

Building Simulation Week 3 Assignment

Weather Study of Chicago City

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Chicago

Data Source:	TWY3
Latitude:	41.98
Longitude:	-81.92
Hours of Strong Cold Stress:	1863
Hours of Moderate Cold Stress:	2088
Hours of Slightly Cold Stress:	1390
Hours of Comfort:	3126
Hours of Strong Heat Stress:	18
Hours of Moderate Heat Stress:	115
Hours of Slightly Heat Stress:	160



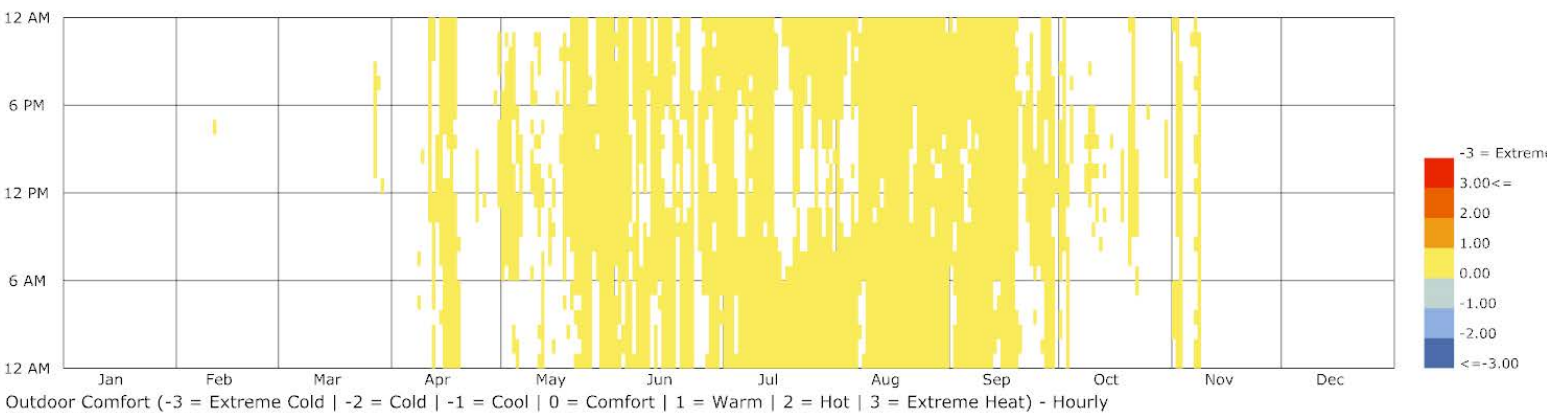
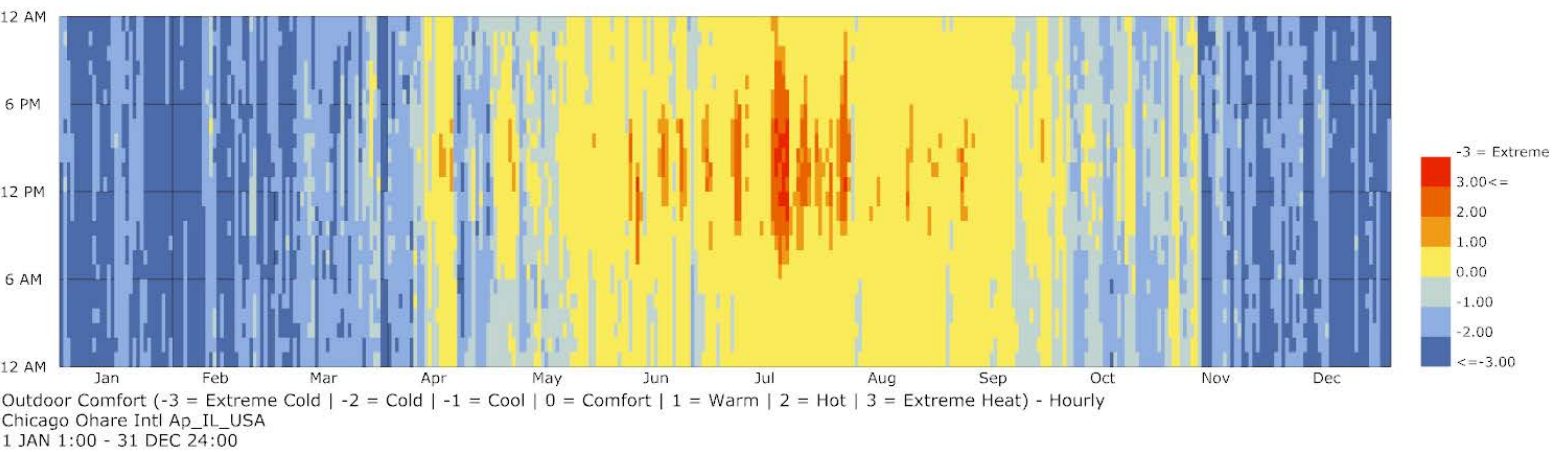
UTCI

The Universal Thermal Climate Index was set up for all assessments of the outdoor thermal conditions in the major fields of human biometeorology such as public weather service, public health system, precautionary planning, and climate impact research in the health sector. UTCI should become an international standard based on recent scientific progress in human response related thermo-physiological modelling.

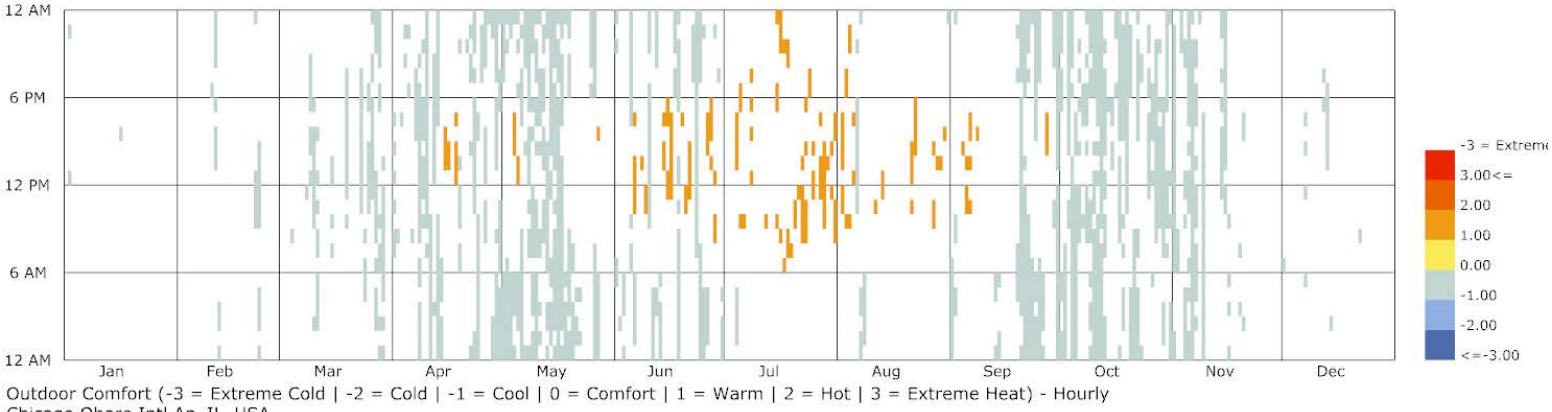
-3 = Extreme Cold | -2 = Cold | -1 = Cool |
0 = Comfort | 1 = Warm | 2 = Hot | 3 = Extreme Hot

From the diagrams on the right, it is obvious that almost all of the uncomfortable time (45.10% of the whole year's period) in a year is caused by cold weather conditions. On the other side, there is only very little uncomfortable time caused by hot weather condition (1.52% of the whole year's period). Most of the comfort time (including short period comfort time) happens summer.

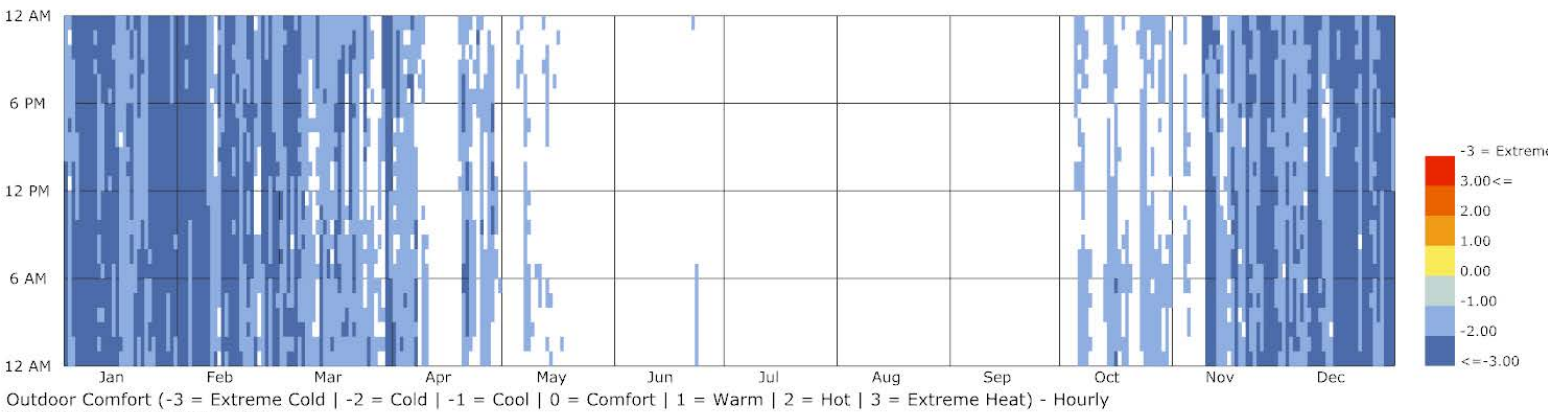
For the building stratagy, architect shall put more attention to prevent the cold weather giving the clients of the house bad experience. At the same time, summer is relatively pleasant and there maybe a chance to create the half enclosed space for people to get access to fresh air in summer.



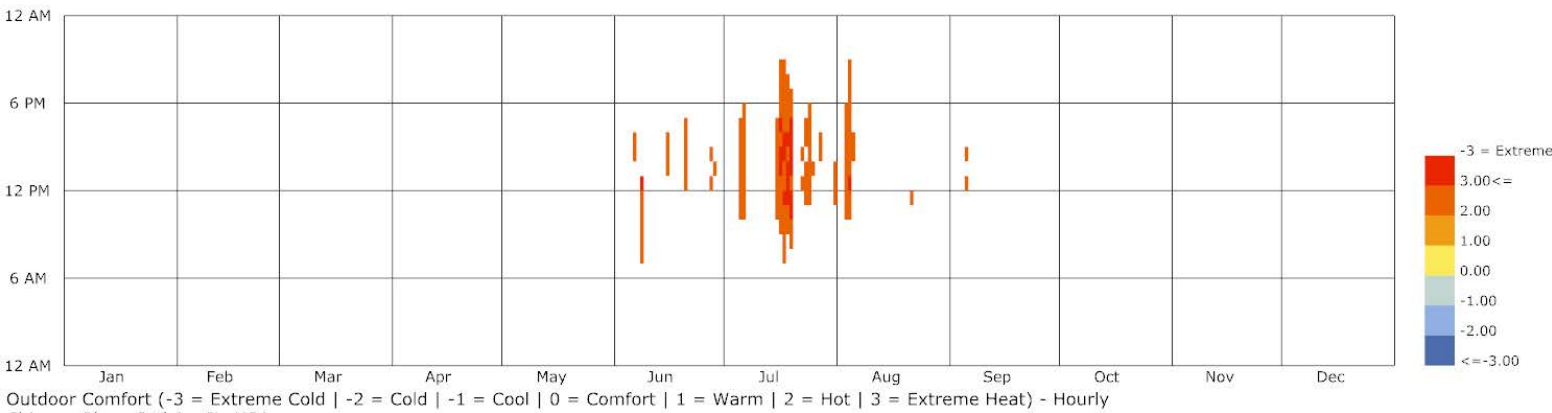
Comfort Time: 35.69% of all year



Short Period Comfort Time: 17.69% of all year



Cold Time: 45.10% of all year

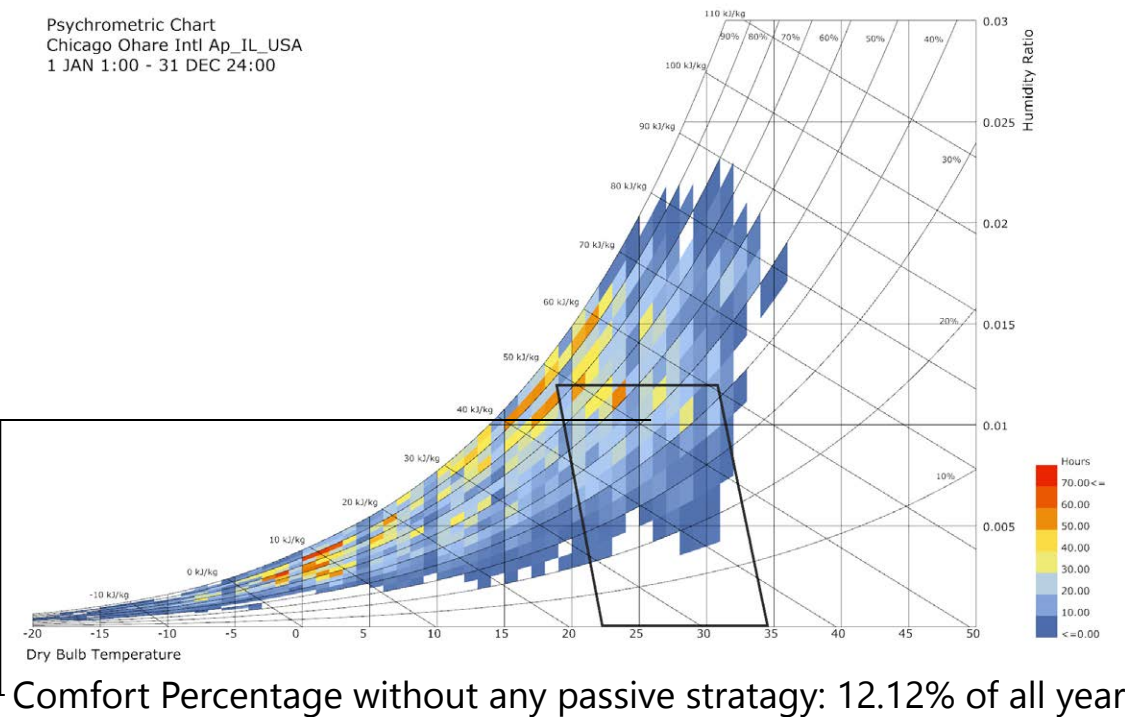
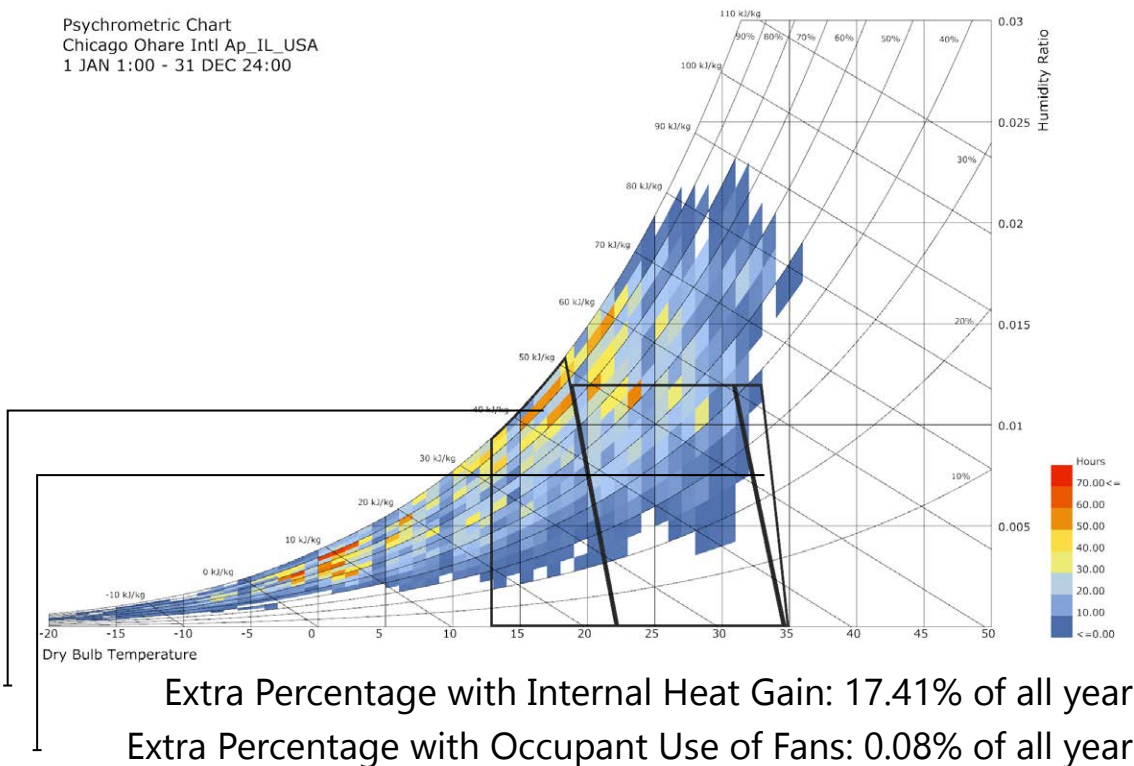
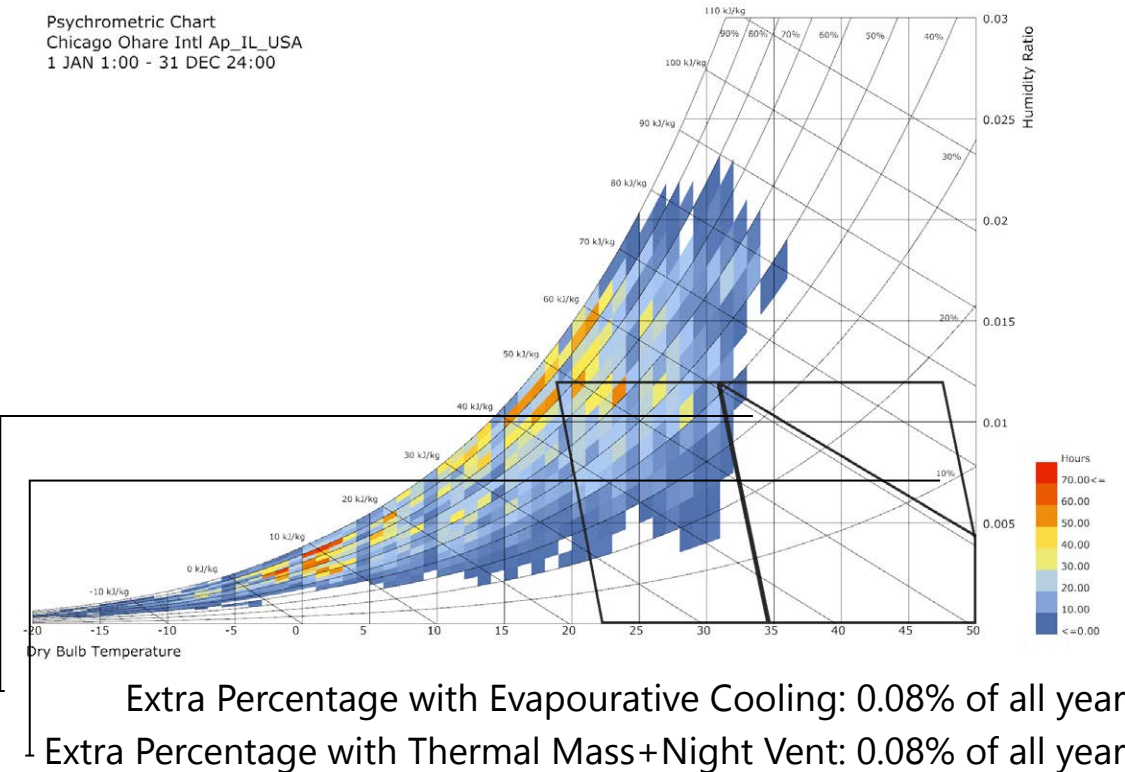
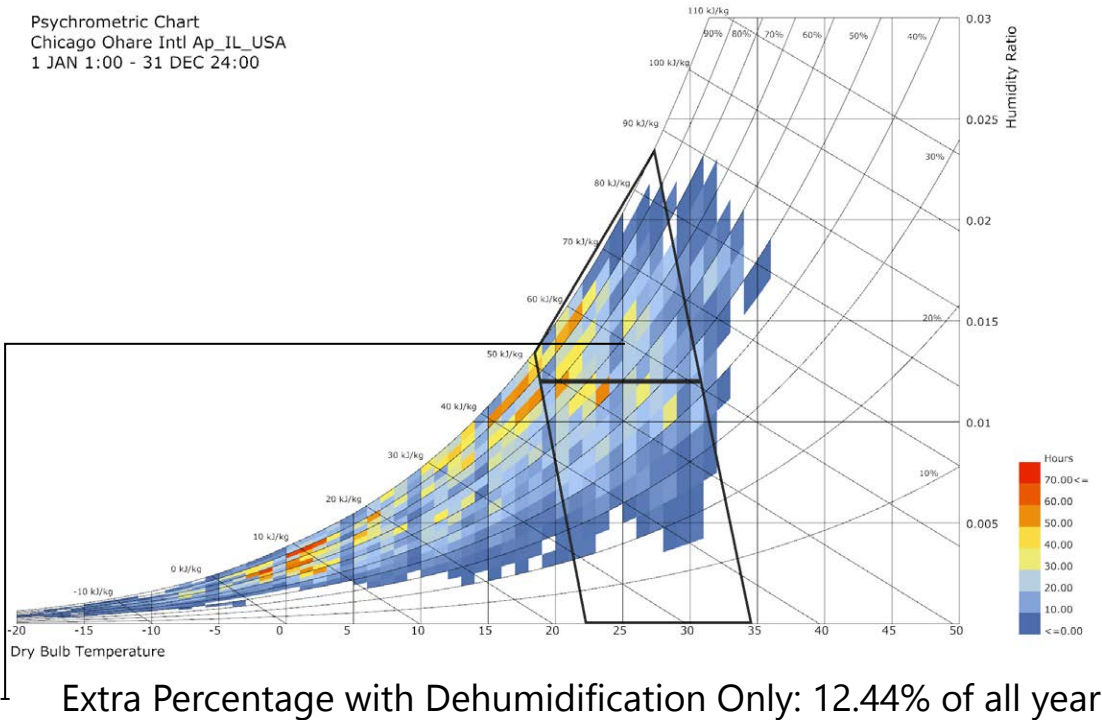


Hot Time: 1.52% of all year

PMV

The PMV/PPD model was developed by P. O. Fanger using heat balance equations and empirical studies about skin temperature to define comfort.

From the diagrams on the right, we can know that only 12.14% of comfort time exists in the whole year without any passive strategy. Amongst all of the passive strategies, Dehumidification and Internal Heat Gain are the most effective strategies which would increase the comfort time by 12.44% and 17.41% respetively. As a result, I will suggest that buildings which have limited exchange with the exterior should employ Dehumidification and Internal Heat Gain.



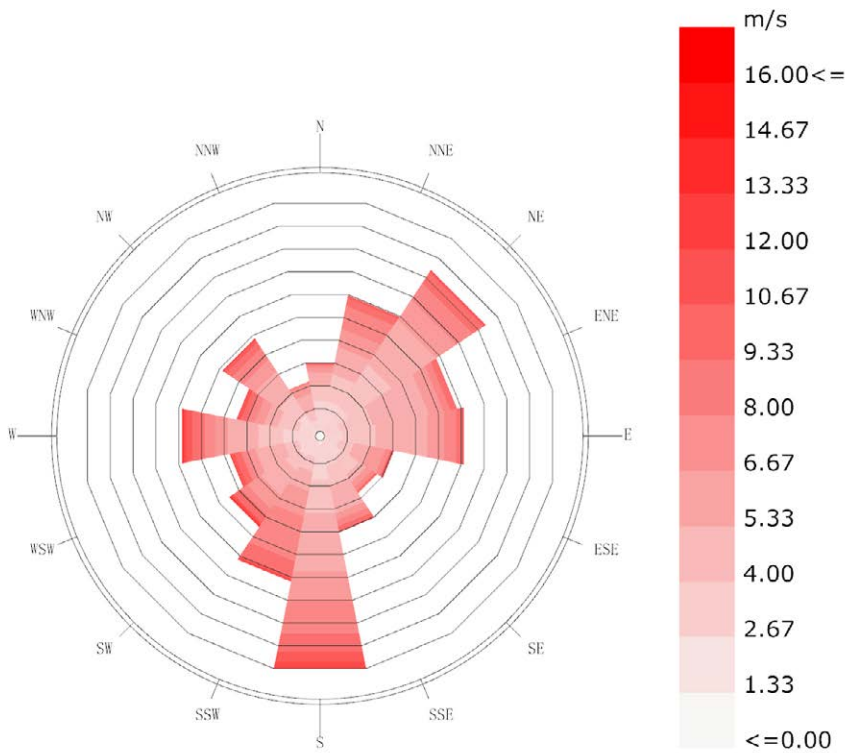
Wind Frequence& Wind Speed

The wind rose diagrams in different seasons show that south and west wind are the main wind for the whole year.

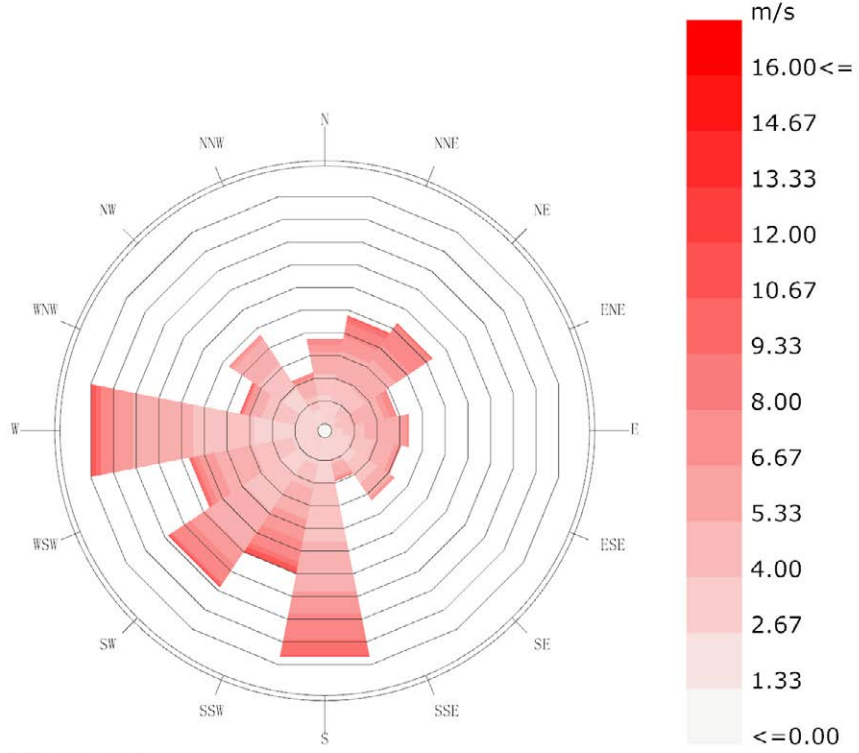
In spring, it seems like most of the wind comes from northeast and south(each more than 10%).

When summer comes, most of the wind comes from the southwest side(including south and west side), taking nearly 50% in total.

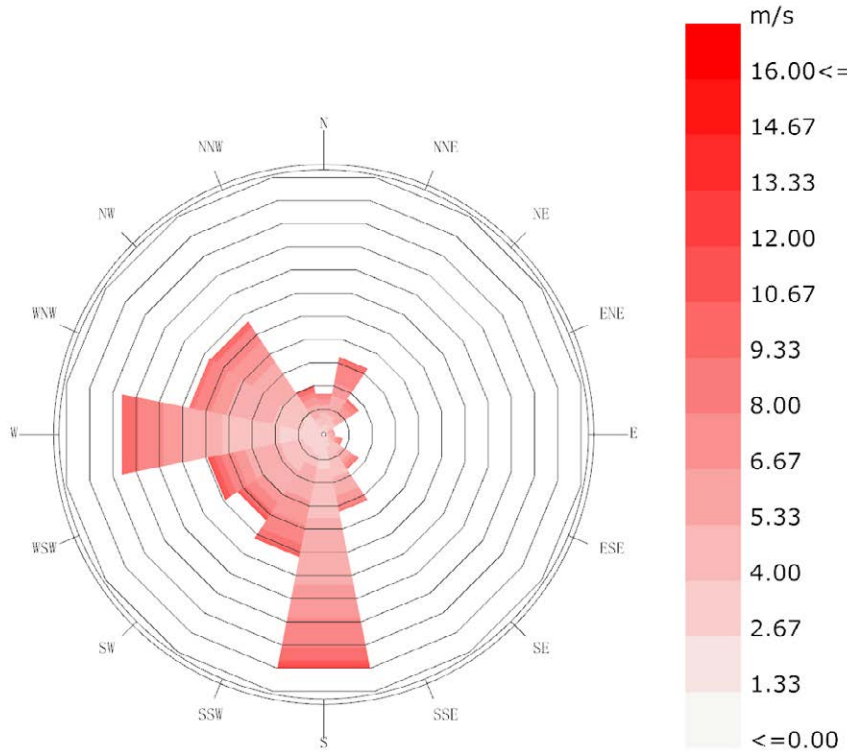
Fall and winter show some similarity to have most of their wind coming from west and south. However, it has more wind coming from north west than winter.



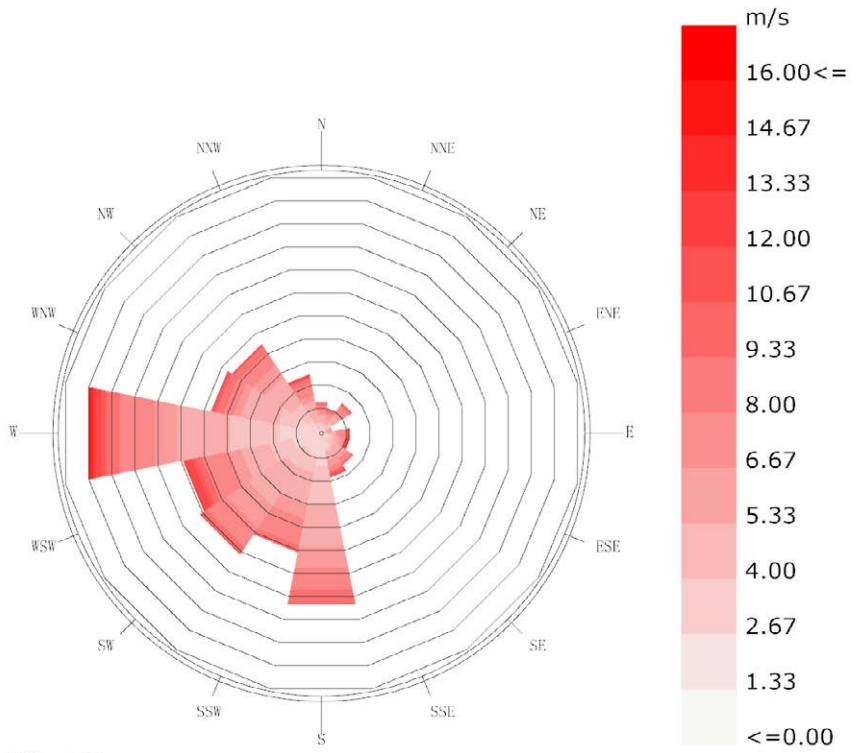
Wind-Rose
Chicago Ohare Intl Ap_IL_USA
21 MAR 1:00 - 22 JUN 24:00
Hourly Data: Wind Speed (m/s)
Calm for 3.72% of the time = 84 hours.
Each closed polyline shows frequency of 1.2%. = 26 hours.



Wind-Rose
Chicago Ohare Intl Ap_IL_USA
21 JUN 1:00 - 21 SEP 24:00
Hourly Data: Wind Speed (m/s)
Calm for 5.73% of the time = 128 hours.
Each closed polyline shows frequency of 1.2%. = 26 hours.



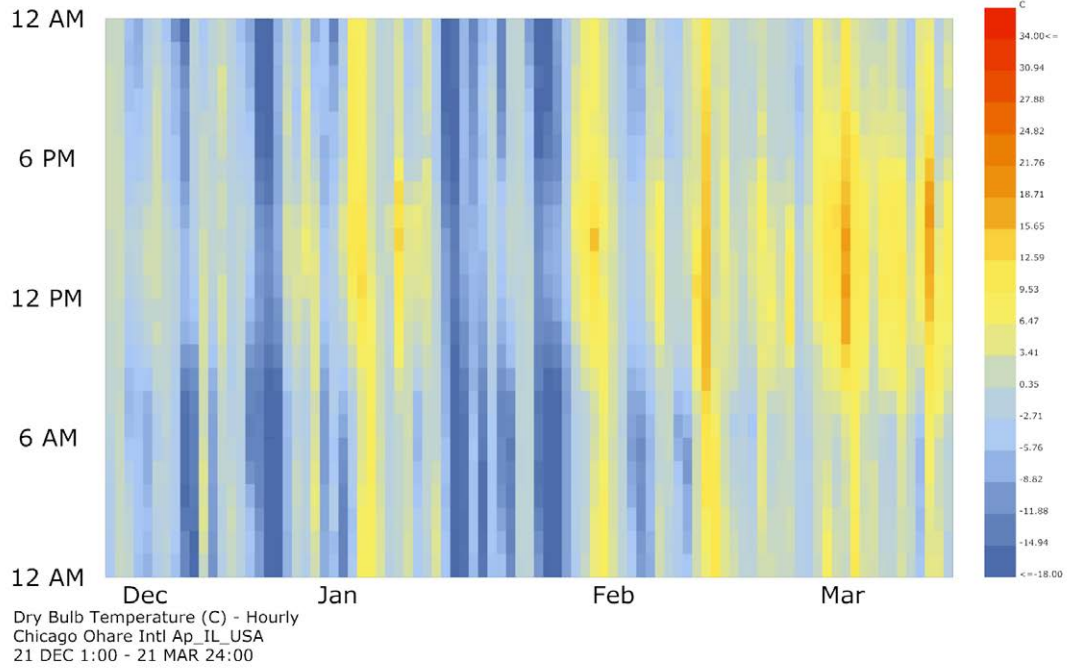
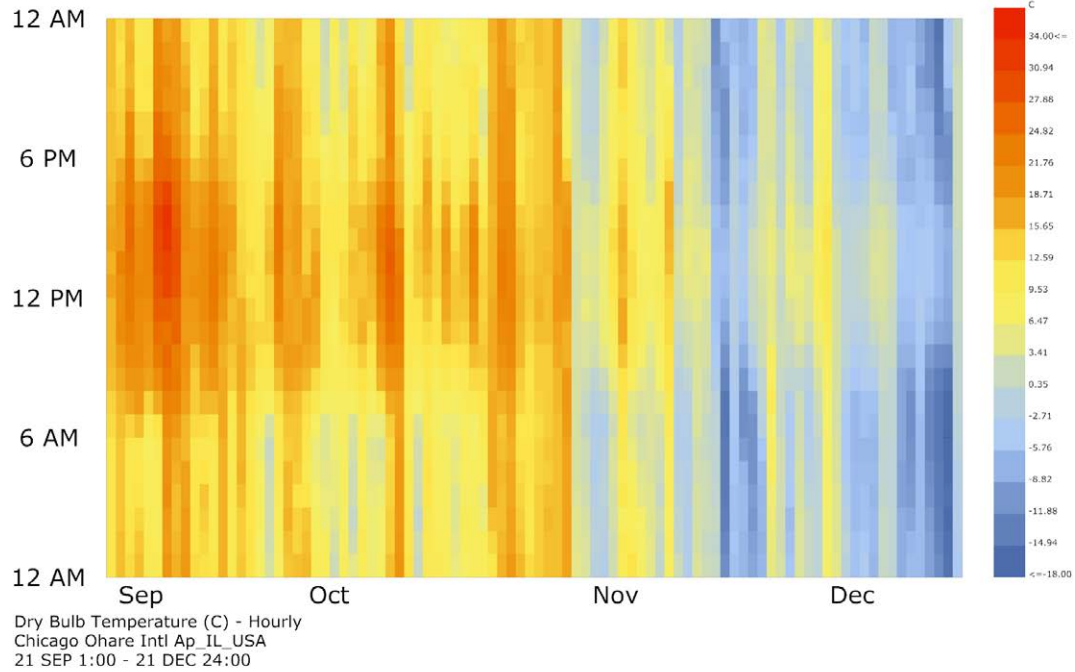
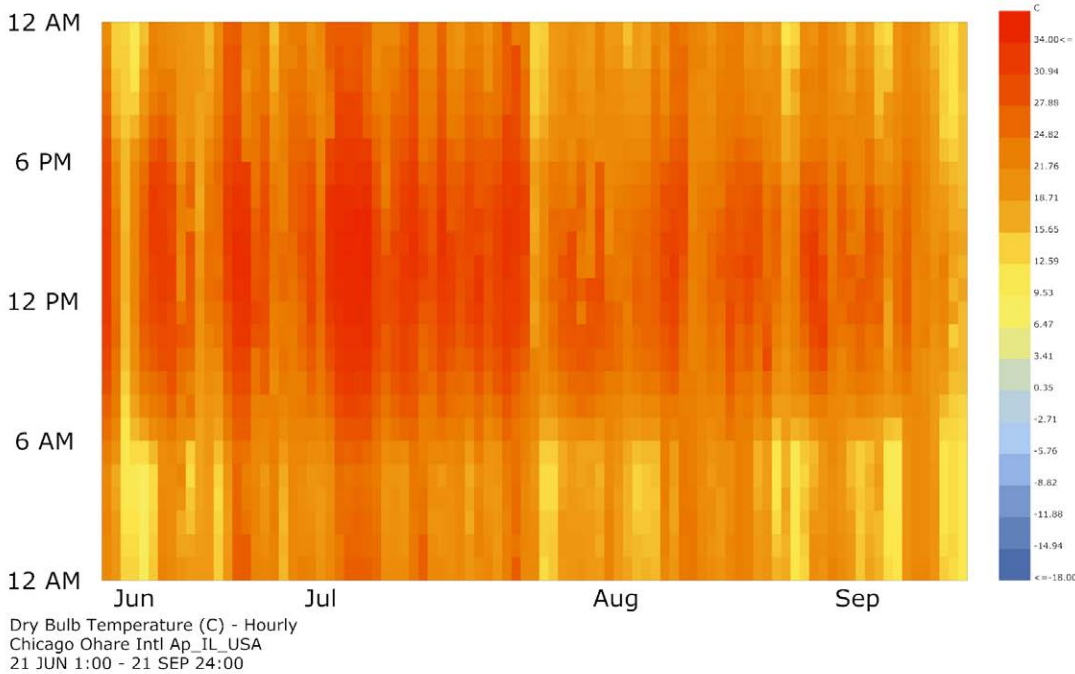
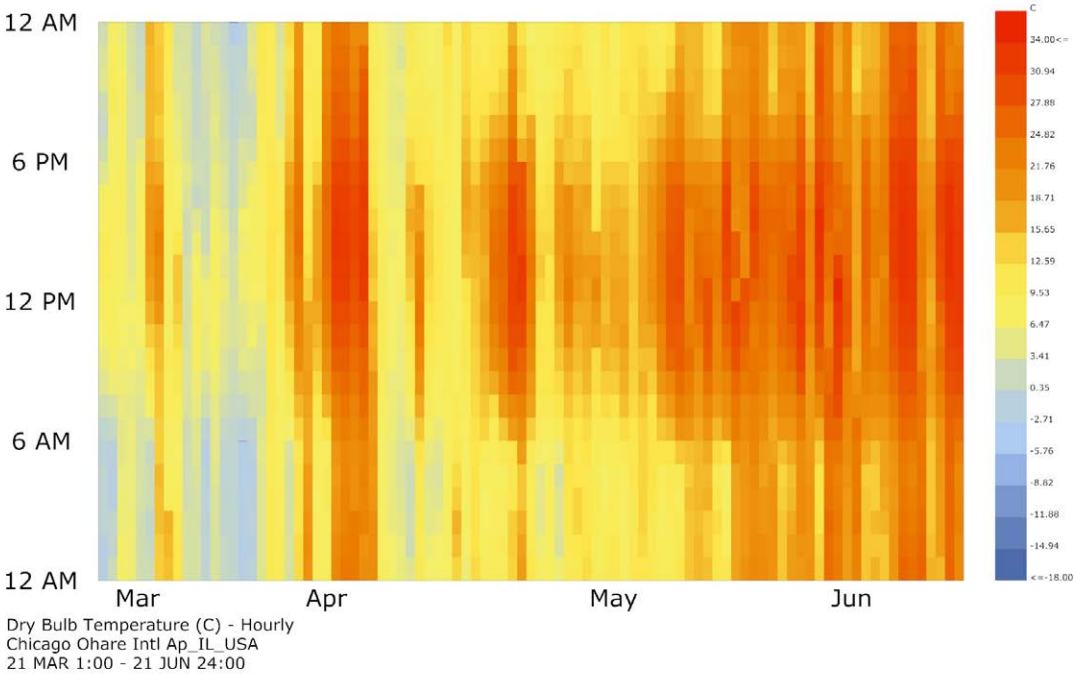
Wind-Rose
Chicago Ohare Intl Ap_IL_USA
21 SEP 1:00 - 21 DEC 24:00
Hourly Data: Wind Speed (m/s)
Calm for 2.22% of the time = 49 hours.
Each closed polyline shows frequency of 1.6%. = 35 hours.



Wind-Rose
Chicago Ohare Intl Ap_IL_USA
21 DEC 1:00 - 21 MAR 24:00
Hourly Data: Wind Speed (m/s)
Calm for 2.20% of the time = 48 hours.
Each closed polyline shows frequency of 1.7%. = 36 hours.

Dry Bulb Temperature

From the diagram, we can know that Chicago has different climates in different seasons. Winter can be very freezing and it has a lot of time to be under freezing point. In summer most of the time it is very hot to be over 20 degrees. Spring and fall share some commons but during the fall time, it is warmer than the spring.

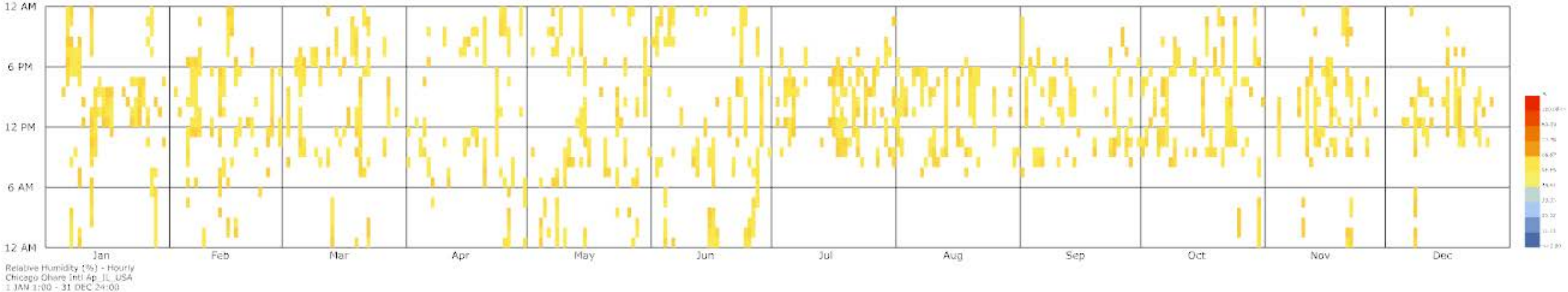
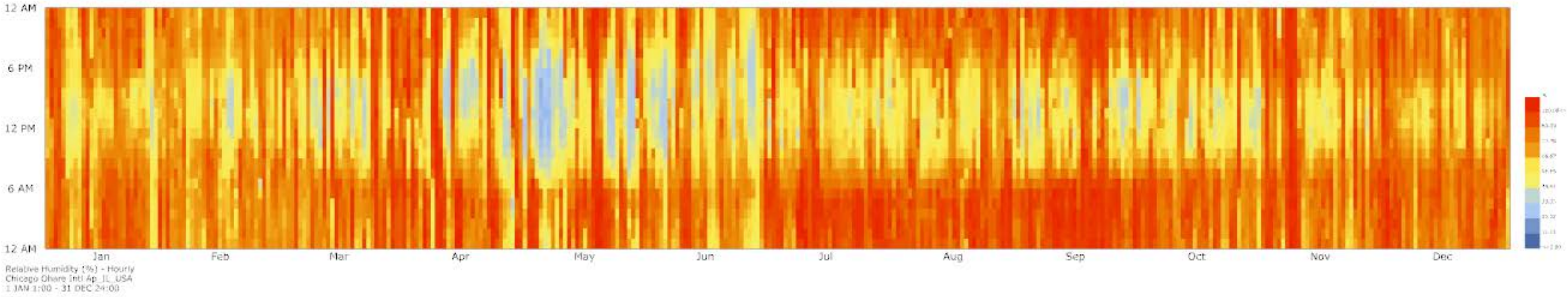


Relative Humidity

Humans can be comfortable within a wide range of humidities depending on the temperature—from thirty to seventy percent—but ideally between 50% and 60%. In the winter, it is advisable to maintain relative humidity at 30 percent or above.

During the whole year, noon is always the driest time of the whole day, especially in the spring. And in spring, Relative humidity varies the most in a day. Summer is the most humid season in the whole year. Fall and Winter share some similarities that extrem relative humidity will not appear a lot in most of the days.

The below diagram I select the ideally humidity (50-60%) for human as the gate to pick the relative humidity data. Most of the ideally time happens around day time in summer and fall. In winter, most of them appear in the morning, night time and in spring they exist in the afternoon, night time.



Relative Humidity

The diagrams show the time when the cloud cover is over 6. Summer is the season when Chicago has the most sunny days that the cloud cover is under 6. In the winter, nearly half of the time it is cloudy in Chicago.

