ARCH 753 Building Performance Simulation
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Assignment 2
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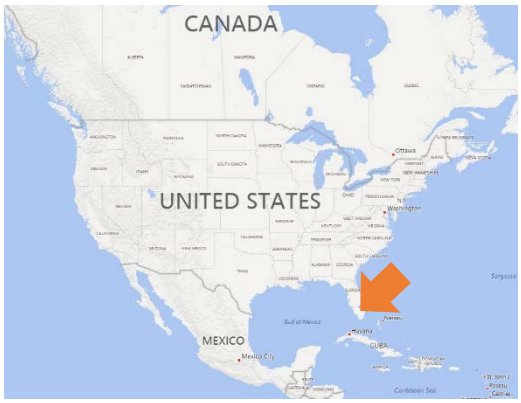
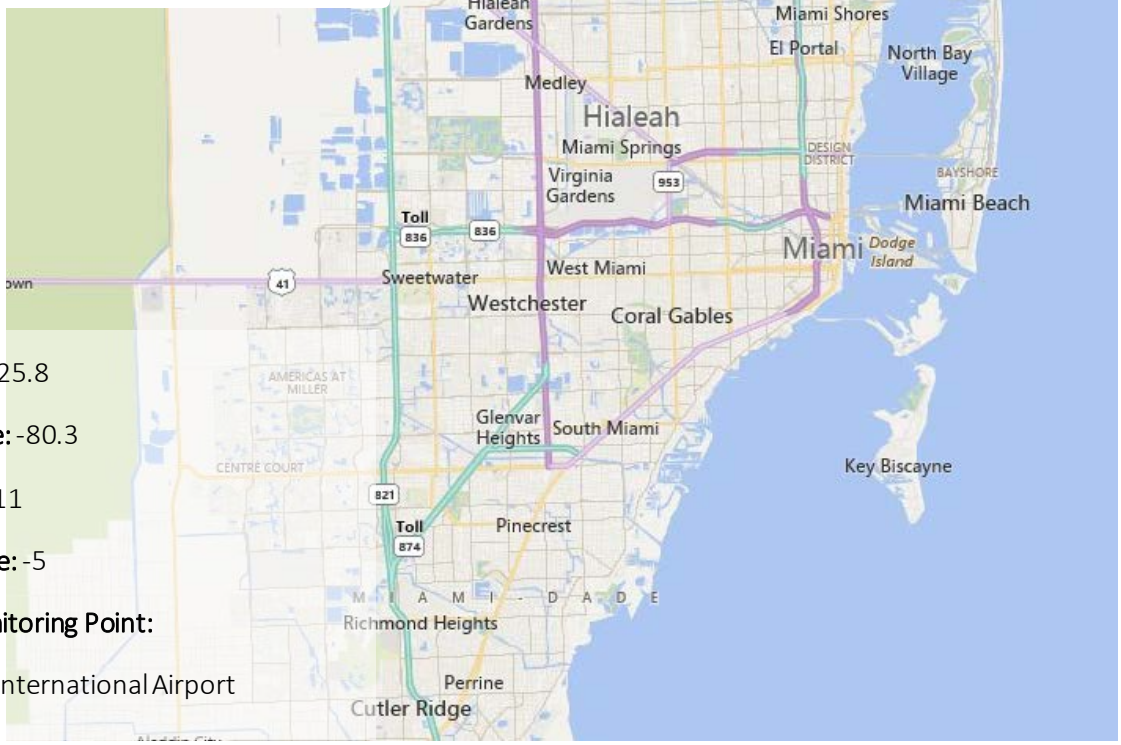
# Climate Analysis Report- Miami

## Location Information:




**Latitude:** 25.8

**Longitude:** -80.3

**Altitude:** 11

**Time Zone:** -5

**Data Monitoring Point:**

Miami International Airport

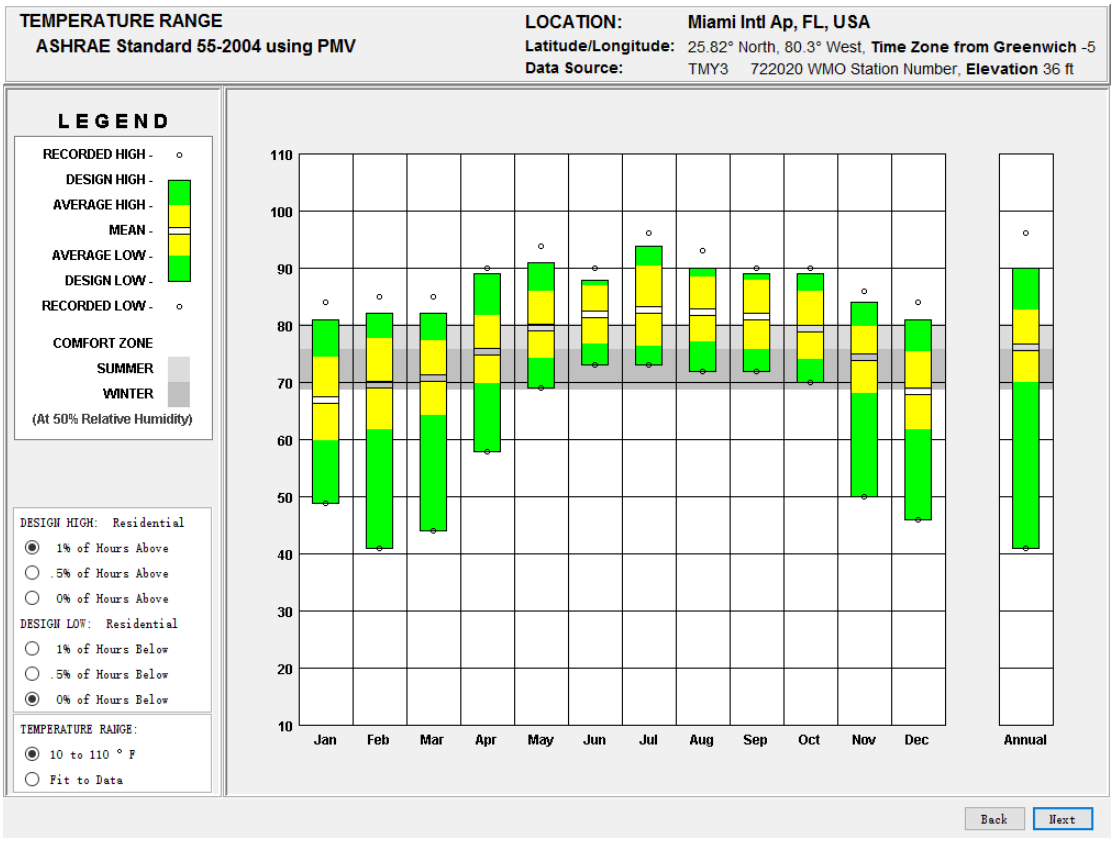
## Location:

From the maps shown above, Miami is very close to tropical area, in which generally has a hot and humid summer, and a short warm winter. Miami is facing Atlantic Ocean on the east, which would bring considerable moisture from east during summer.

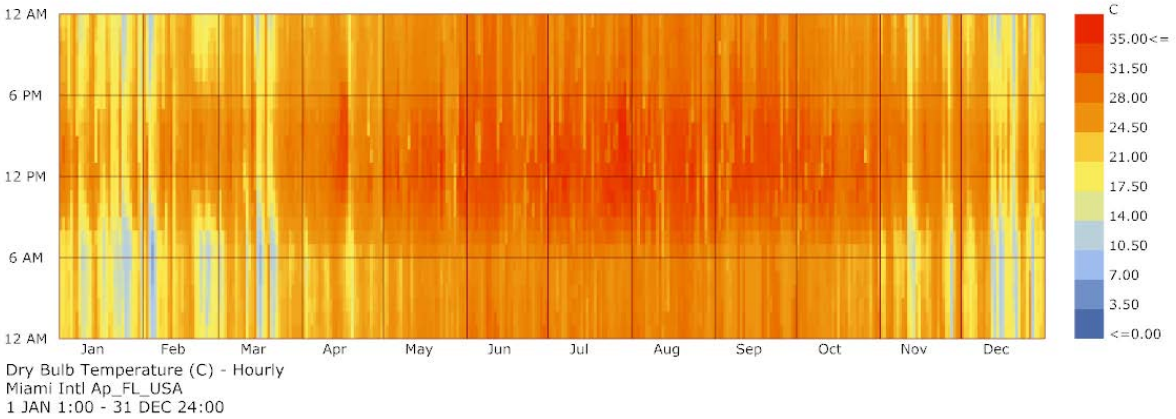
## Temperature Range:

Summer time in Miami, monthly average temperature reaches 80 degrees Fahrenheit, and average high temperature reaches 90 degrees Fahrenheit. Average temperatures of winter time are around 68 degrees Fahrenheit, which is generally comfortable in terms of air temperature.

By looking at temperature from 9 am to 5 pm (office hour) from temperature hourly range chart, cooling strategy is needed from May to October.




Temperature Range Chart

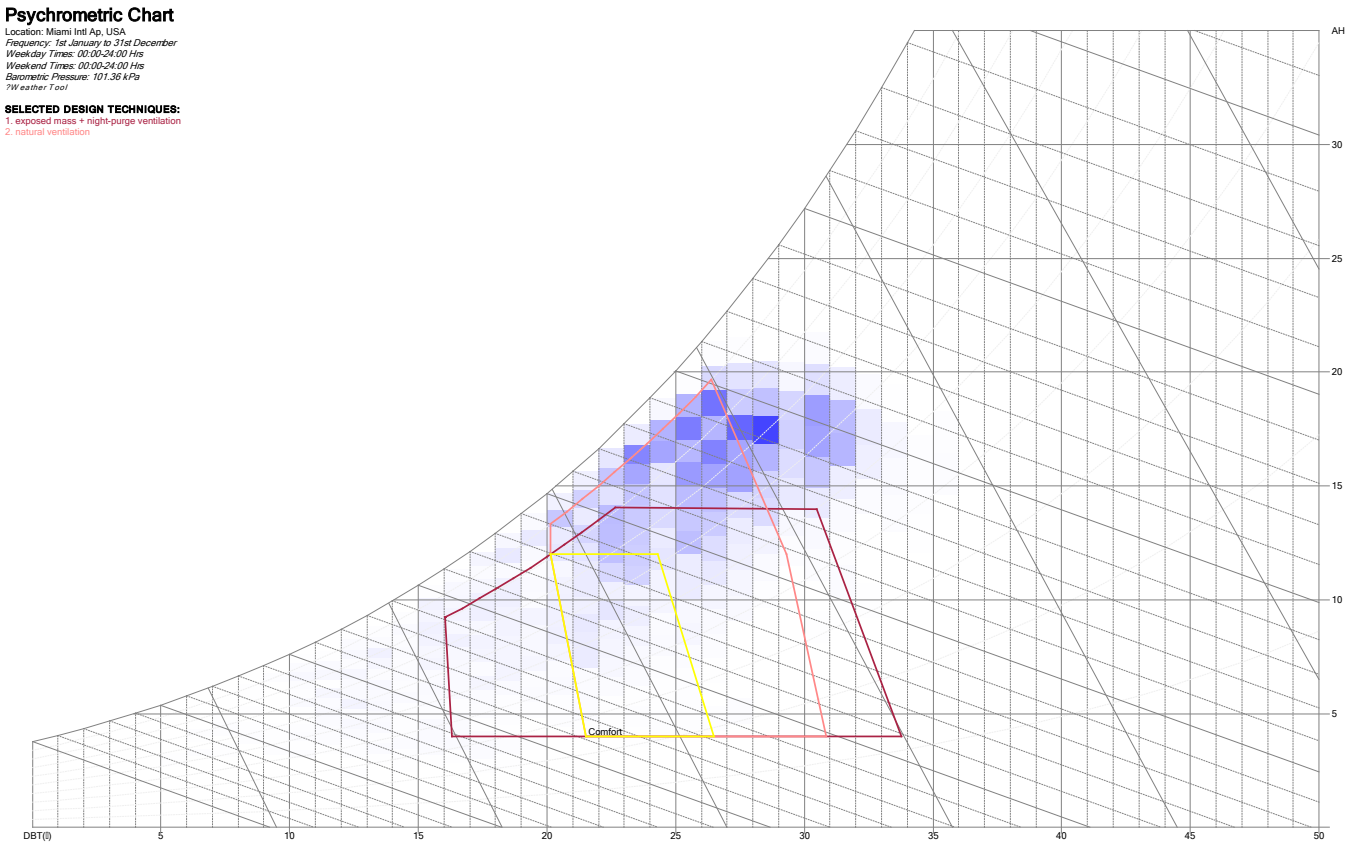



Temperature Hourly Range Chart

## Psychrometric Chart:

Observing annual data plotted on the psychrometric chart, the most frequent weather type in Miami is hot and humid. Cooling and dehumidification are needed to be applied to indoor environment to increase indoor comfort hours. Night-purge ventilation and natural ventilation are two effective design techniques to reduce indoor temperature, and an active system is needed for dehumidification.

By applying night-purge ventilation and natural ventilation strategies, there is a significant comfort improvement (yellow: before, red: after) throughout year.

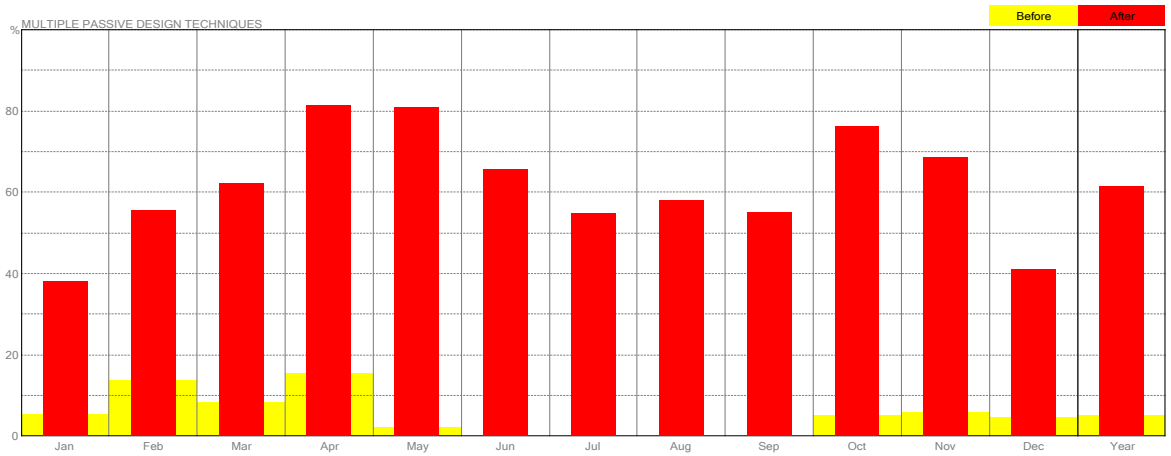



Psychrometric Chart

Comfort Percentages
NAME: Miami Intl Ap
LOCATION: USA
WEEKDAYS: 00:00 - 24:00 Hrs
WEEKENDS: 00:00 - 24:00 Hrs
POSITION: 25.8? -80.3?
?Weather Tool

CLIMATE: Af
*Tropical moist climate where precipitation occurs all year long.*
*Monthly temperature variation is less than 3 degrees Celsius.*
*Intense heating and humidity cause afternoon clouds almost every day.*
*Daily highs about 32⁄ while night time temperatures average 22⁄ .*

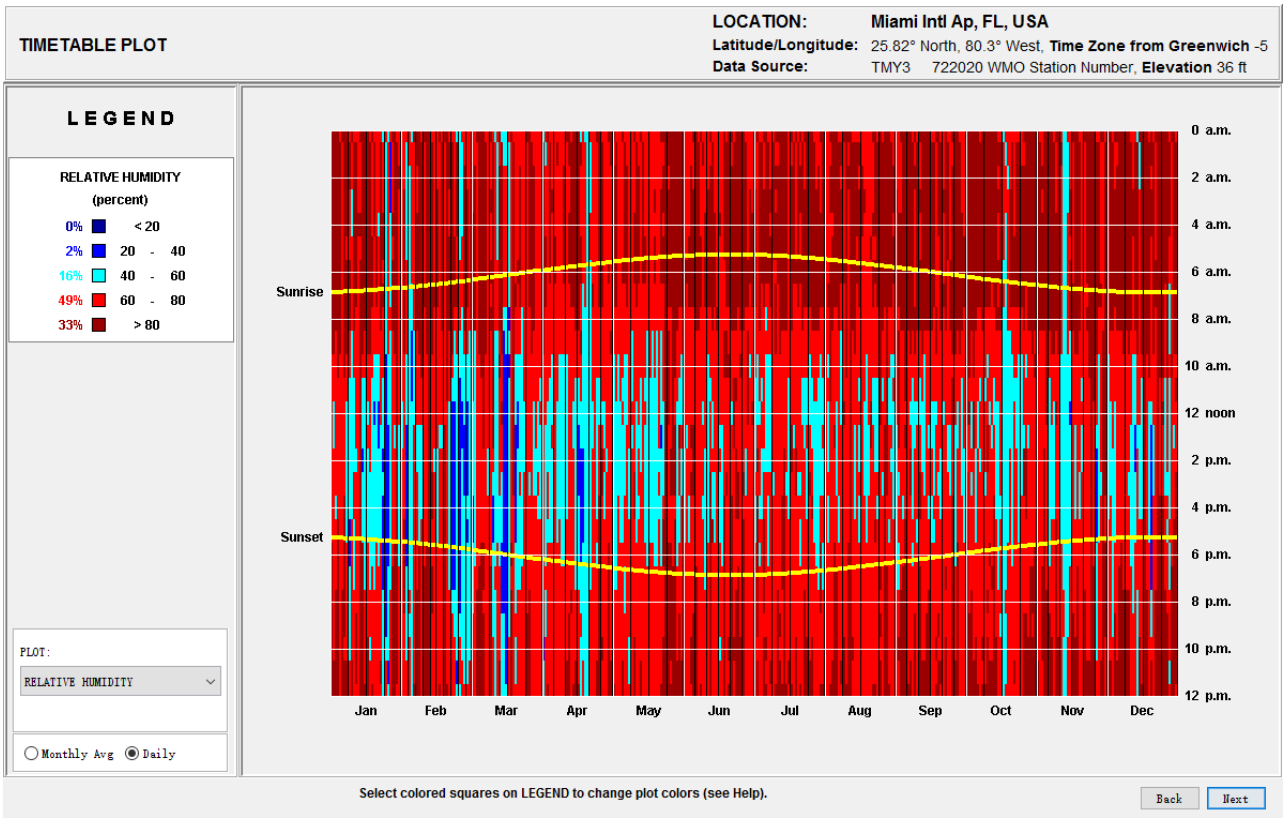
SELECTED DESIGN TECHNIQUES:
1. exposed mass + night-purge ventilation
2. natural ventilation




Improved Comfort Percentage Chart

## Humidity Timetable Plot:

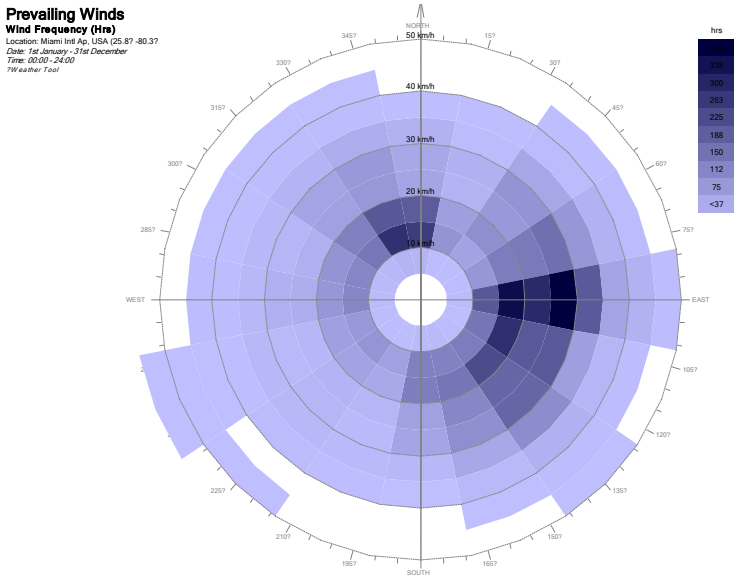
Take a closer look of humidity data, high relative humidity level (>80%) concentrated on before 8 am and after 8 pm throughout year, which means for a commercial use building, humidity level is relative in comfort range during general office hour (9am – 5pm).



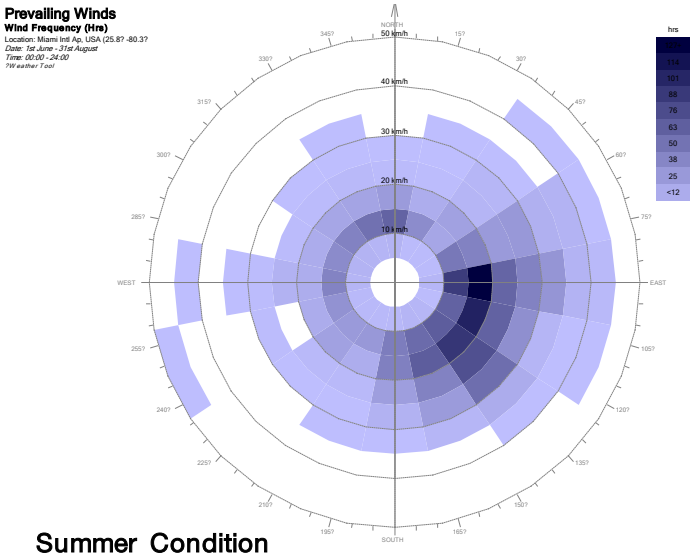

Annual Humidity Plot

## Wind Rose Chart

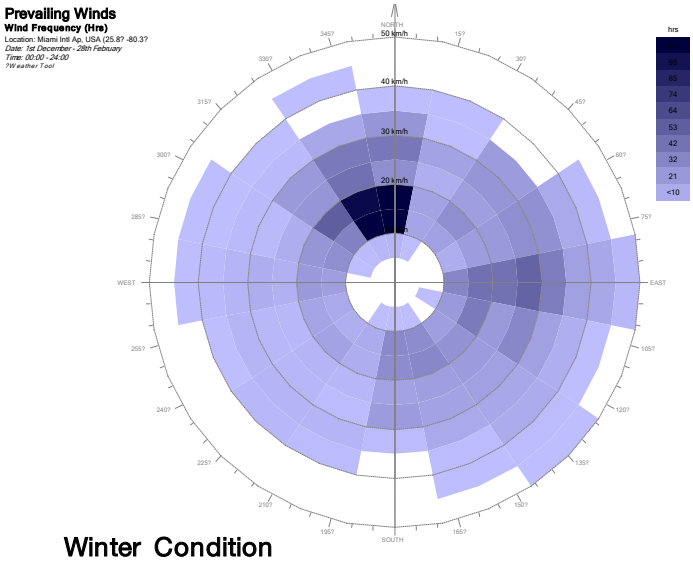
In Miami, prevailing wind comes from east in general. But during winter time, wind comes from north side with wind velocity: 20 km/h (5.5 m/s) and average wind temperature 15-20 ℃. This winter wind could be introduced into building to reduce indoor temperature during daytime.



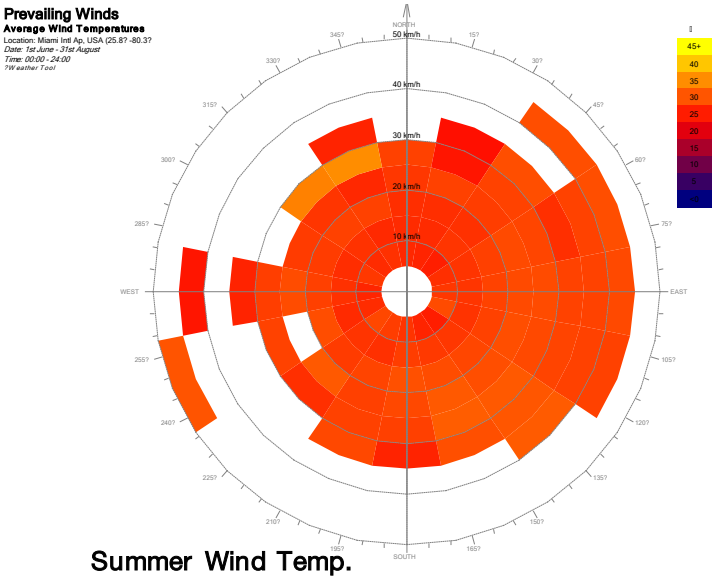

Annual Wind frequency



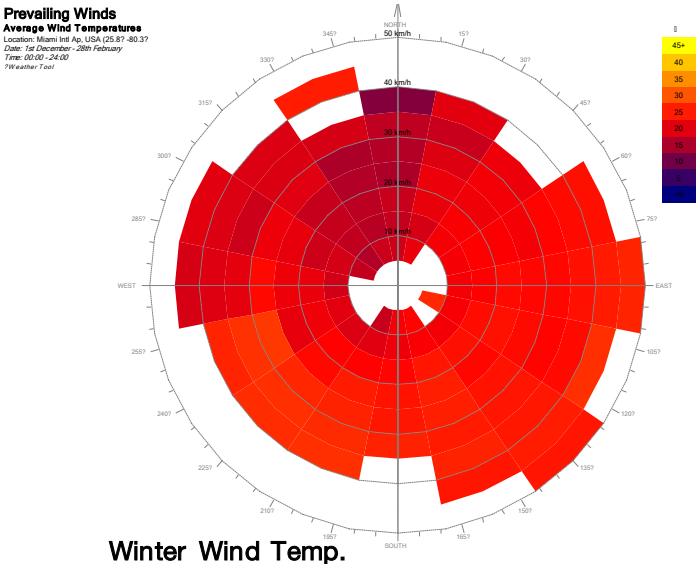

Summer Condition



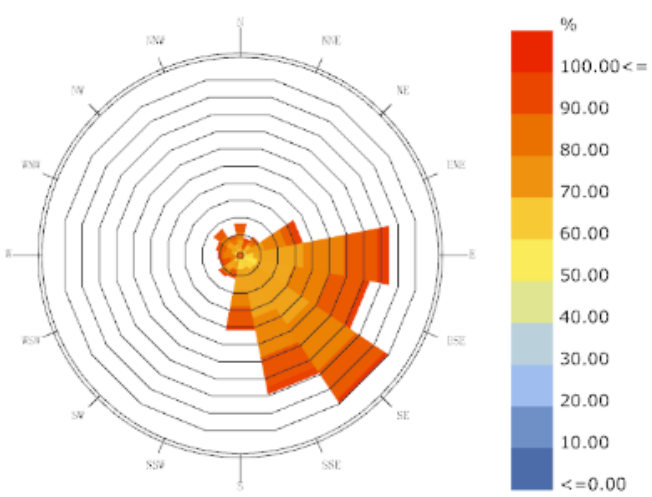

Winter Condition




Summer Wind Temp.

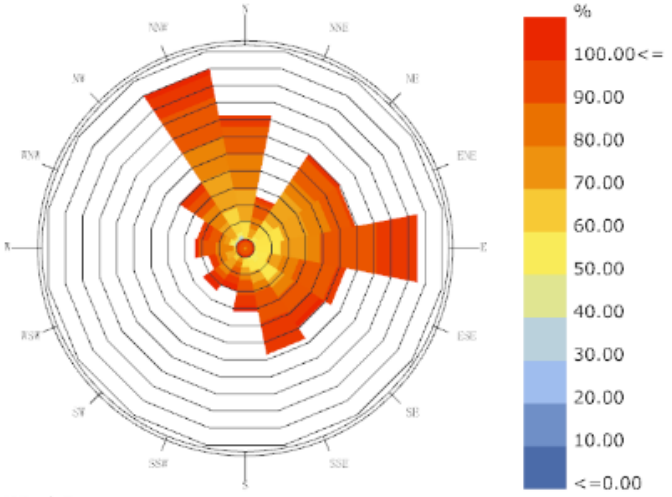



Winter Wind Temp.




Wind-Rose
Miami Intl Ap_FL_USA
1 JUN 9:00 - 31 AUG 17:00
Hourly Data: Relative Humidity (%)
Calm for 2.01% of the time = 44 hours.
Each closed polyline shows frequency of 0.7%. = 14 hours.

**Summer Relative Humidity (Office Hour)**

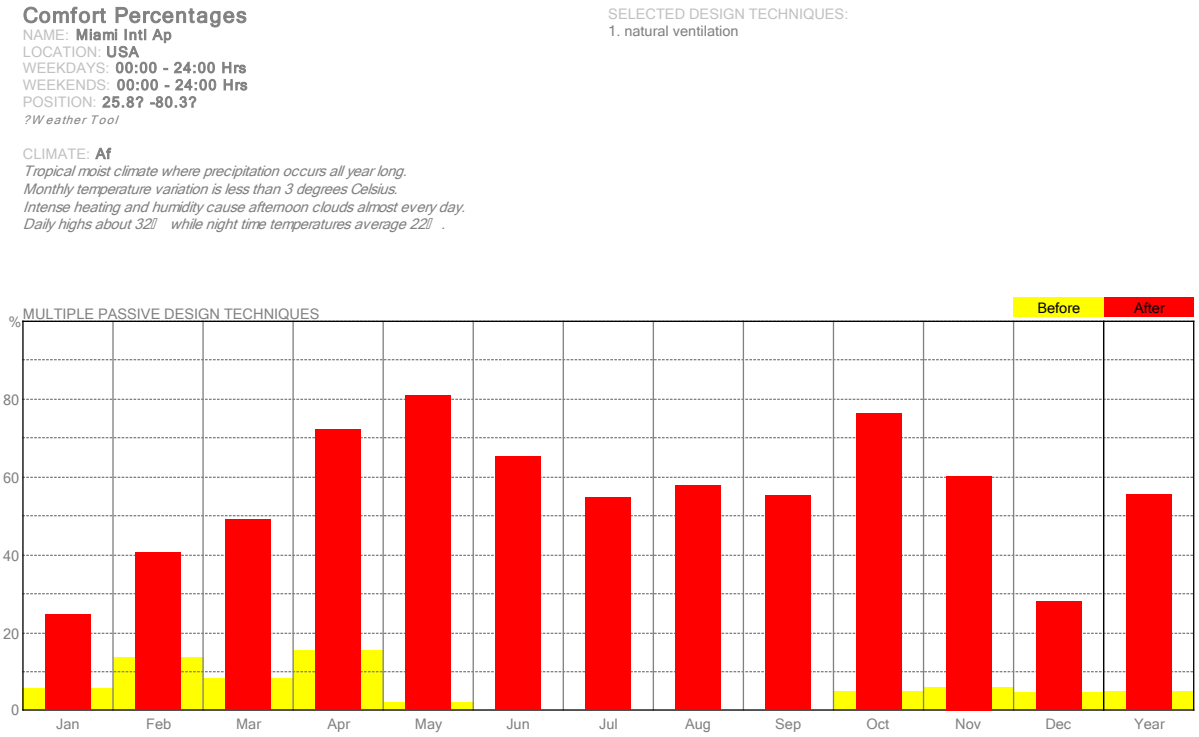



Wind-Rose
Miami Intl Ap_FL_USA
1 DEC 9:00 - 28 FEB 17:00
Hourly Data: Relative Humidity (%)
Calm for 3.59% of the time = 77 hours.
Each closed polyline shows frequency of 0.4%. = 9 hours.

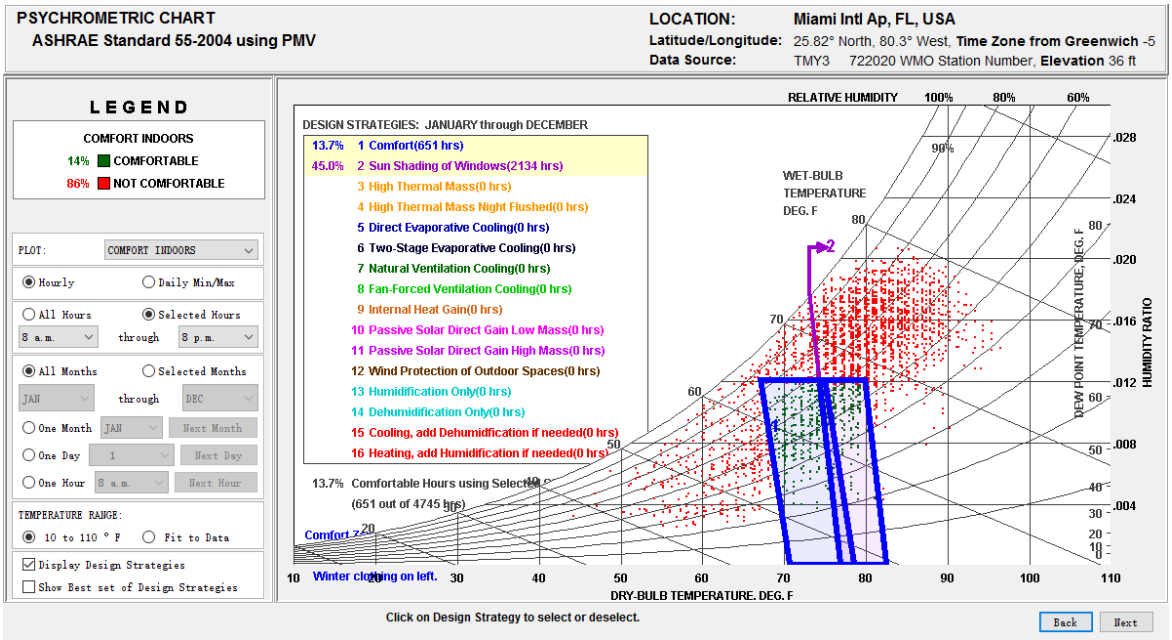
**Winter Relative Humidity (Office Hour)**

## Passive Design Strategies:

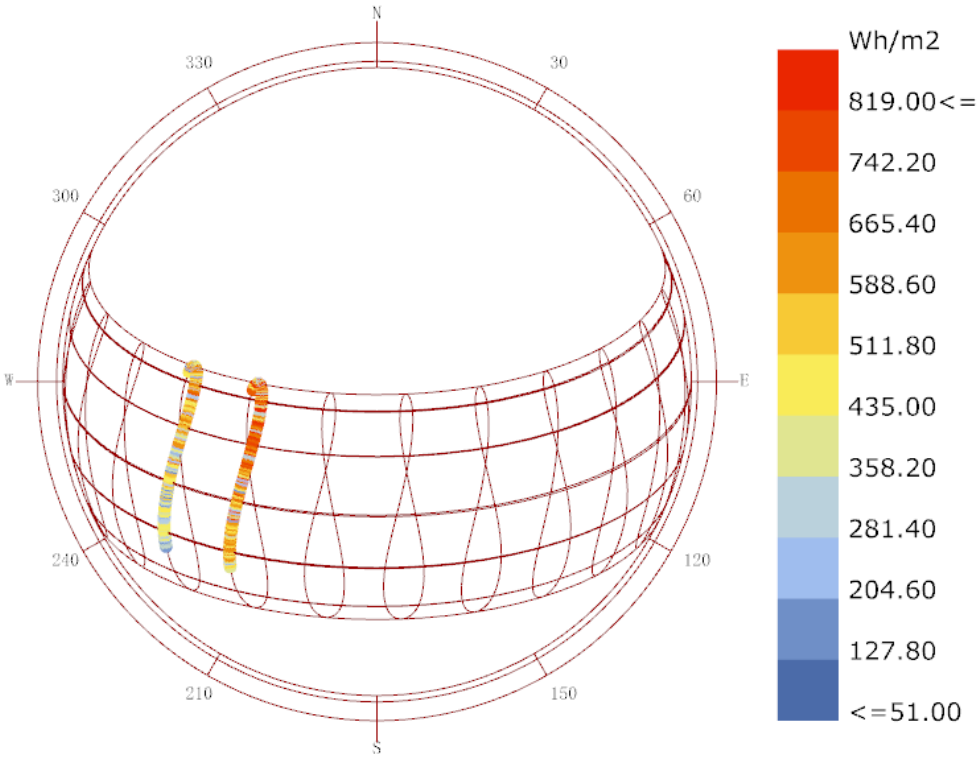
1. Use operable windows to introduce natural ventilation to minimize air conditioning. Red bar in below chart represents improvements when natural ventilation applied.




2. Use shading devices to protect south facing windows from solar heat gain. Adding shading devices for windows could have 45% potential improvement of comfort.



3. Minimize west facing glazing to reduce afternoon heat gain. Graphic shows below represent global horizontal radiation from 2 pm – 4 pm, June – October.




Sun-Path Diagram - Latitude: 25.82
Hourly Data: Global Horizontal Radiation (Wh/m2)
Miami Intl Ap_FL_USA

**Moving forward, what other data do you need from the client and/or the design team for the next steps of the analysis?**

**From client:** Programs

**From Design Team:** Building Massing& Orientation\ Glazing % of each façade\ Zoning

**How does climate change will affect your design recommendations?**

Climate change will affect the first design recommendation, which is using natural ventilation. Rising outdoor temperature is one of main effect of climate change, which would reduce outdoor comfort hours, which further increase indoor active systems energy demand.

**Updates:**

9/26 : Temperature Hourly Range Chart, for identify temperature of office hour (9 am- 5 pm).

9/27: Wind Relative Humidity (office hour) chart, for identify which direction is available for operable openings for natural ventilation.