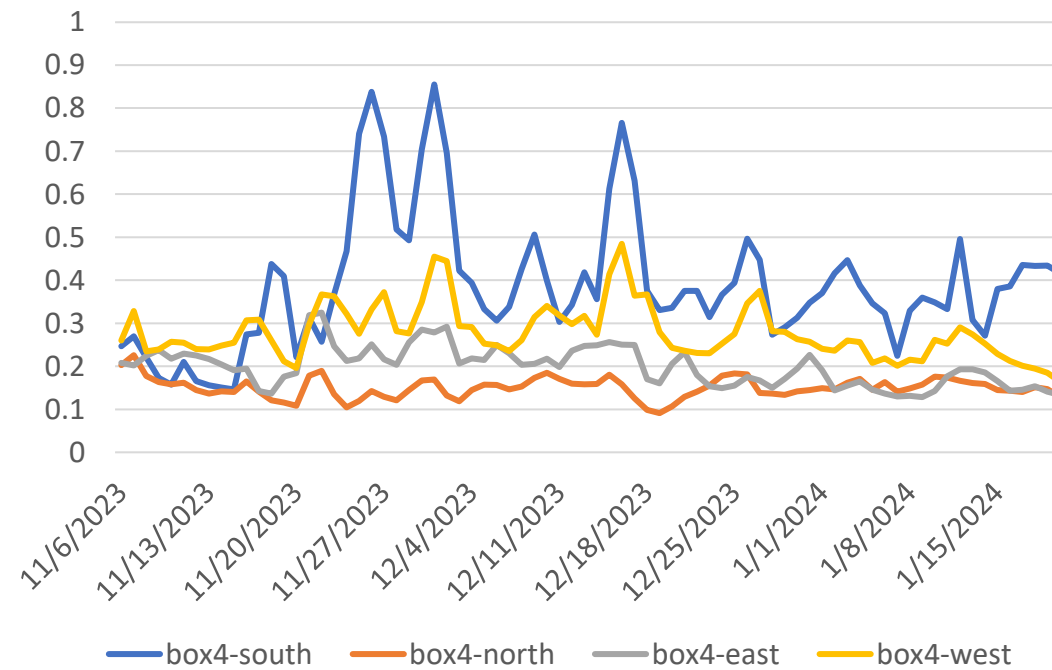
Sask2-Box2- Mean Daily VPD



Box3-Mean Daily VPD



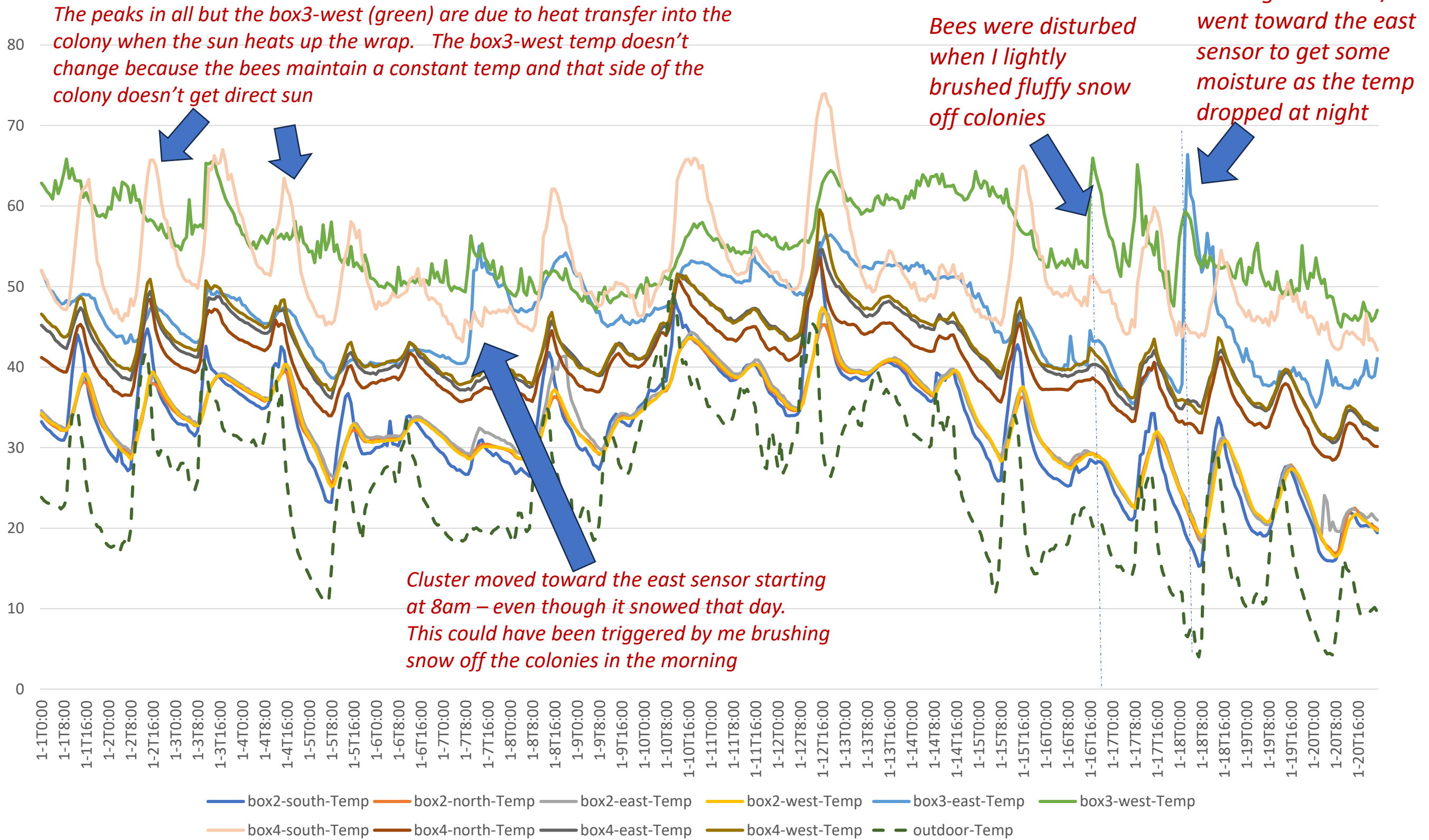
Box4-Daily MeanVPD



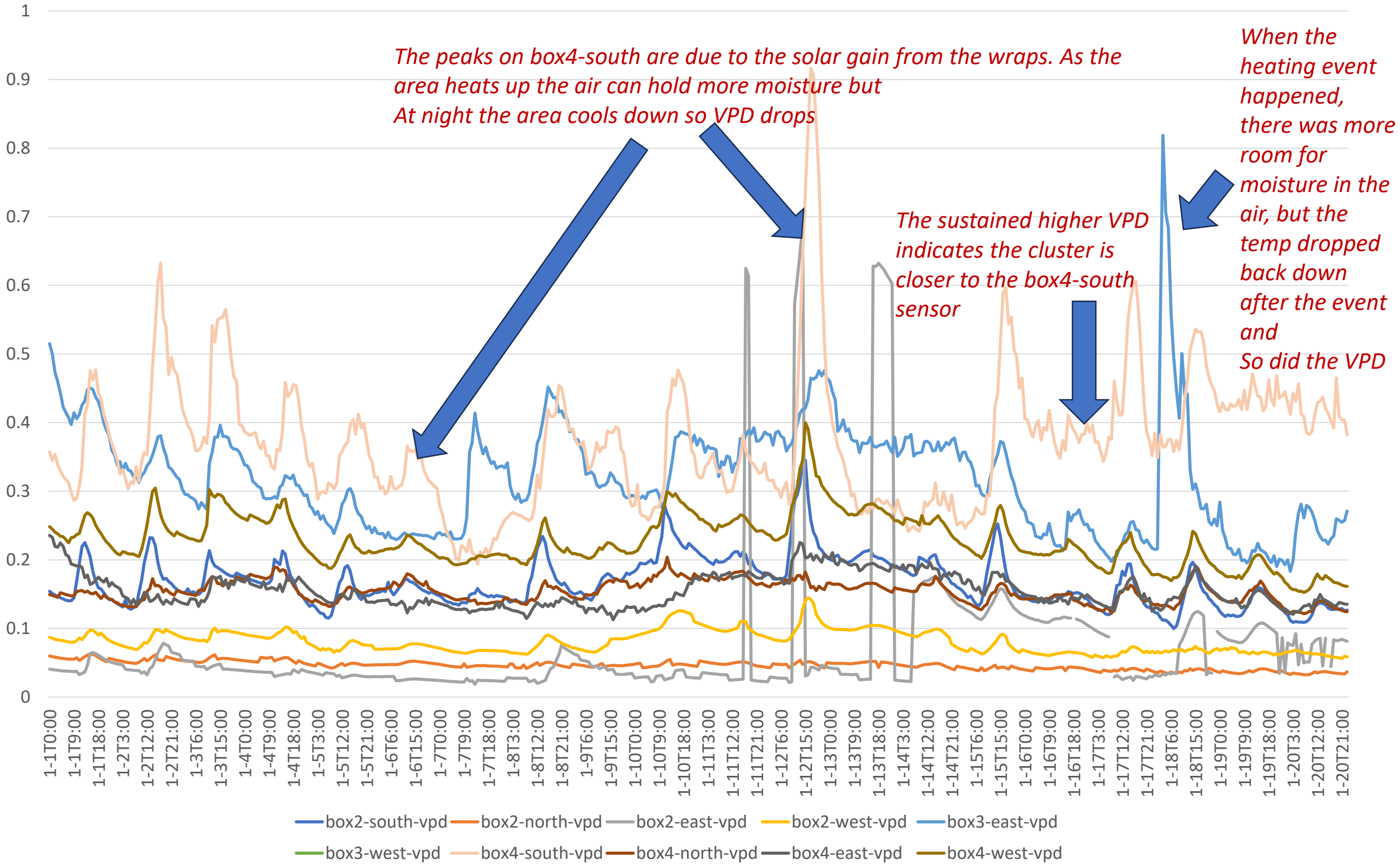
Bees are clustering  
between  
Box3-east, box3-west  
and box4-south



# January Hourly Temps



# January Hourly VPDs

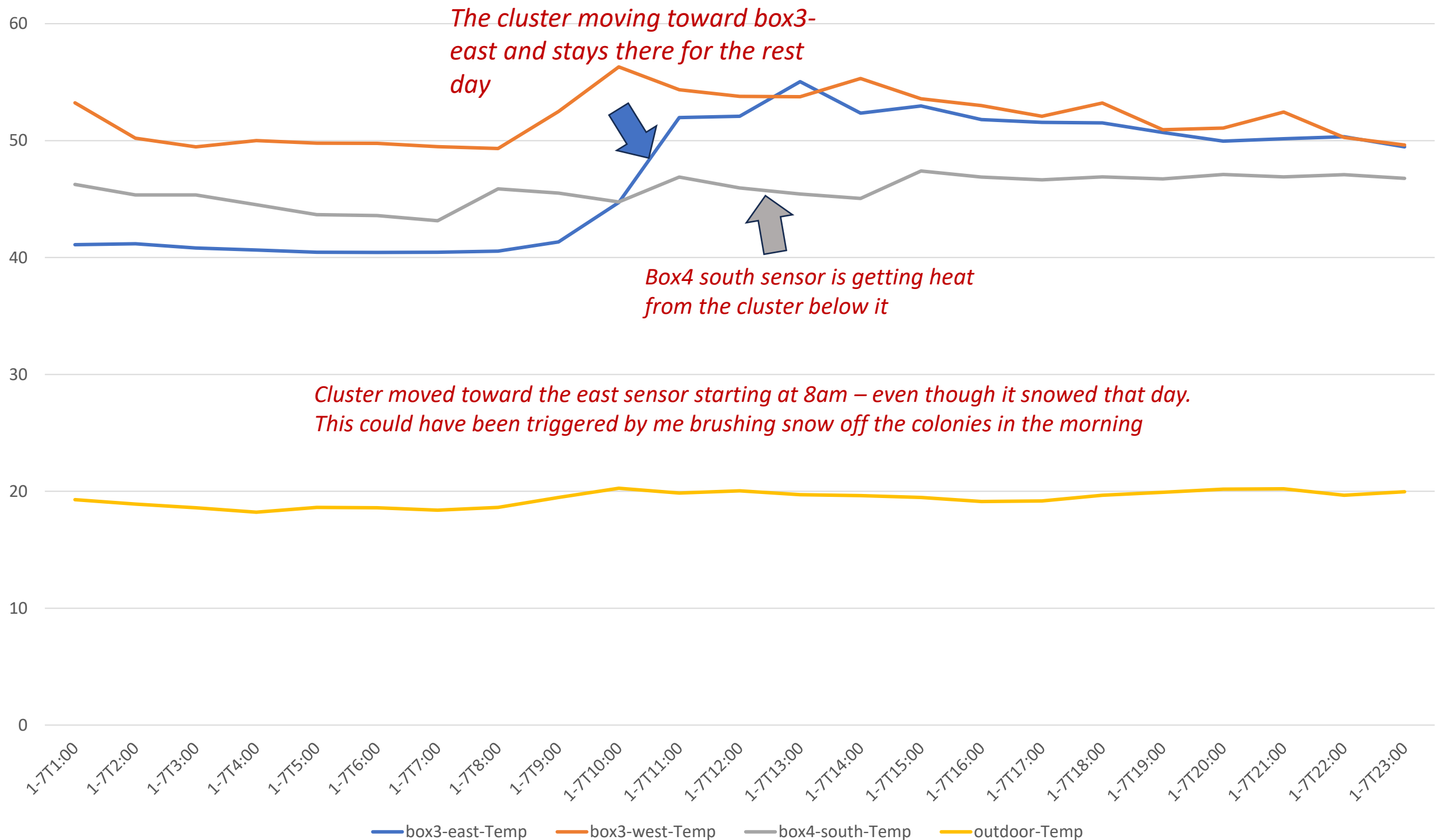


— box2-south-vpd  
 — box2-north-vpd  
 — box2-east-vpd  
 — box2-west-vpd  
 — box3-east-vpd  
— box3-west-vpd  
 — box4-south-vpd  
 — box4-north-vpd  
 — box4-east-vpd  
 — box4-west-vpd

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

January 7 at 8am

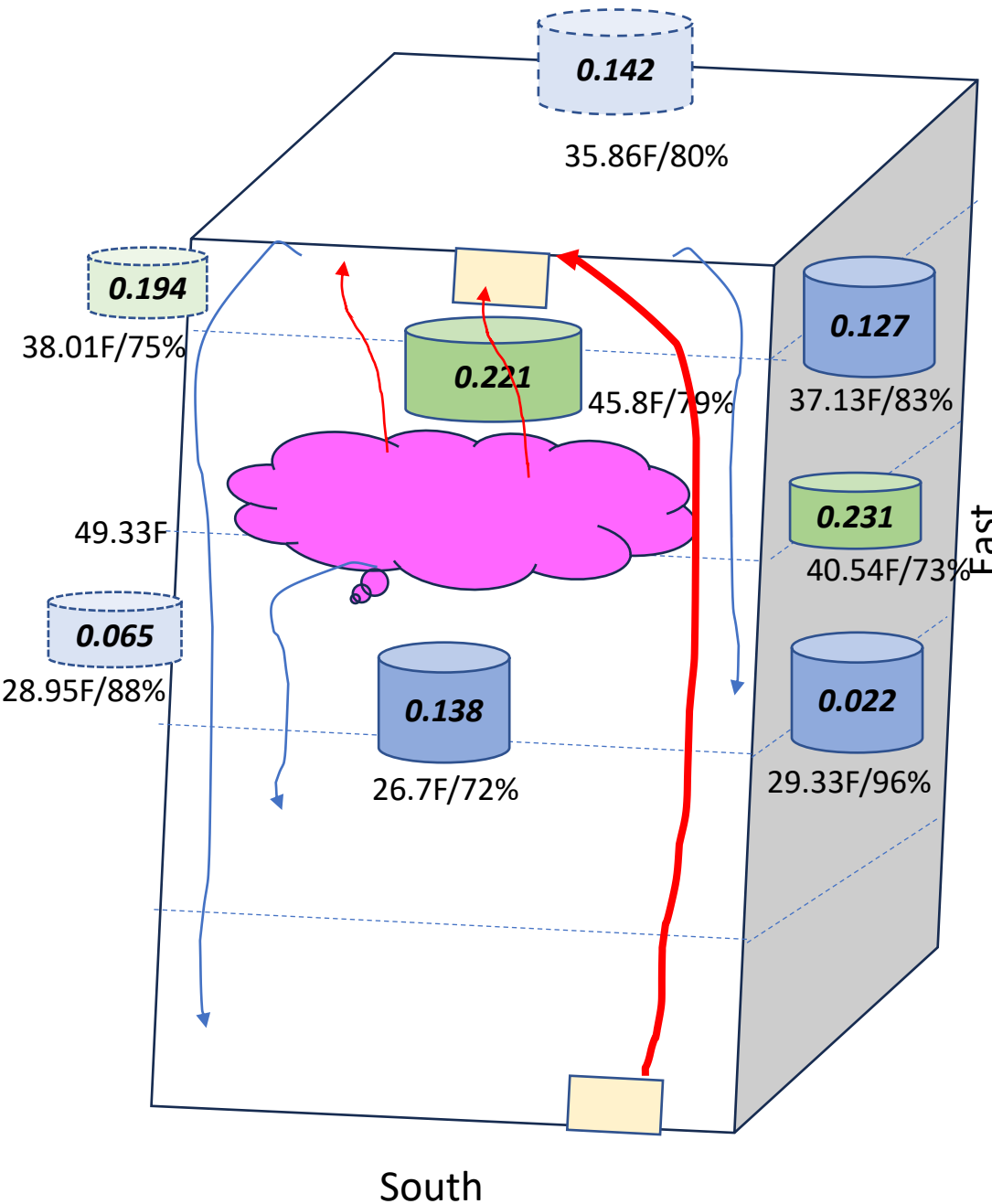
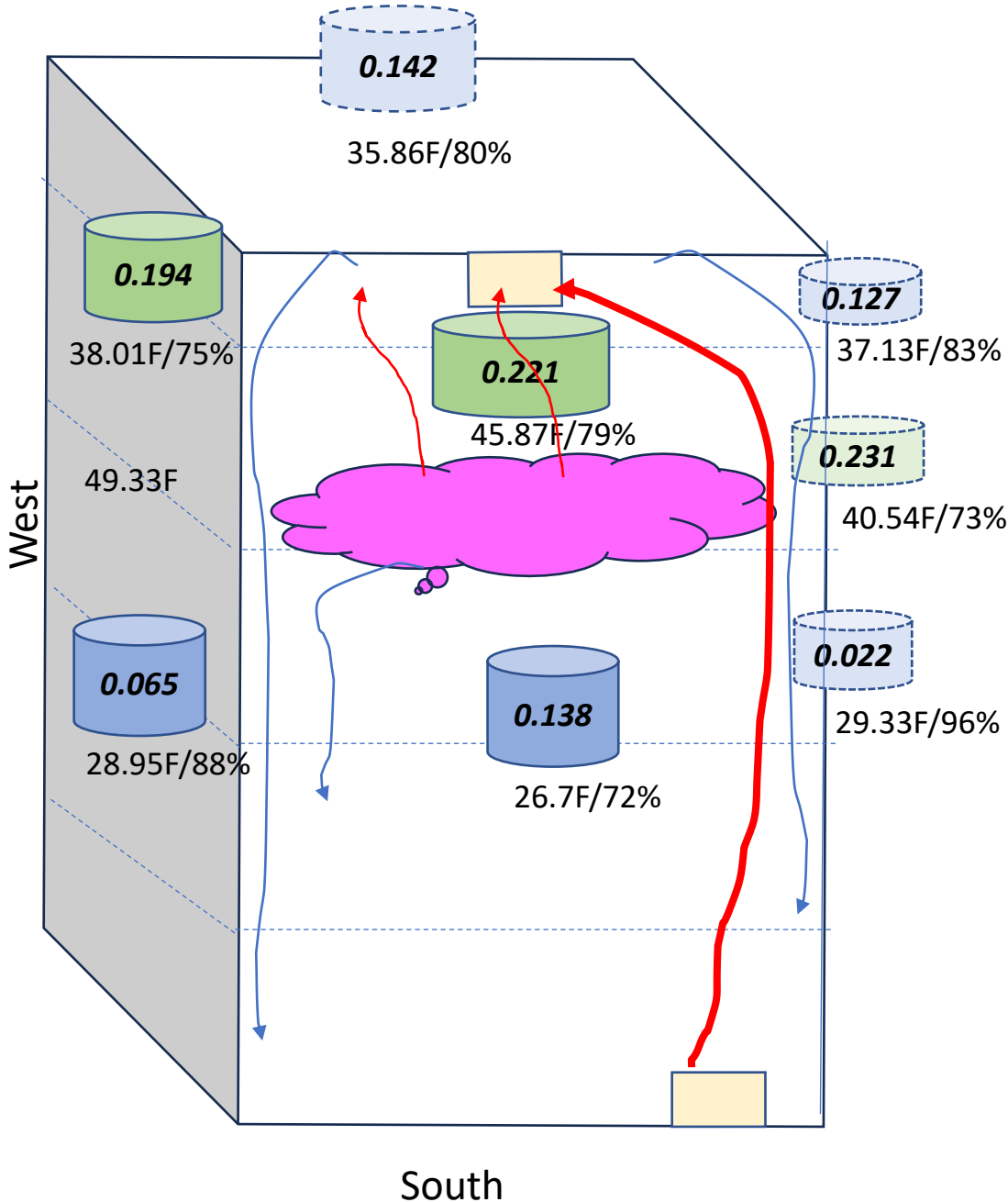
# A closer look at the bees move on 1/7



Note the 10F+ change in Box3-east - this is caused by the cluster moving - it then settles between box3-east & west  
 Box4-south sensor is getting heat pulled from the cluster as air moves from the lower entrance to the top entrance

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

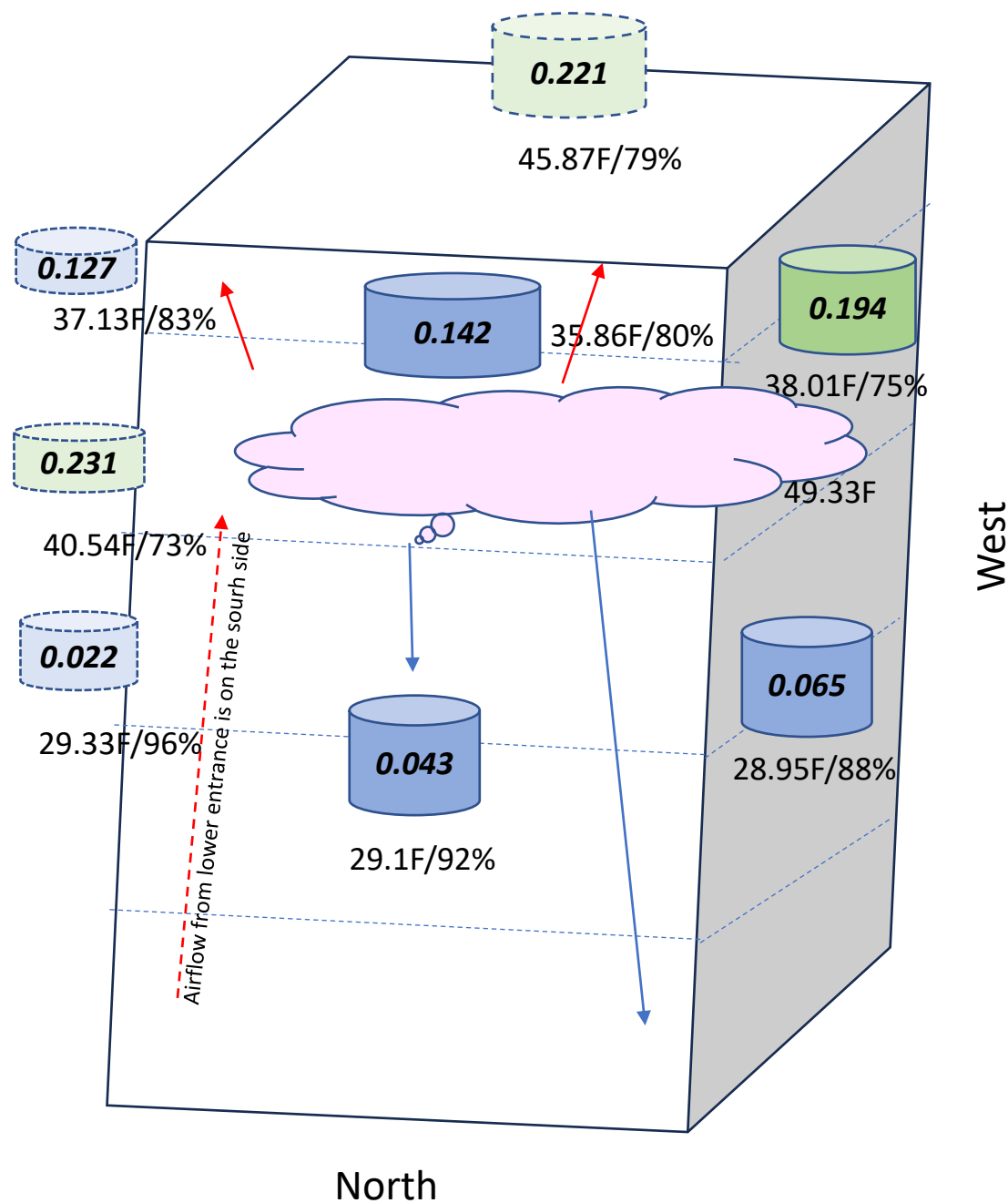
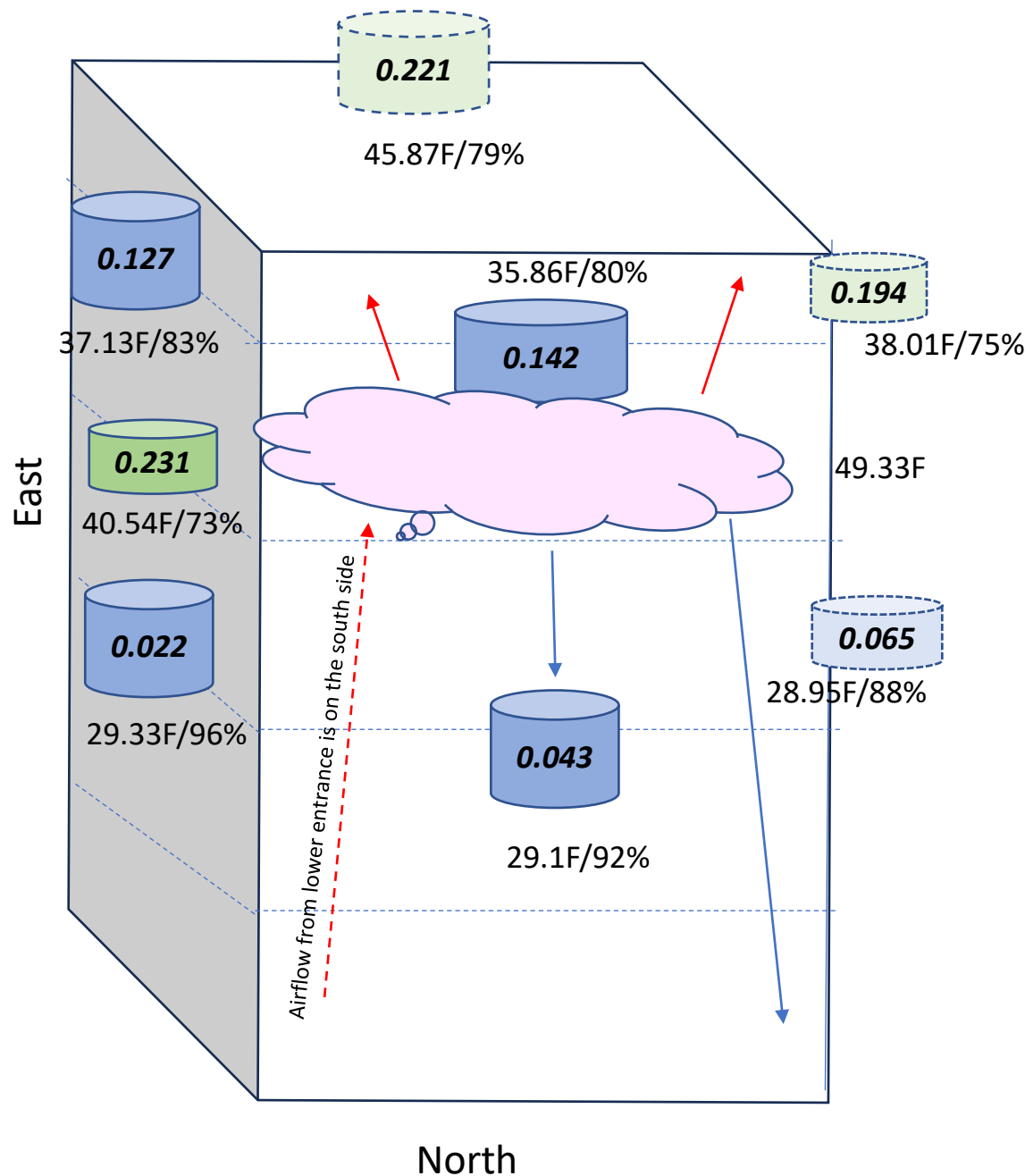
## View from SW & SE



1-7T8:00	box2-south	box2-north	box2-east	box2-west	box3-east	box3-west	box4-south	box4-north	box4-east	box4-west	outdoor
Temp (F)	26.67	29.1	29.33	28.95	40.54	49.33	45.87	35.86	37.13	38.01	18.62
RH (%)	72	92	96	88	73		79	80	83	75	
VPD (g/m3)	0.14	0.04	0.02	0.06	0.23		0.22	0.14	0.13	0.19	

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

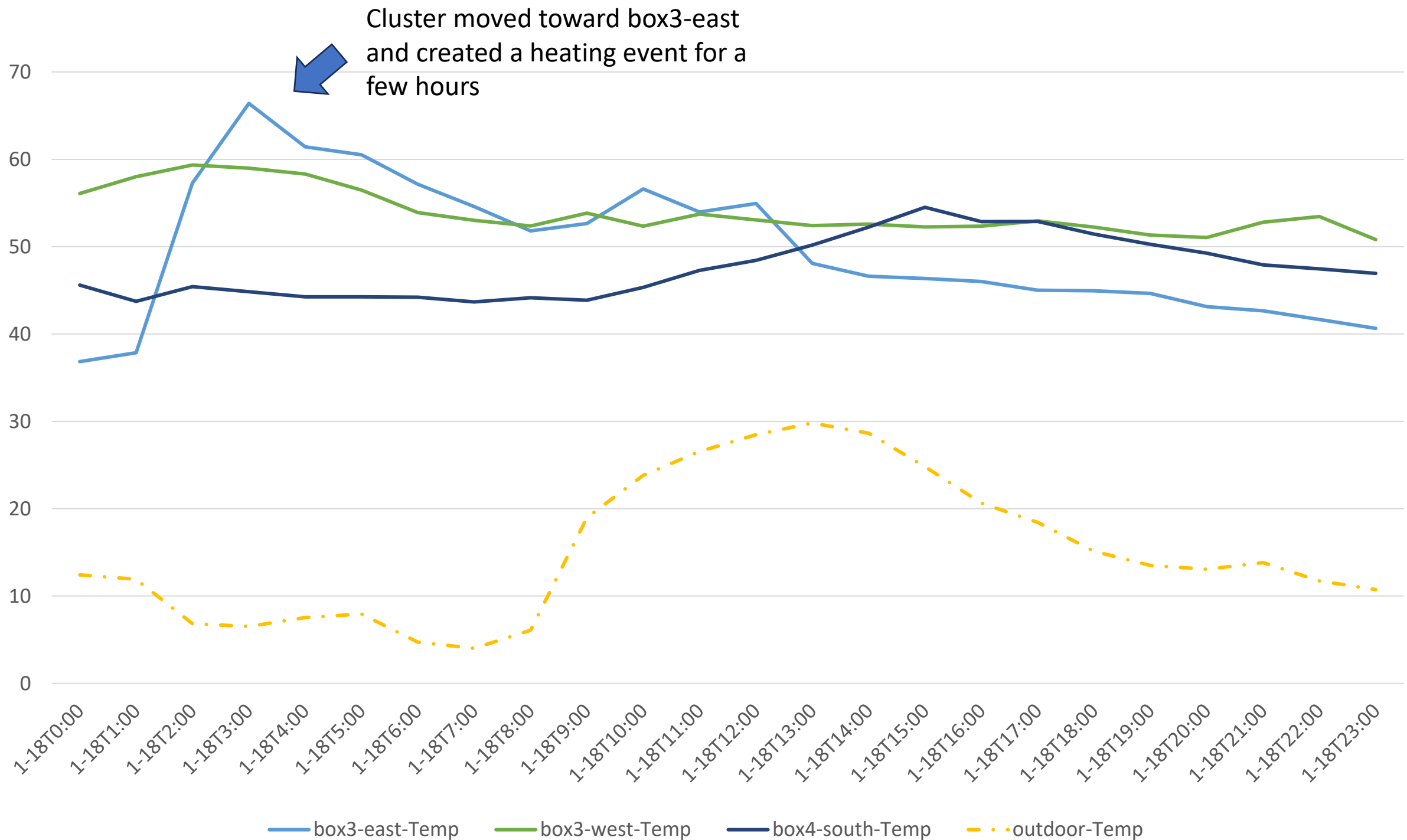
## View from NE & NW



1-7T8:00	box2-south	box2-north	box2-east	box2-west	box3-east	box3-west	box4-south	box4-north	box4-east	box4-west	outdoor
Temp (F)	26.67	29.1	29.33	28.95	40.54	49.33	45.87	35.86	37.13	38.01	18.62
RH (%)	72	92	96	88	73		79	80	83	75	
VPD (g/m3)	0.14	0.04	0.02	0.06	0.23		0.22	0.14	0.13	0.19	

January 18 at 7am  
During the bees heating event

# Jan 18 heating event.



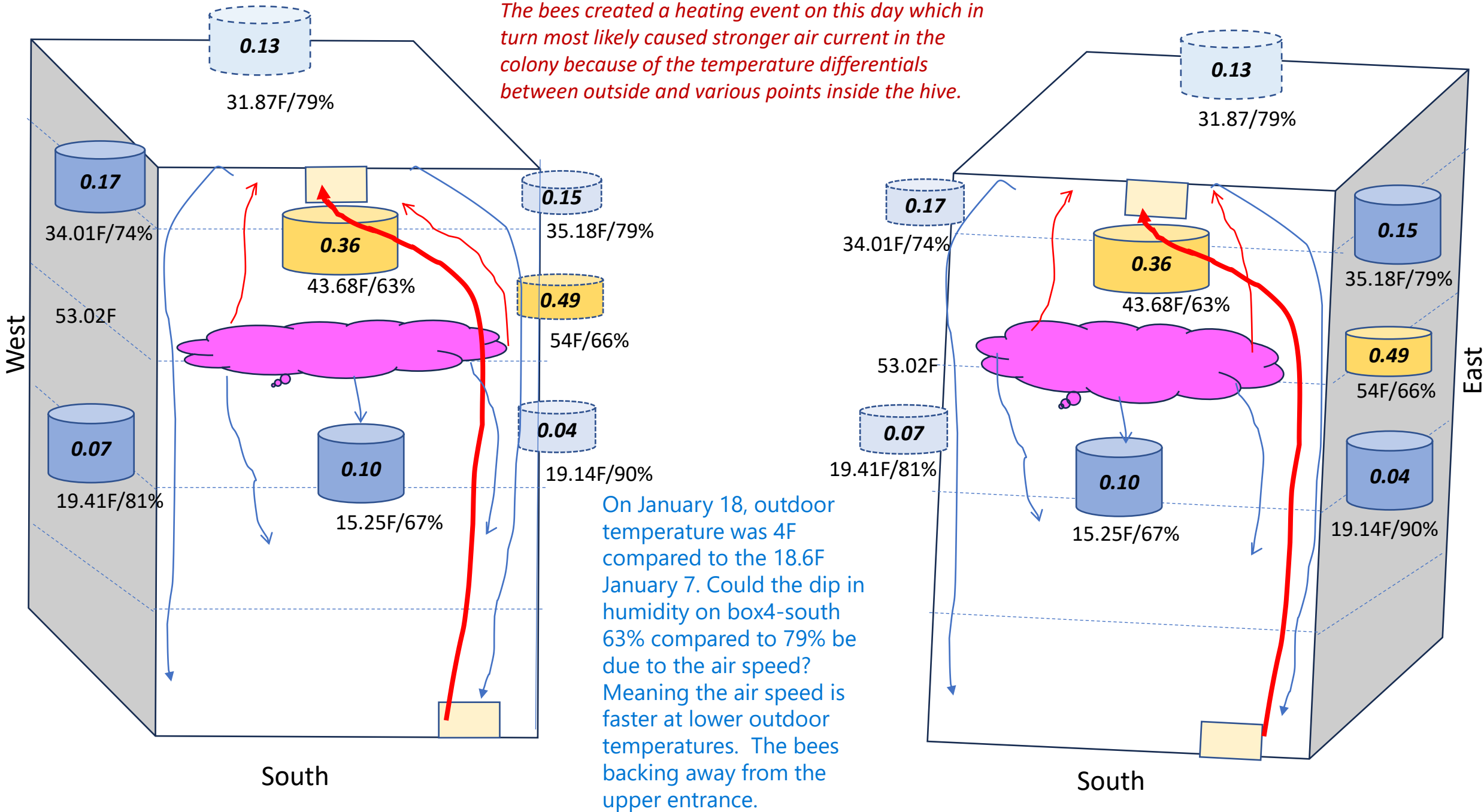
Note the 10F+ change in Box3-east - this is caused by the cluster moving - it then settles between box3-east & west  
Box4-south sensor is getting heat pulled from the cluster as air moves from the lower entrance to the top entrance



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

## View from SW & SE

*The bees created a heating event on this day which in turn most likely caused stronger air current in the colony because of the temperature differentials between outside and various points inside the hive.*



1-18T7:00	box2-south	box2-north	box2-east	box2-west	box3-east	box3-west	box4-south	box4-north	box4-east	box4-west	outdoor
Temp (F)	15.25	18.66	19.14	19.41	54.6	53.02	43.68	31.87	35.18	34.3	4
RH (%)	67	90	90	81	66		63	79	79	74	
VPD (g/m3)	0.10	0.04	0.04	0.07	0.49		0.36	0.13	0.15	0.17	