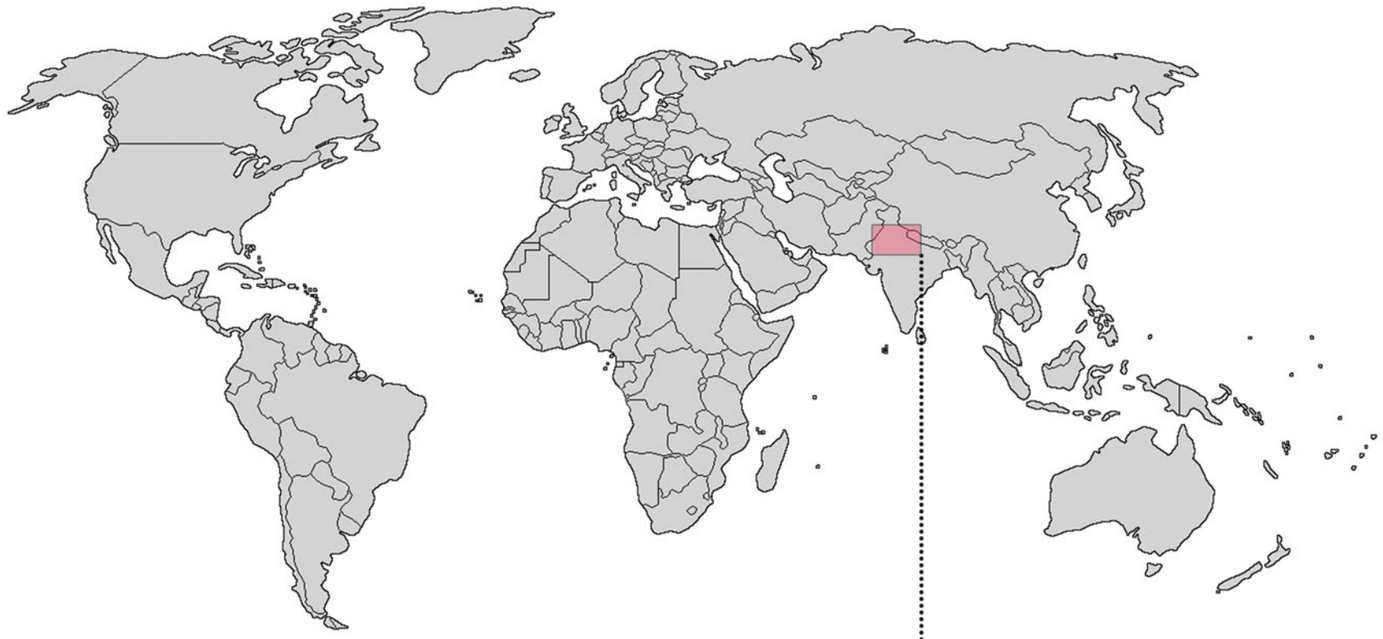
CLIMATE ANALYSIS OF DREAM ROOM

NEW DELHI

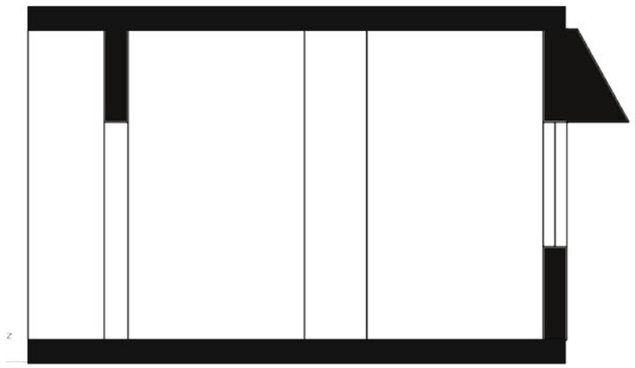


Latitude and longitude of new delhi
28.6139° N, 77.2090° E

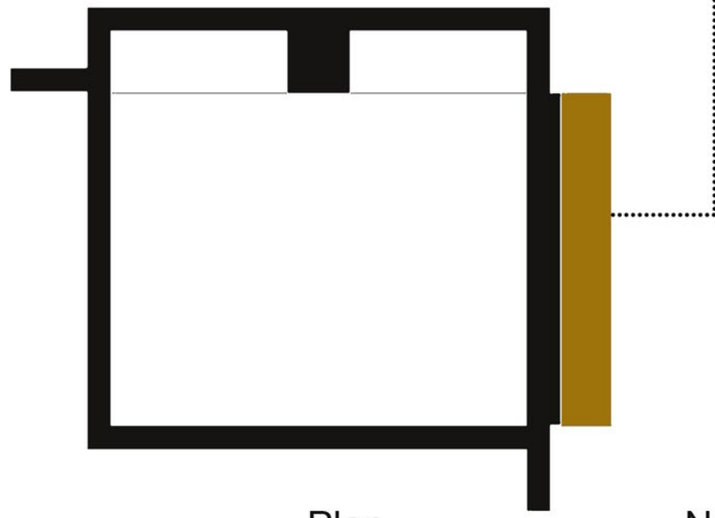
Area of the room : 14 sq.m

Windows are facing south east

New Delhi



Section



Plan

N

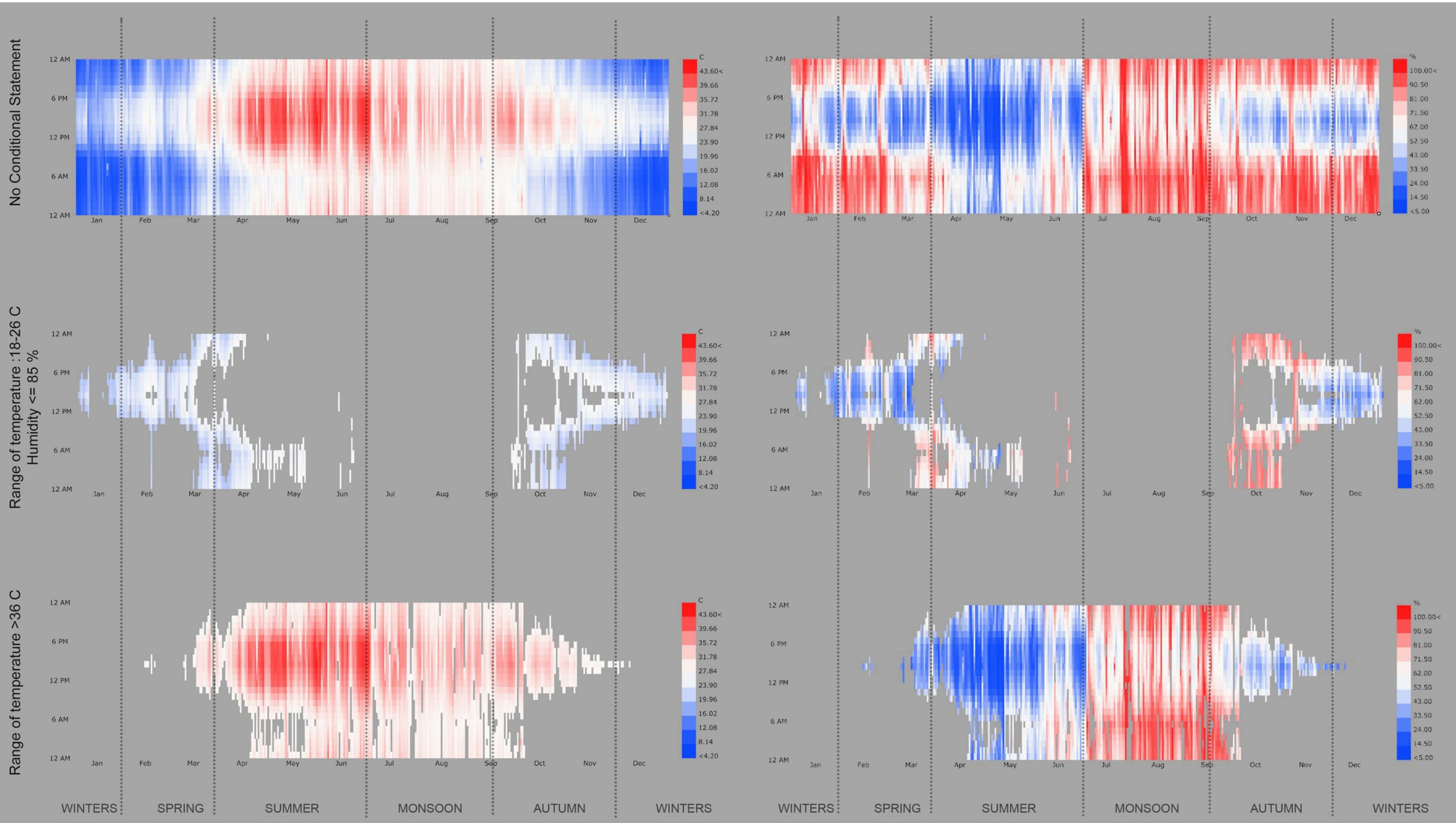
Naman Gupta | Fall 2017
University of Pennsylvania
Arch 753
Prof. Mostapha Sadeghipour

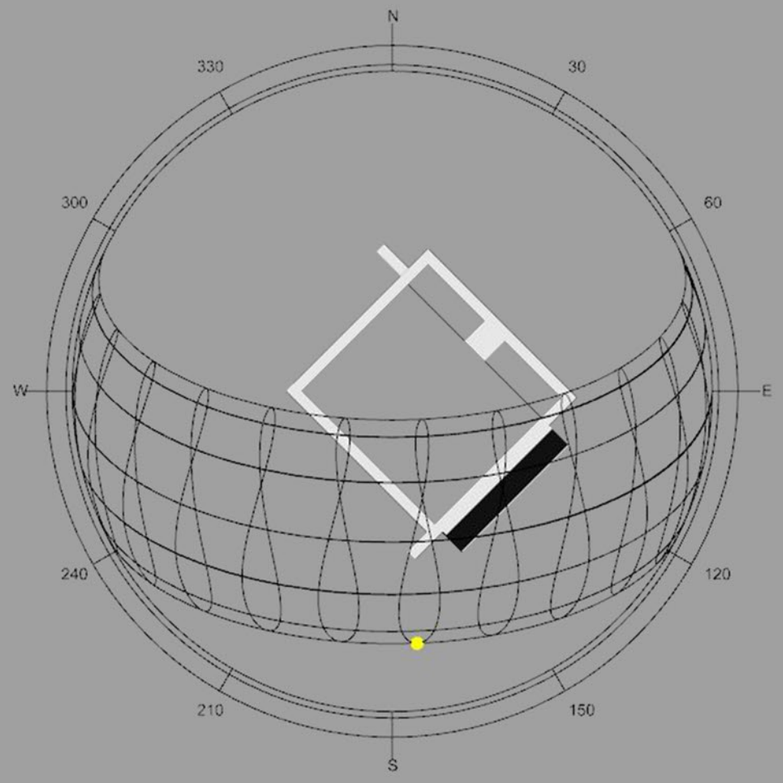
Dry Bulb Temperature

Temperature in Delhi ranges from 3 to 44 C
The comfortable range can be only obtained during the months: February to April and October to November.
The most uncomfortable and hottest months are April mid to summer.

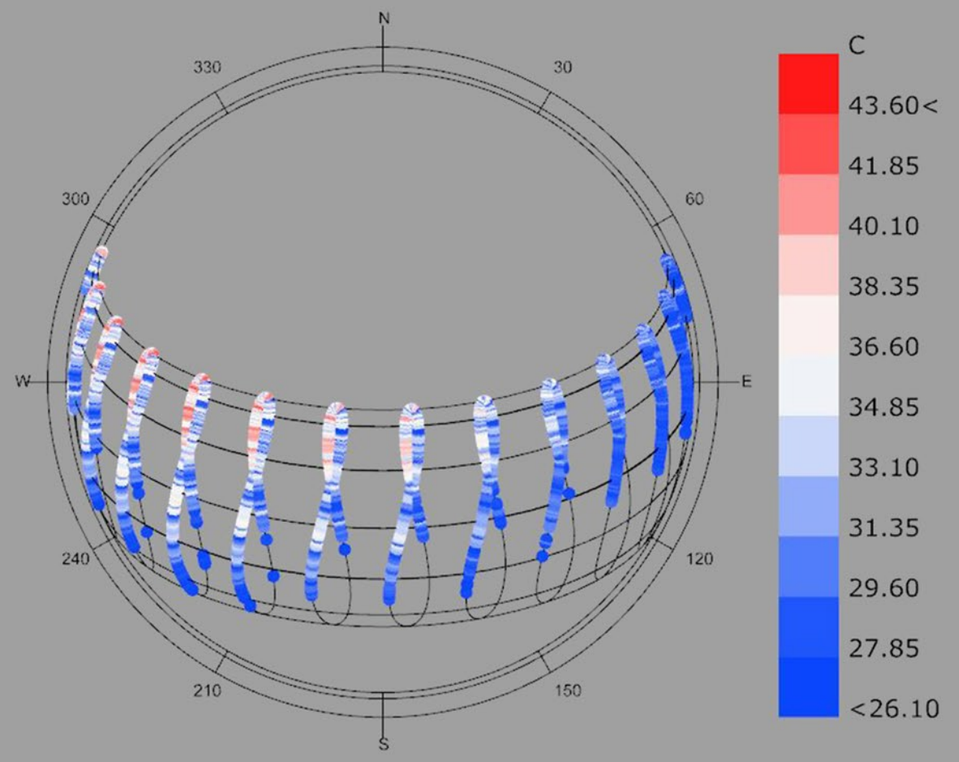
Relative Humidity

It ranges from 5 to 100 %
During the months February to April and September to November, we can use ventilation to cool the house. But during the hottest months, we need to avoid the direction of the wind.

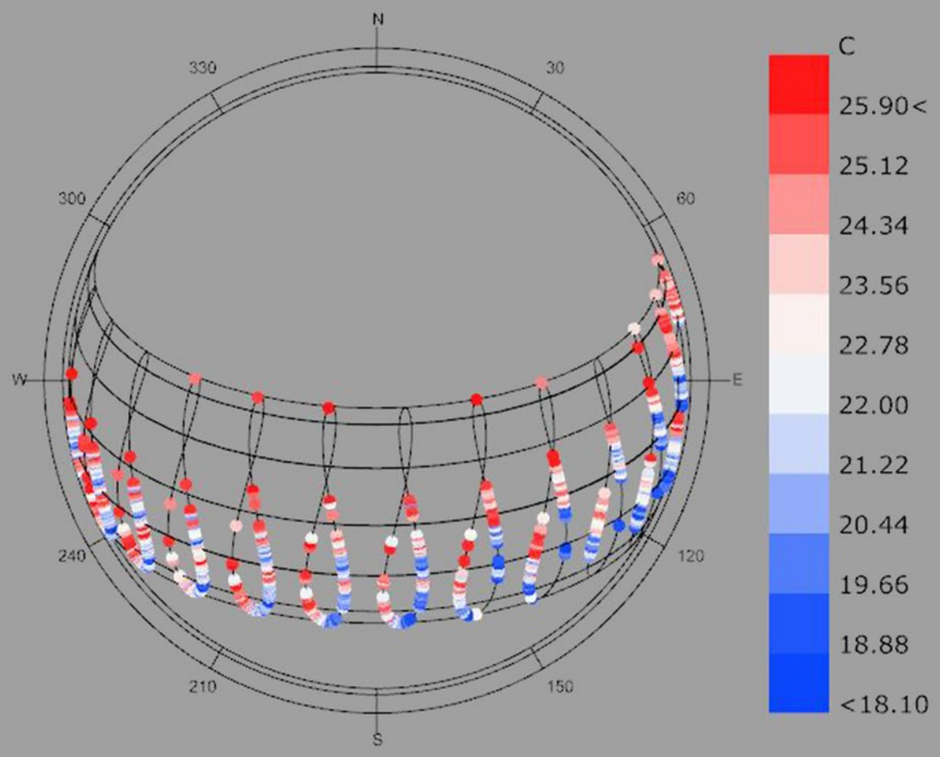




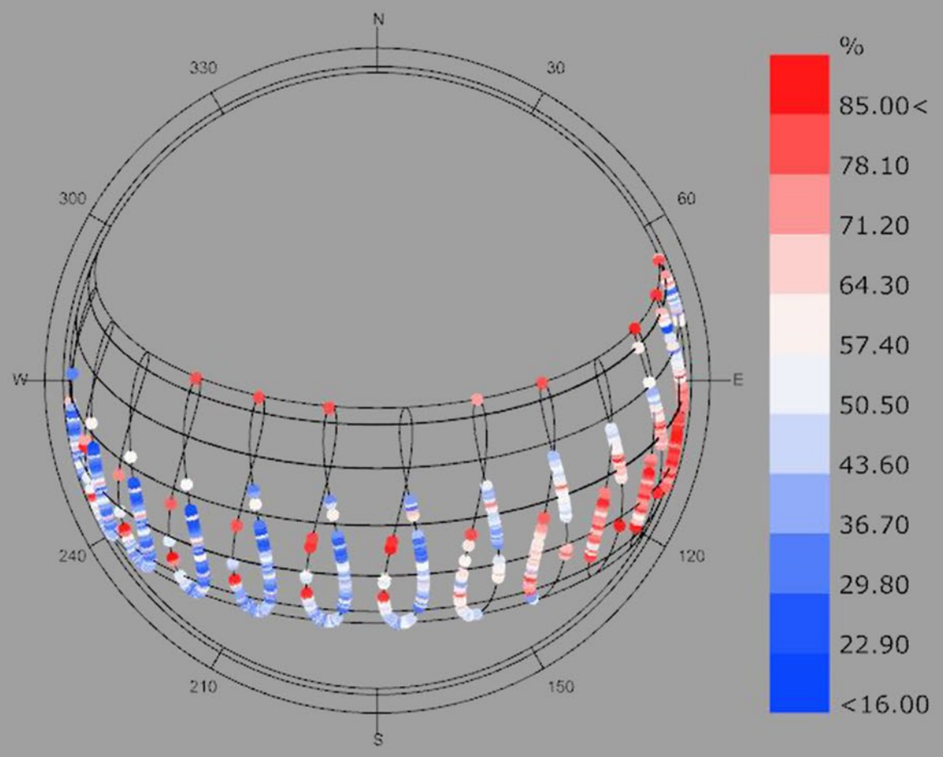
Sun path overlaid on the room



Sun Path when Dry Bulb Temperature : >26 C



Sun Path when Dry Bulb Temperature : 18-26 C

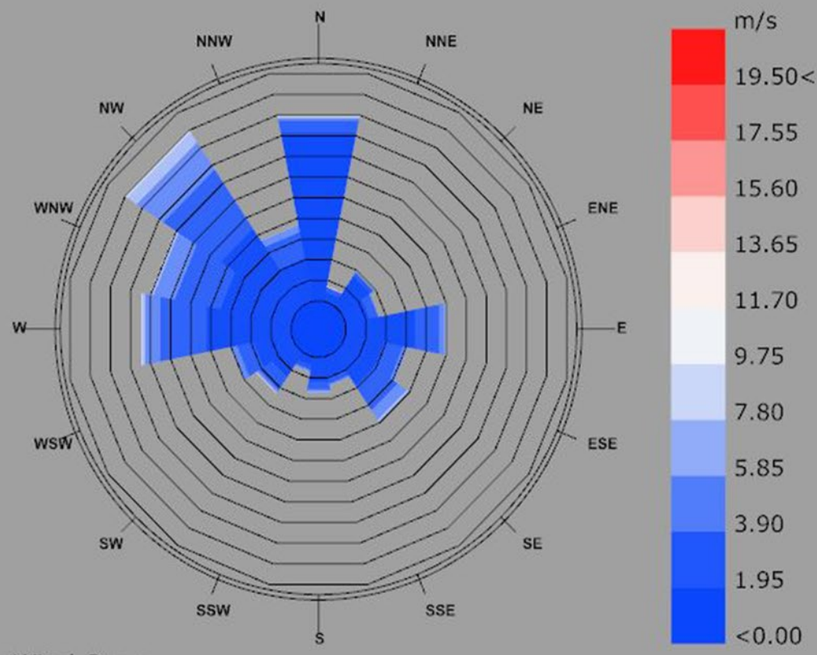


Sun Path when Relative Humidity <85%

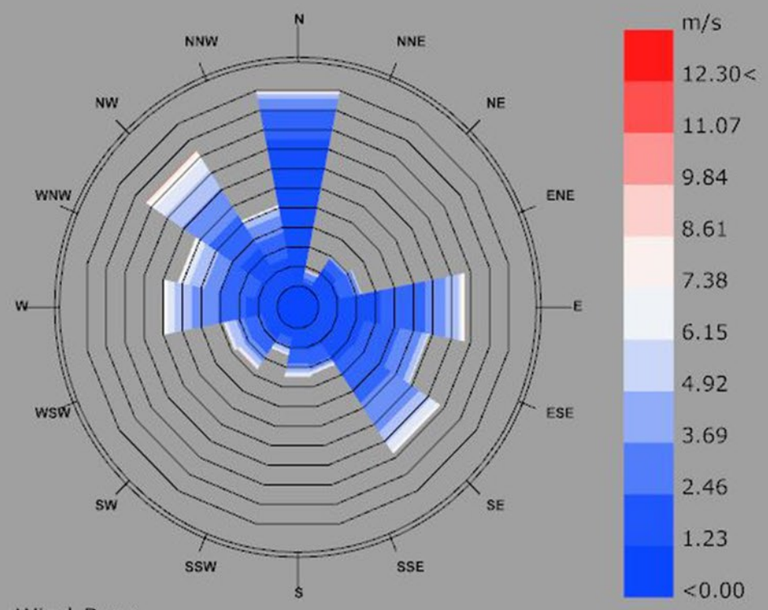
Sun Path

The sun path showed that during the hottest months, we get most sun after noon, we need to avoid the sun during that time in these months. Thus it has more radiation during this time.It is better to provide sun shade facilities to cool down the temperature of the room.

During the comfortable time period in the year, the required sunshine is more before noon, we can capture the sun radiation before noon.



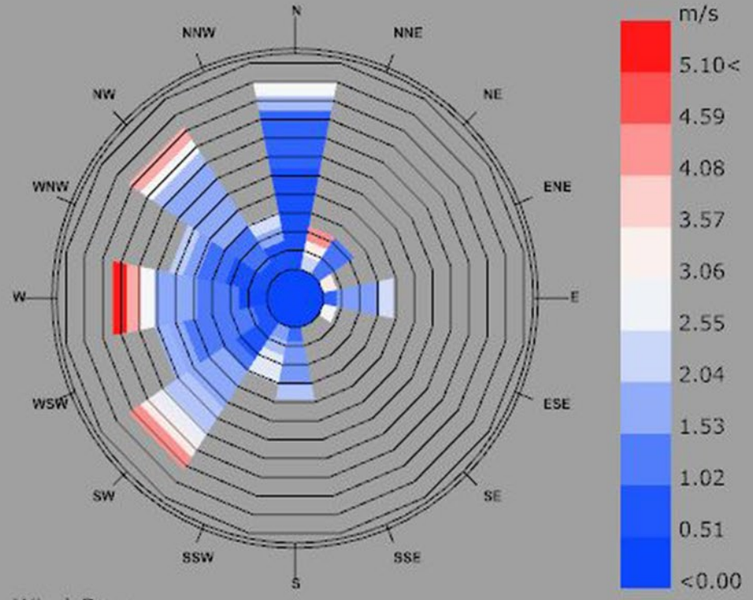
Wind-Rose
NEW DELHI_IND
1 JAN 1:00 - 31 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 25.67% of the time = 2249 hours.
Each closed polyline shows frequency of 1.2%. = 103 hours.



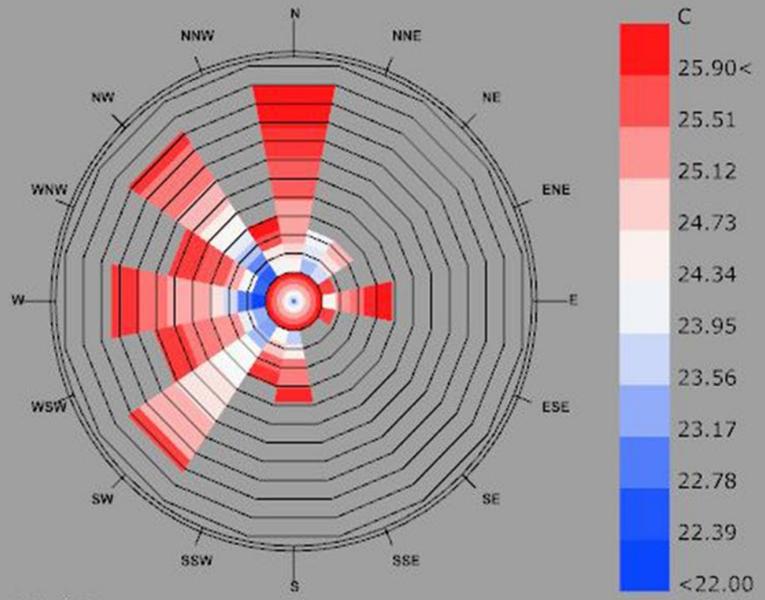
Wind-Rose
NEW DELHI_IND
1 MAY 1:00 - 30 SEP 24:00
Hourly Data: Wind Speed (m/s)
Calm for 19.25% of the time = 707 hours.
Each closed polyline shows frequency of 1.1%. = 41 hours.

Wind Rose Diagram

The predominant wind during the year is from the North and North West directions. During the hottest months, we also have winds from the Southeast and east Direction, these are the winds which we need to avoid. During the comfortable period of these months, we get winds from the direction of west and north. But the Windows of the room does not lie in this direction.



Wind-Rose
NEW DELHI_IND
1 MAY 1:00 - 30 SEP 24:00
Hourly Data: Wind Speed (m/s)
Calm for 0.87% of the time = 32 hours.
Each closed polyline shows frequency of 0.0%. = 1 hours.
... ...
Conditional Selection Applied:
18<Dry Bulb Temperature<26
and Relative Humidity<=85
121.0 hours of total 8760.0 hours (1.38%).
121.0 hours of analysis period 3672.0 hours (3.30%).



Wind-Rose
NEW DELHI_IND
1 MAY 1:00 - 30 SEP 24:00
Hourly Data: Dry Bulb Temperature (C)
Calm for 0.87% of the time = 32 hours.
Each closed polyline shows frequency of 0.0%. = 1 hours.
... ...
Conditional Selection Applied:
18<Dry Bulb Temperature<26
and Relative Humidity<=85
121.0 hours of total 8760.0 hours (1.38%).
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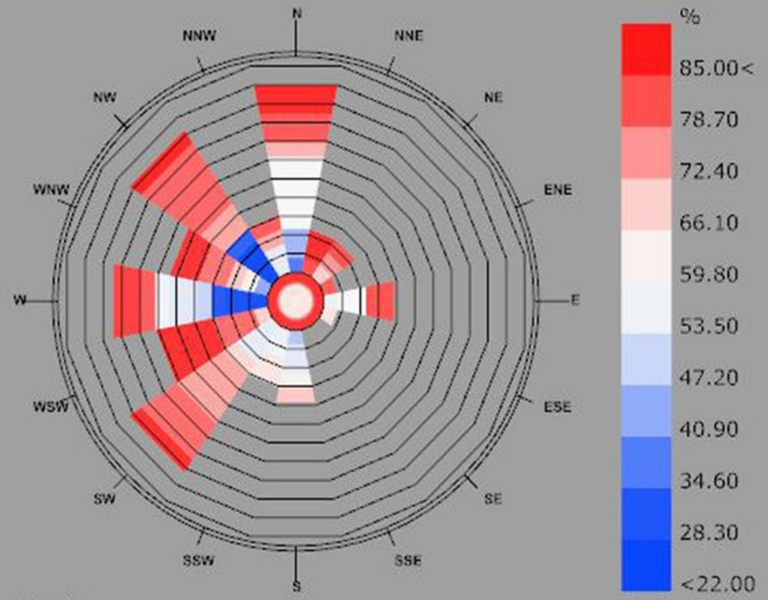

Wind-Rose
NEW DELHI_IND
1 MAY 1:00 - 30 SEP 24:00
Hourly Data: Relative Humidity (%)
Calm for 0.87% of the time = 32 hours.
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Conditional Selection Applied:
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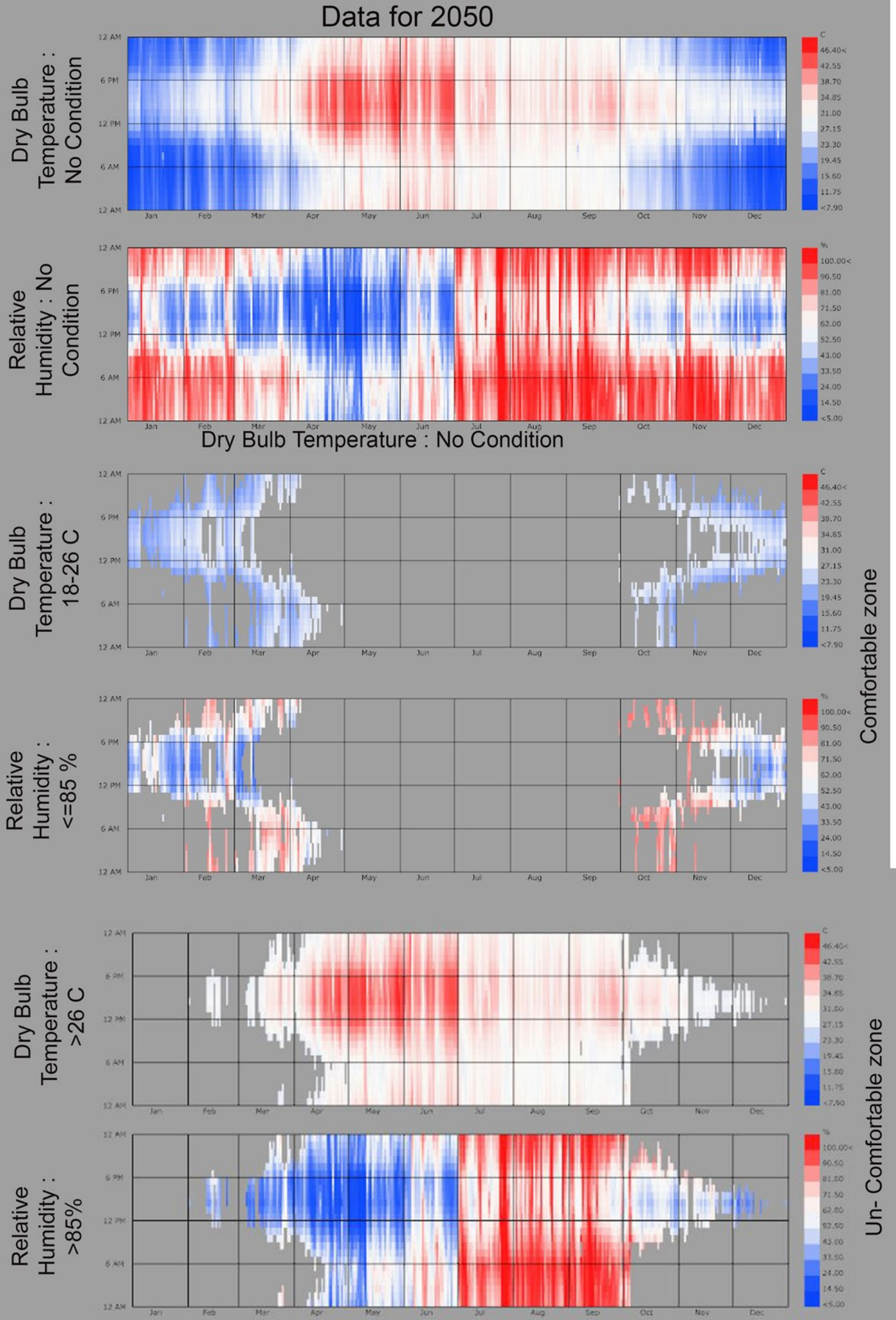


Recommendations

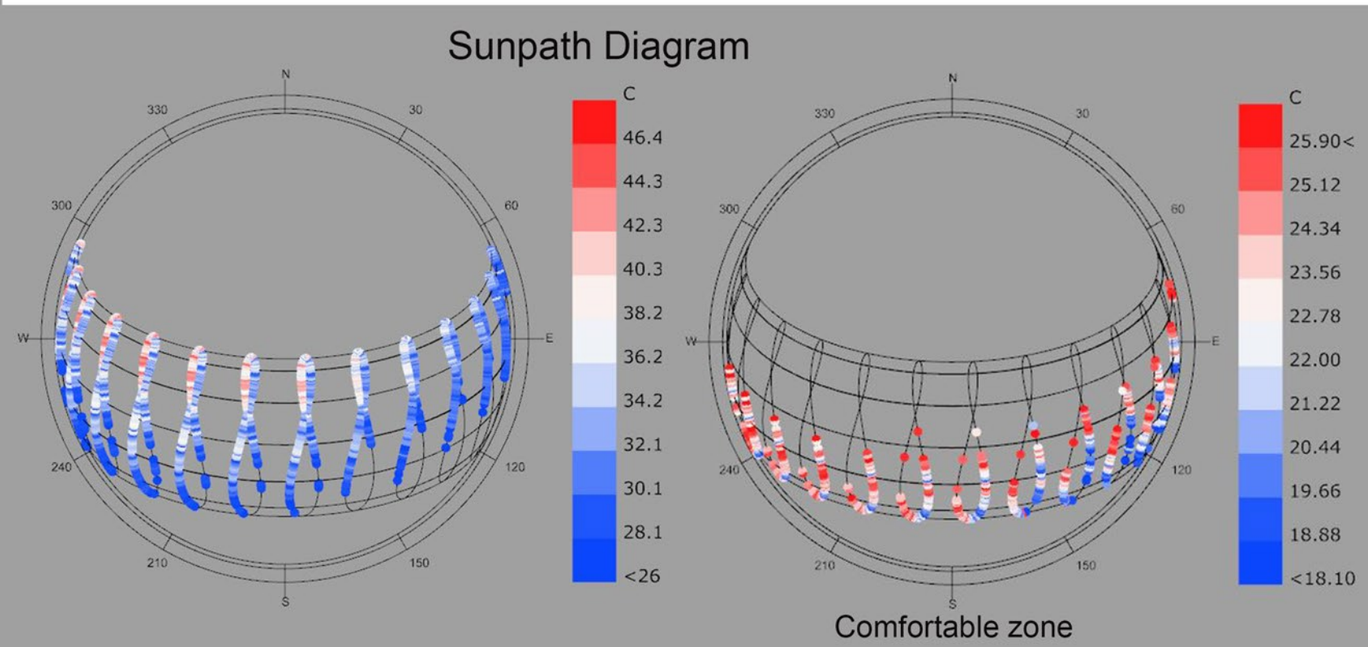
The three passive strategies to make the environment more comfortable can be :

1. To keep the windows open until noon to have fresh air inside the room and close these windows after noon to avoid hot air flowing from the direction of Southeast.
2. Provide vertical overhangs along with the horizontal overhangs to reduce the penetration of heat and also to use to smart glasses or reflective glasses instead of normal glass.
3. we can provide a strip of greenery along the windows so that it can provide shade and help air to cool down before entering.

Effect of Climate Change

(referred 2050 data)

The recommendation would be altered with the change in climate. we would need to keep windows closed before noon as well, to avoid solar heat gains. The length of hottest months would increase and we need some of these recommendations for longer time period (April to October) We need to provide shading to cover sun after 9 am. Also, we cannot provide water body in front of the window as humidity tend to increase in future.



Outdoor Comfort Model

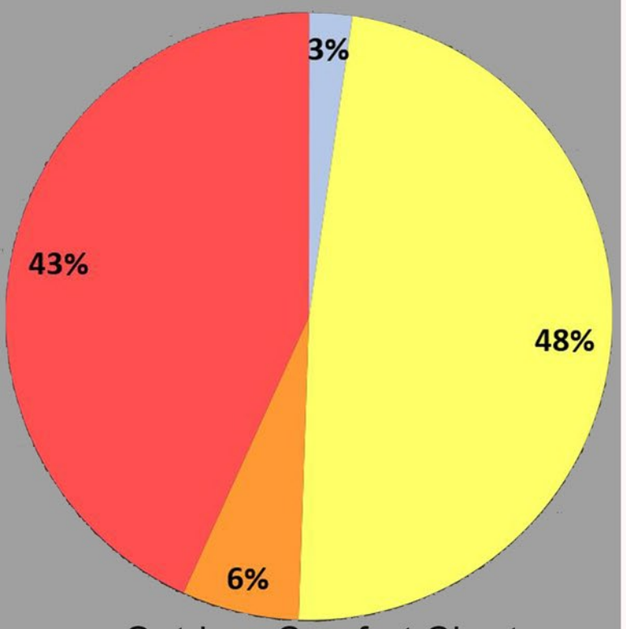
In Delhi,

48 % of the time of the year a person feels comfortable

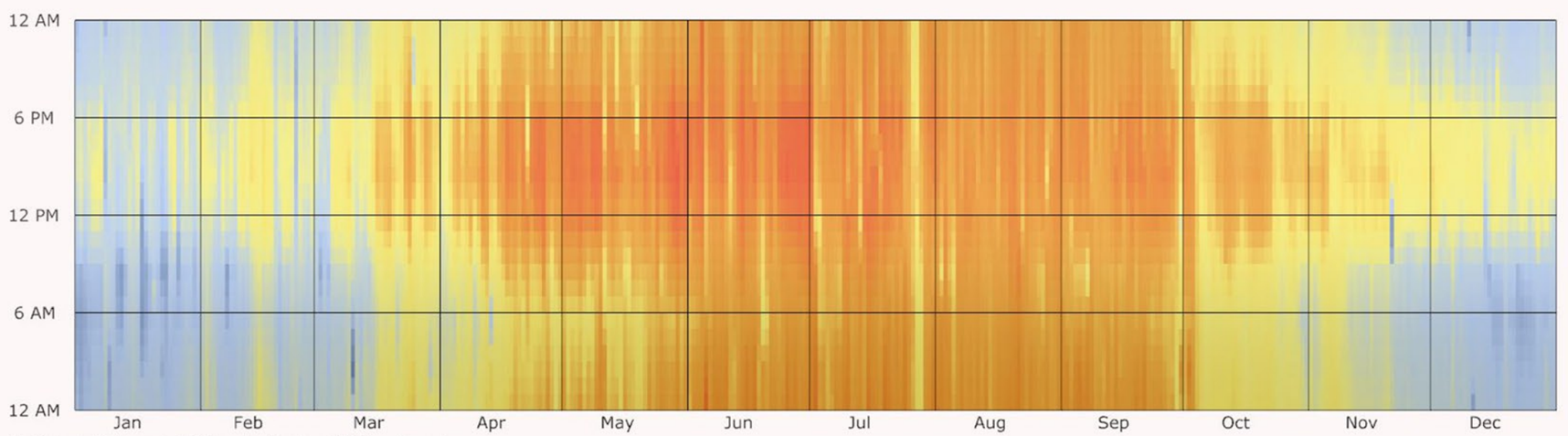
43 % of the time of the year, there is heat stress

There is no cold stress in Delhi

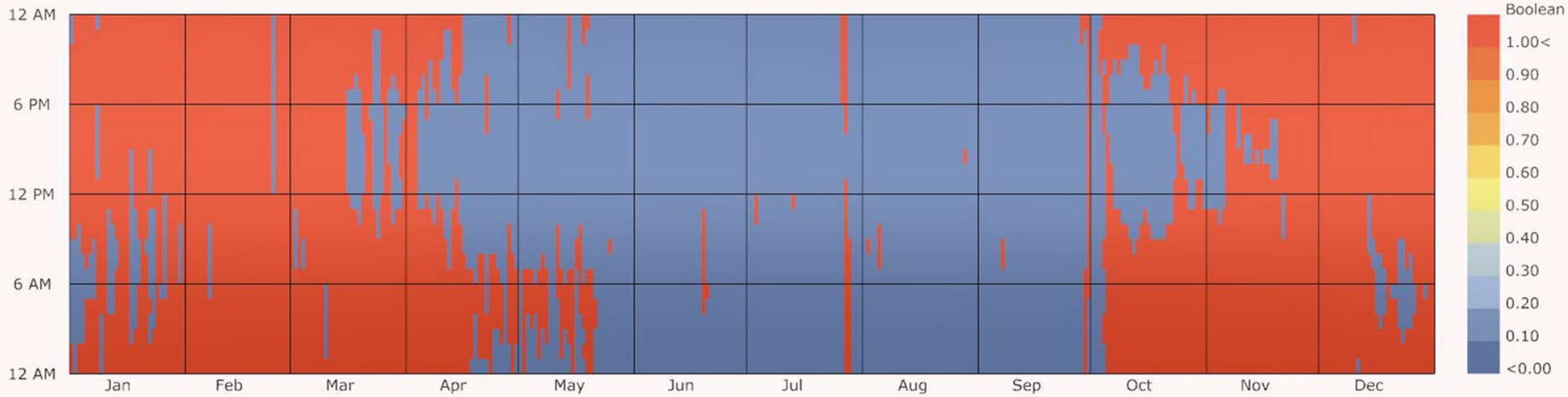
From 12 to 6 pm, there is more heat stress in Delhi, we need to come up with a strategy with which we can reduce the heat stress during these hours of the day



Outdoor Comfort Chart representing the percentage of various condition

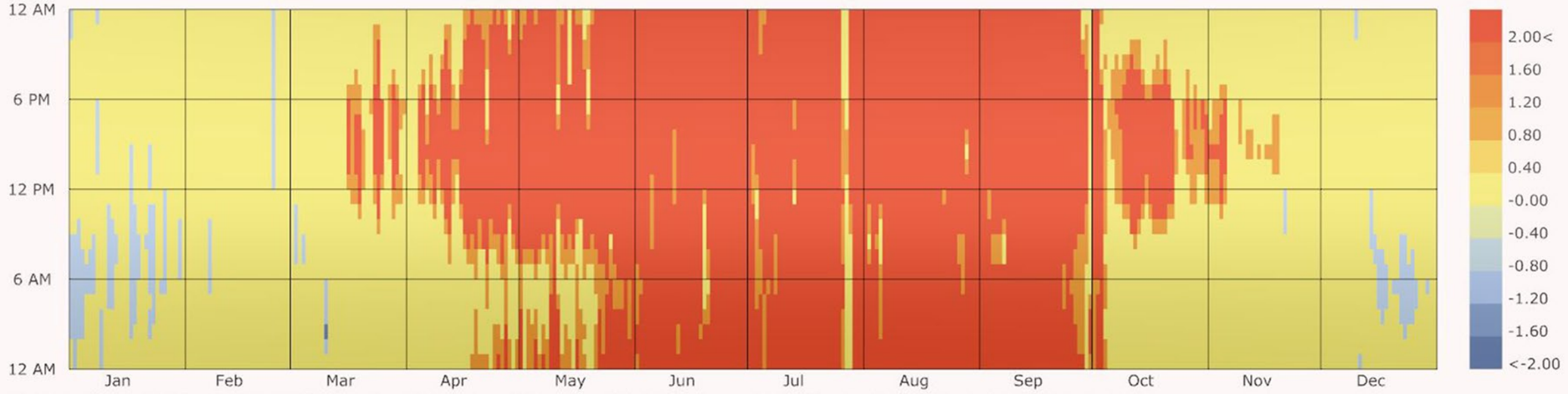


Universal Thermal Climate Index (°C) - Hourly
NEW DELHI_IND
1 JAN 1:00 - 31 DEC 24:00



Comfort or Not (Boolean Value) - Hourly
NEW DELHI_IND
1 JAN 1:00 - 31 DEC 24:00

-3 = Extreme Cold | -2 = Cold | -1 = Cool | 0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Heat



Outdoor Comfort (-3 = Extreme Cold | -2 = Cold | -1 = Cool | 0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Heat) - Hourly
NEW DELHI_IND
1 JAN 1:00 - 31 DEC 24:00

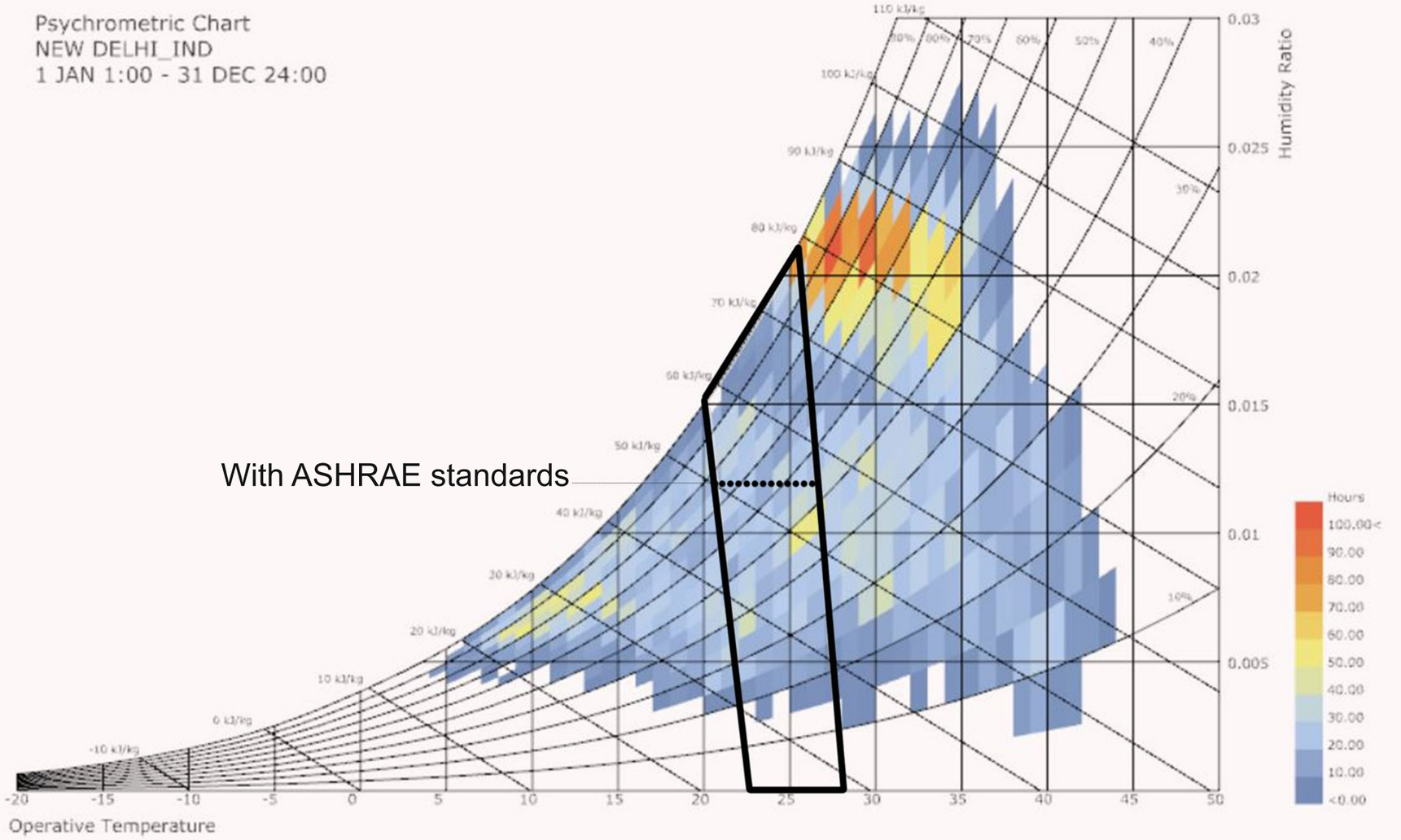
Comfort Model
Psychometeric Chart

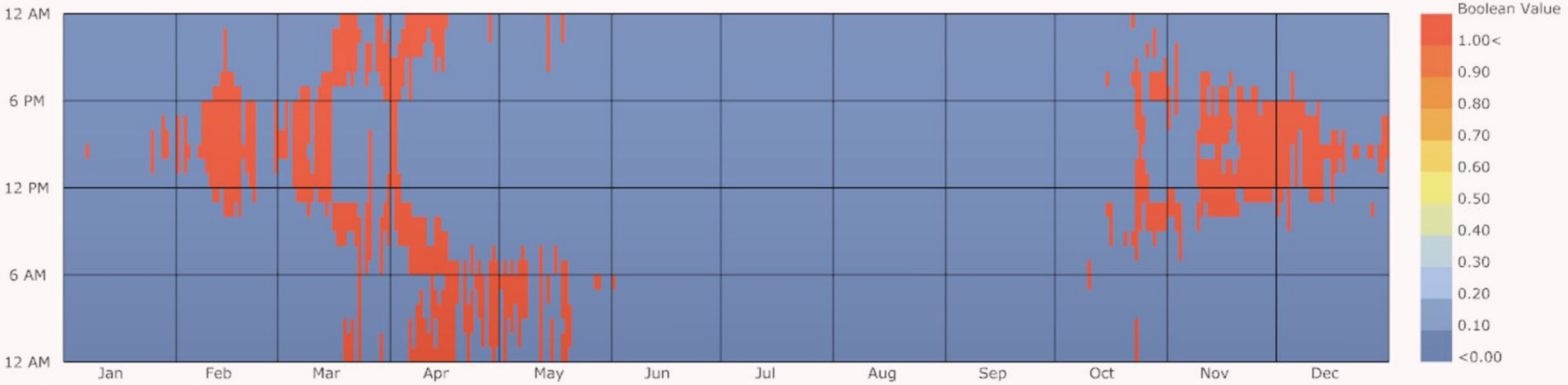
This model is generated when the clothing varies from .5 to 1.

During this time in Delhi,12 % of the time of the year a person feels comfortable

Because of high heat stress, one is not comfortable throughout the summers.

During the months of Feburary to May and from october to December, a person feels comfortable at some times.





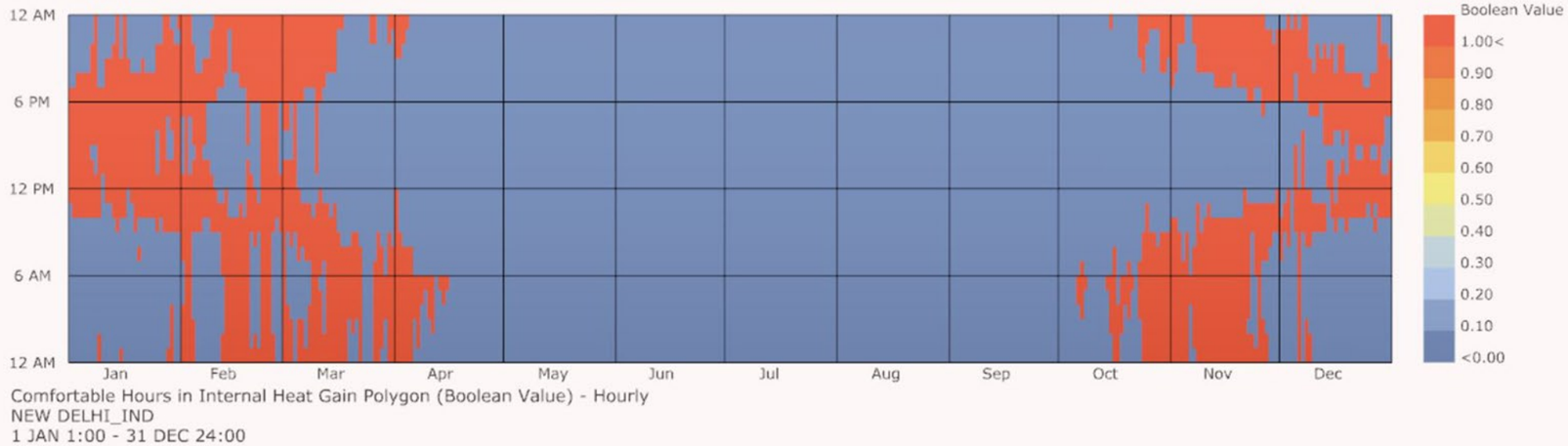
Comfortable Hours in All Polygons (Boolean Value) - Hourly
NEW DELHI_IND
1 JAN 1:00 - 31 DEC 24:00

Comfort Model with passive strategies

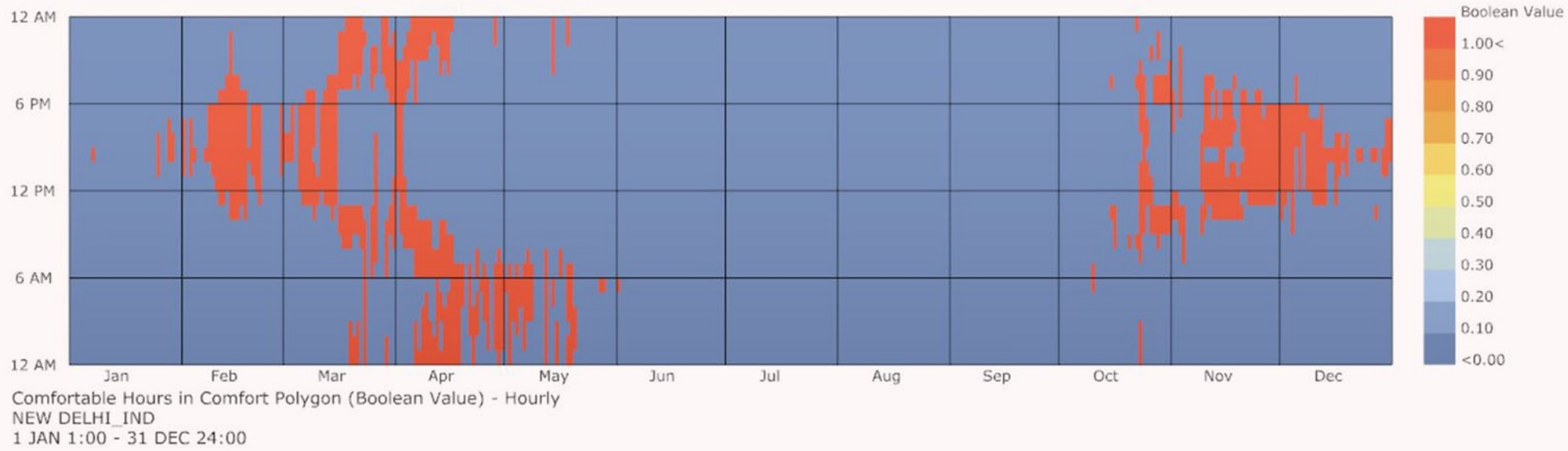
Psychometeric Chart

This model is generated with some passive strategies and they have different impact creating comfort -
Clothing :11.1%
Evaporative Cooling : 8.7%
Thermal Mass : 4.4%
Occupant use of Fan : 6.0%
Internal heat Gain : 22.2
Dessicant Dehumidification : 2.4%
Dehumidification : 6.8%

Internal heat Gain proves to be the best passive strategies in this climate
Dehumidification works somtimes during summer season to create comfort .



Maximum comfort with internal heat gain



Comfort with clothing

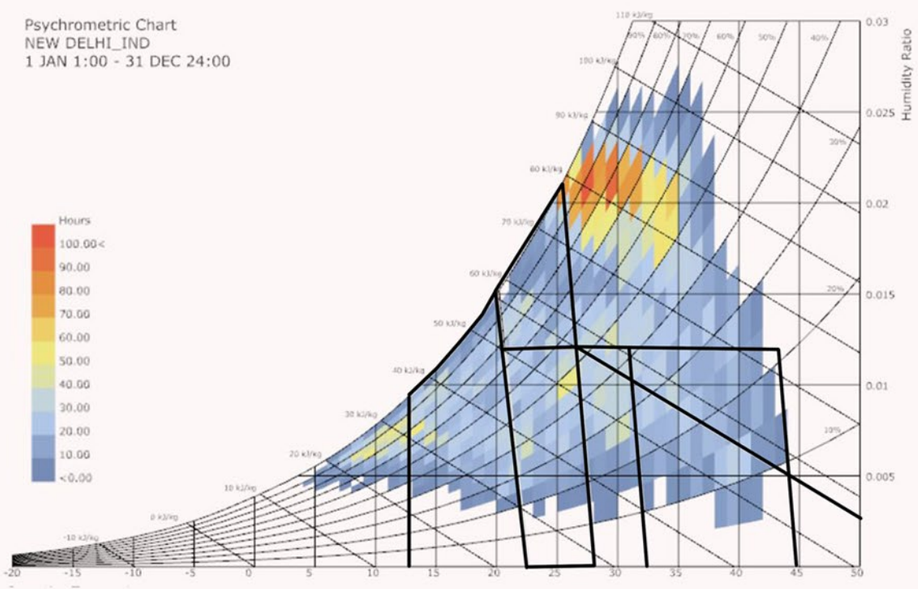
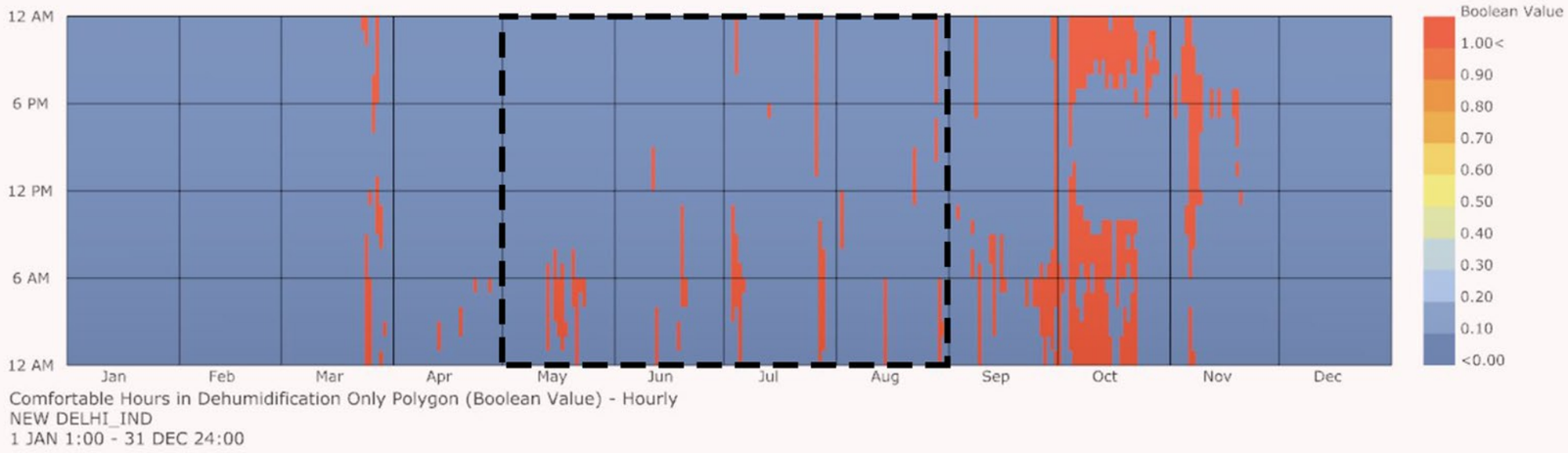


Chart with strategies



Comfort with dehumidifcation during summers

Question 2.

50% of the timte it is comfortable and 50% of time it is not comfortable in Delhi