

Building Simulation Week 2 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



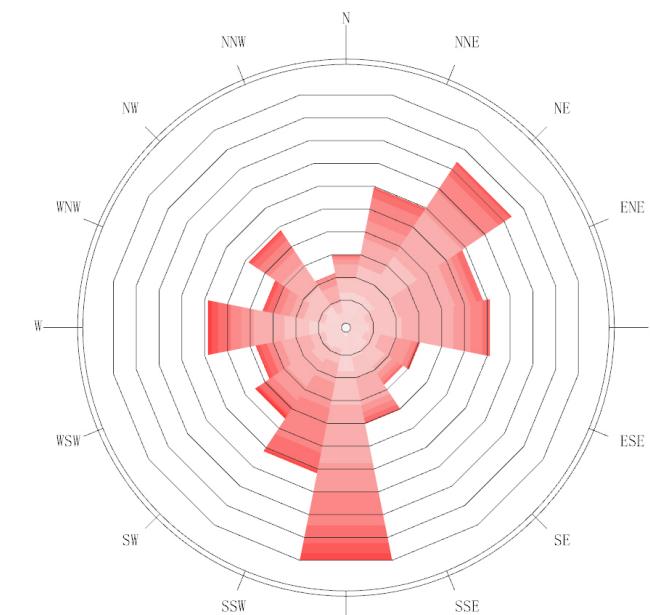
Wind Frequency & Wind Speed

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

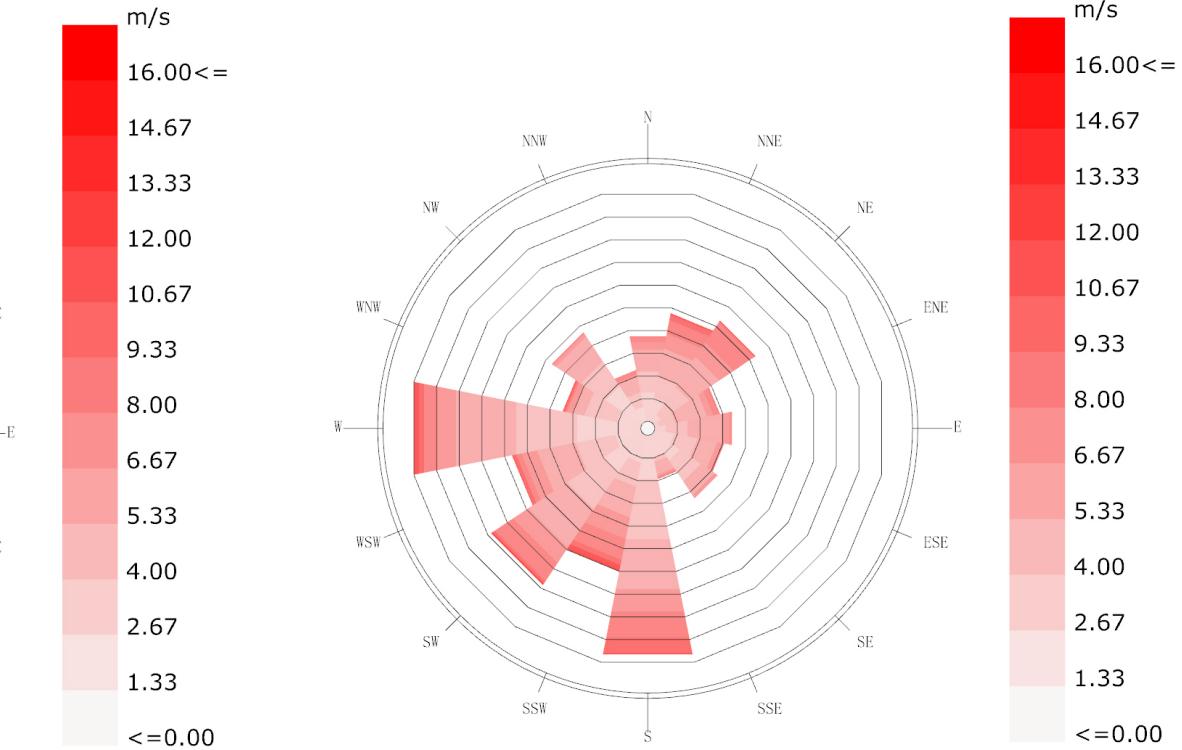
In spring, it seems like most of the wind comes from northeast and south(each more than 10%).

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

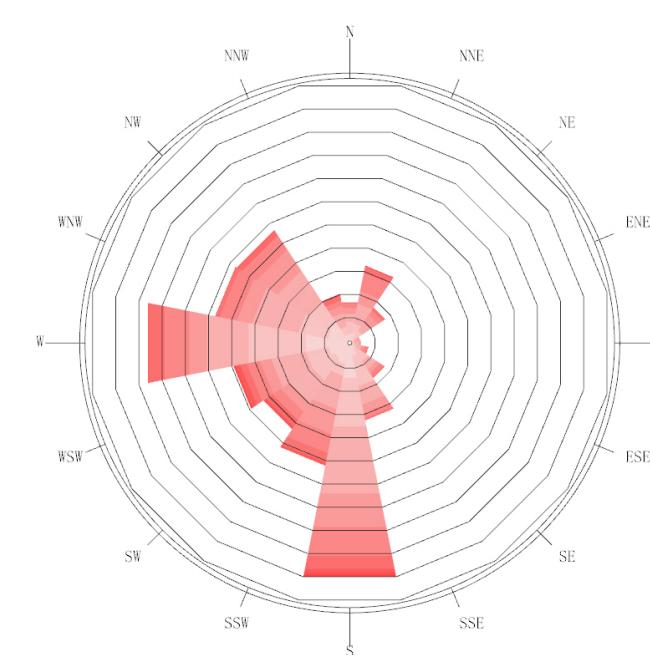
Fall and winter show some similarity to have most of their wind coming from west and south. However, it has more wind coming from north west than winter



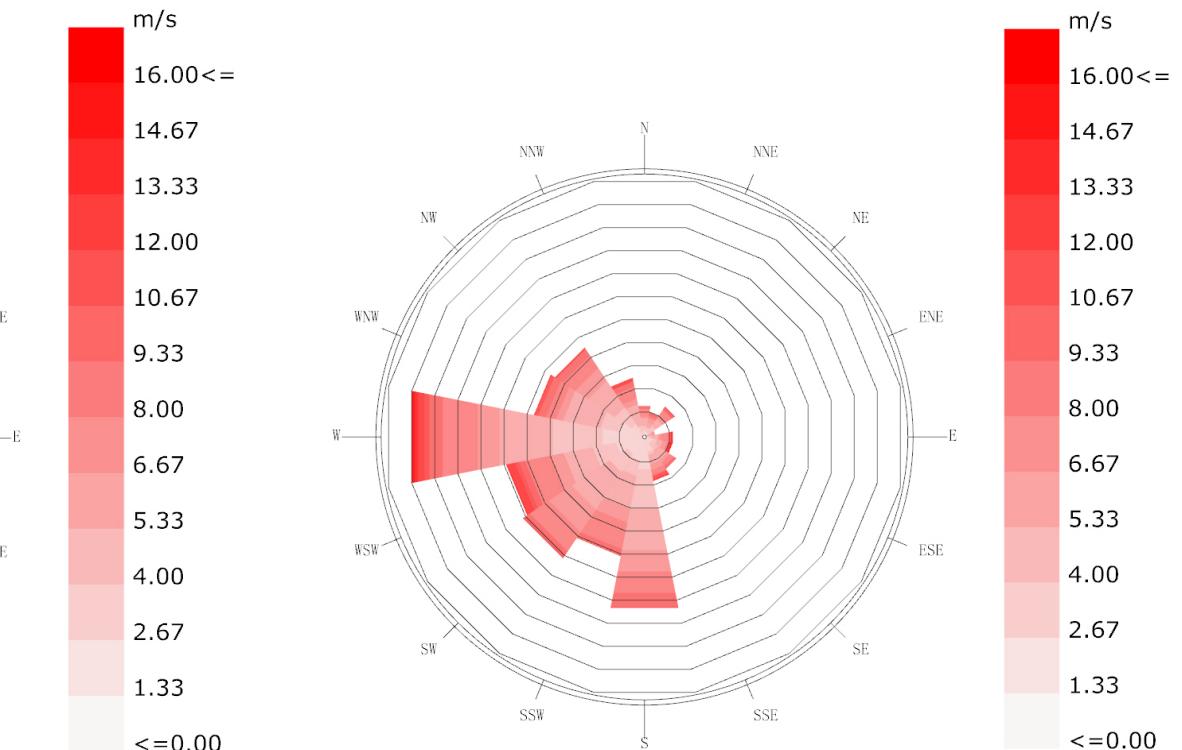
Wind-Rose
Chicago O'Hare Intl Ap_IL_USA
21 MAR 1:00 - 22 JUN 24:00
Hourly Data: Wind Speed (m/s)
Calm for 3.72% of the time = 84 hours.
Each closed polyline shows frequency of 1.2%. = 26 hours.



Wind-Rose
Chicago O'Hare 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 O'Hare 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.



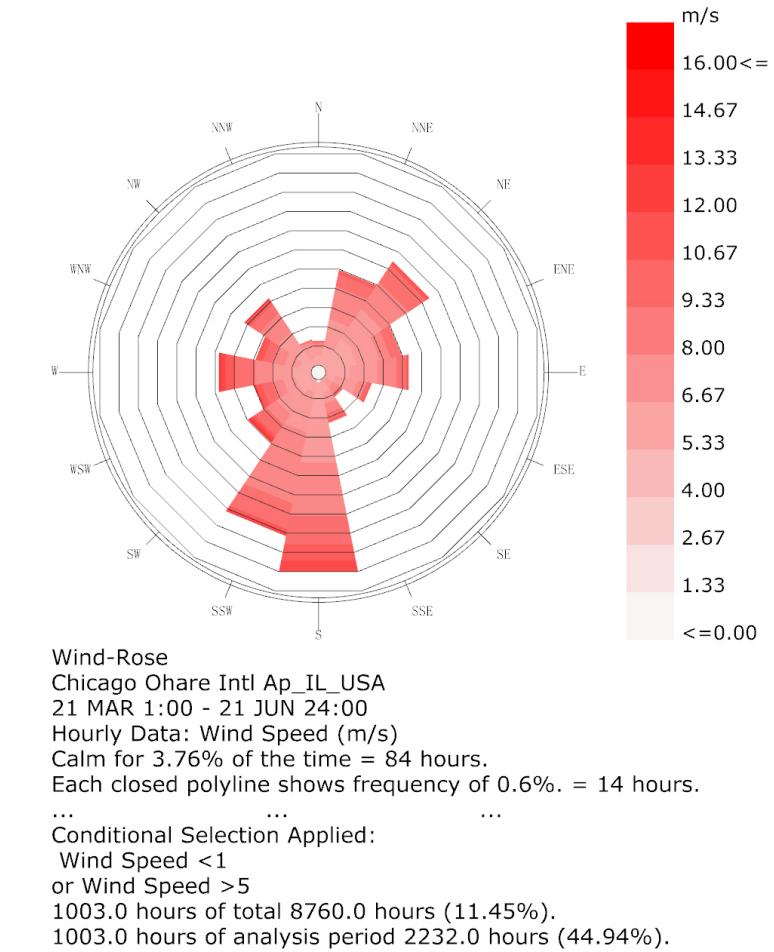
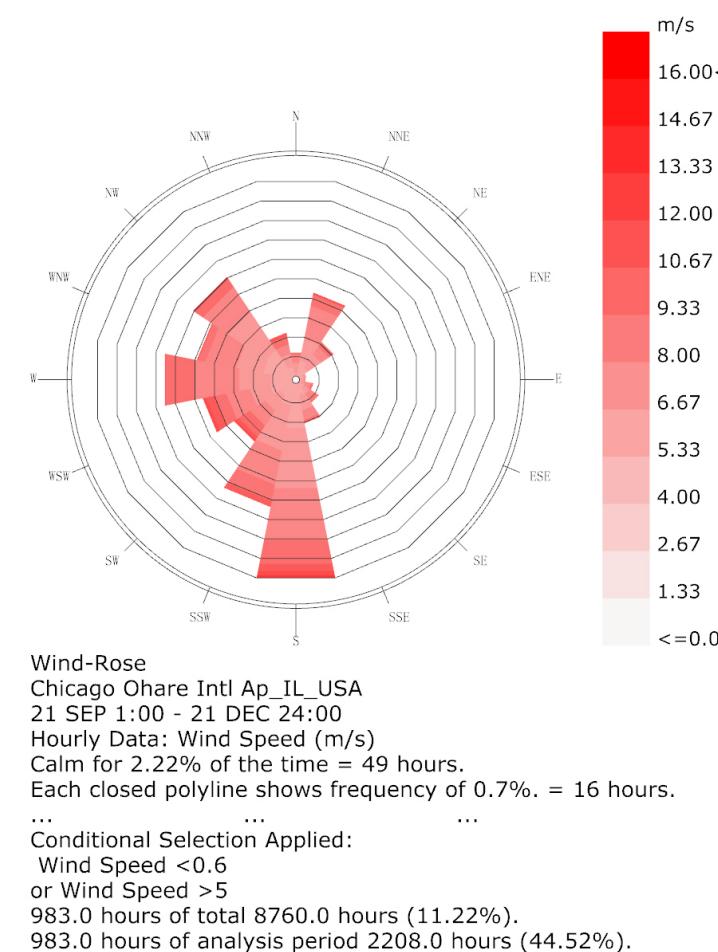
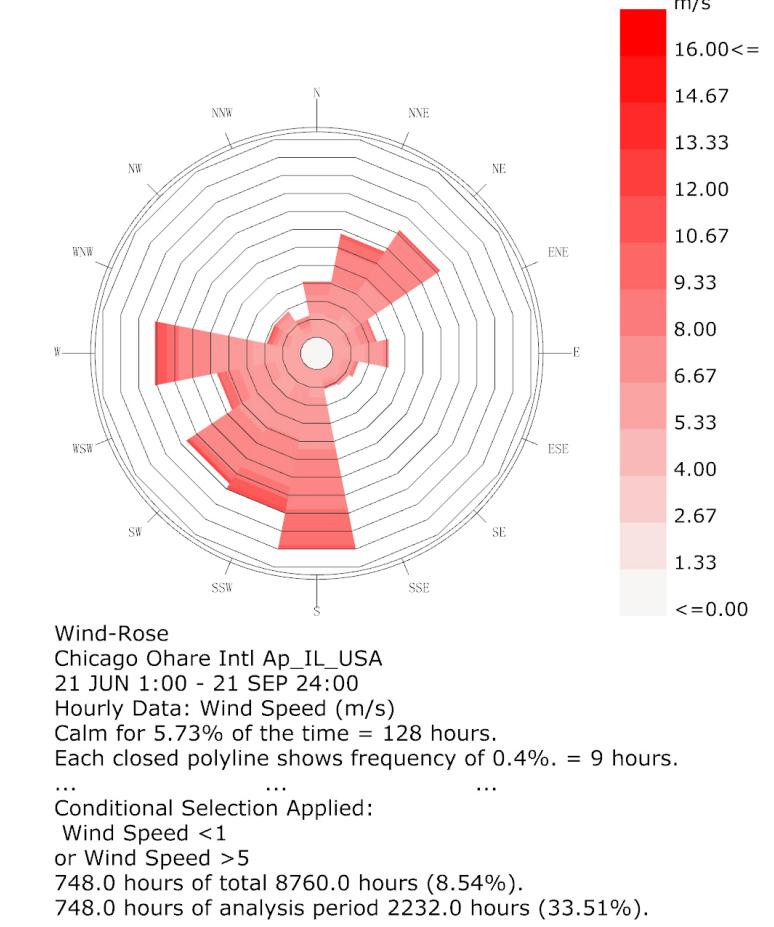
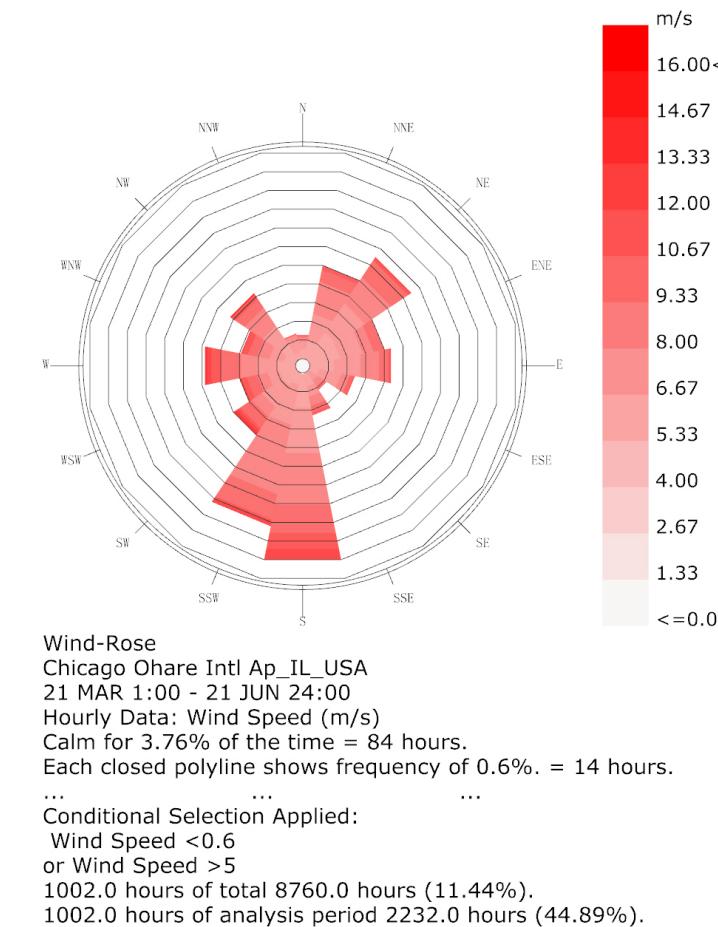
Wind-Rose
Chicago O'Hare Intl Ap_IL_USA
21 DEC 1:00 - 21 MAR 24:00
Hourly Data: Wind Speed (m/s)
Calm for 2.20% of the time = 48 hours.
Each closed polyline shows frequency of 1.7%. = 36 hours.

Exterior Uncomfortness Wind

Uncomfortable exterior wind speed:

Spring/ Autumn:	$0.6 \text{ m/s} < v < 5 \text{ m/s}$
Summer:	$1 \text{ m/s} < v < 5 \text{ m/s}$
Winter:	$3 \text{ m/s} < v$

During the year, most of the uncomfortable wind comes from the south direction. In spring the other main uncomfortable wind direction is northeast. In the summer, most of the uncomfortable wind comes from east, southeast and south.



Dry Bulb Temperature

Uncomfortable exterior wind speed:

Spring/ Autumn: 0.6m/s

< v < 5m/s

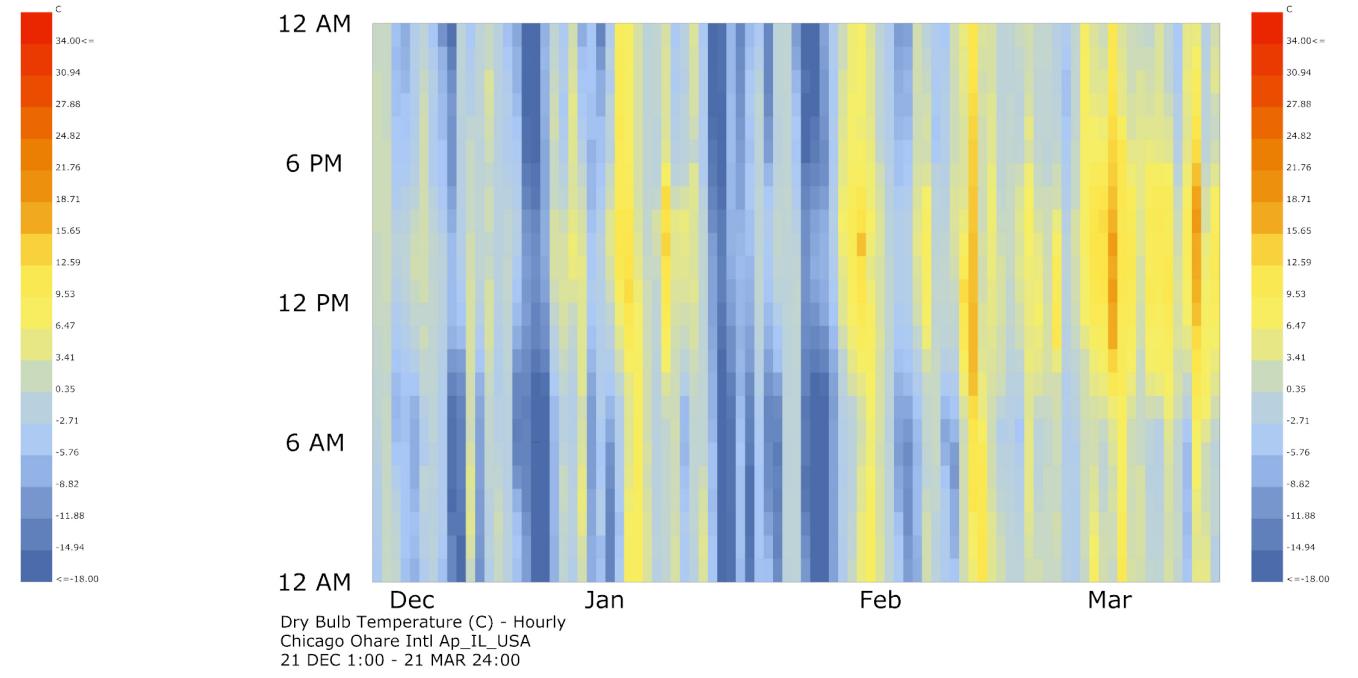
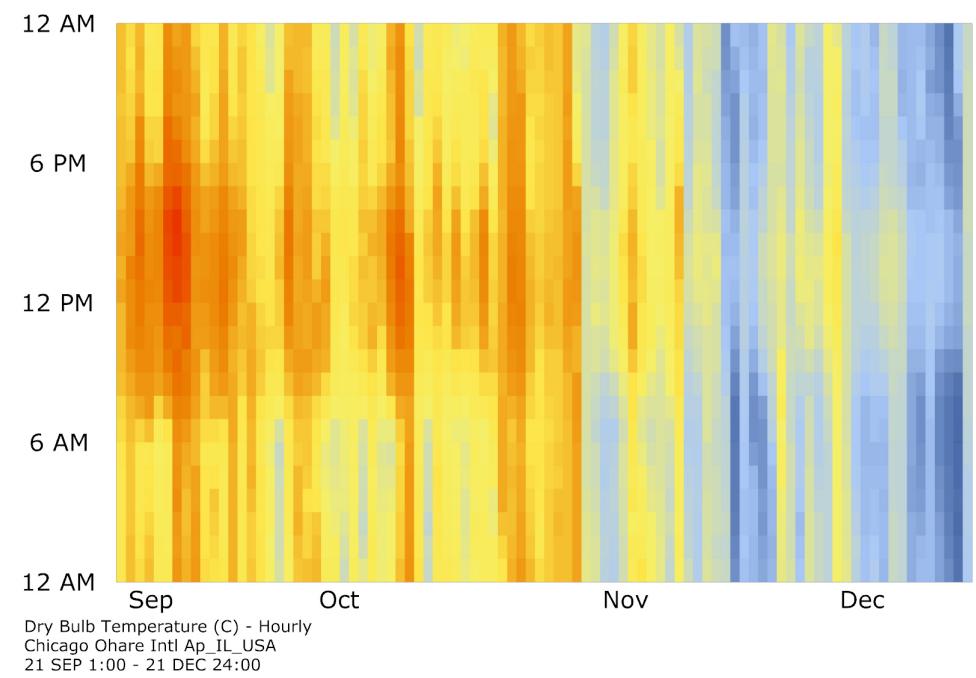
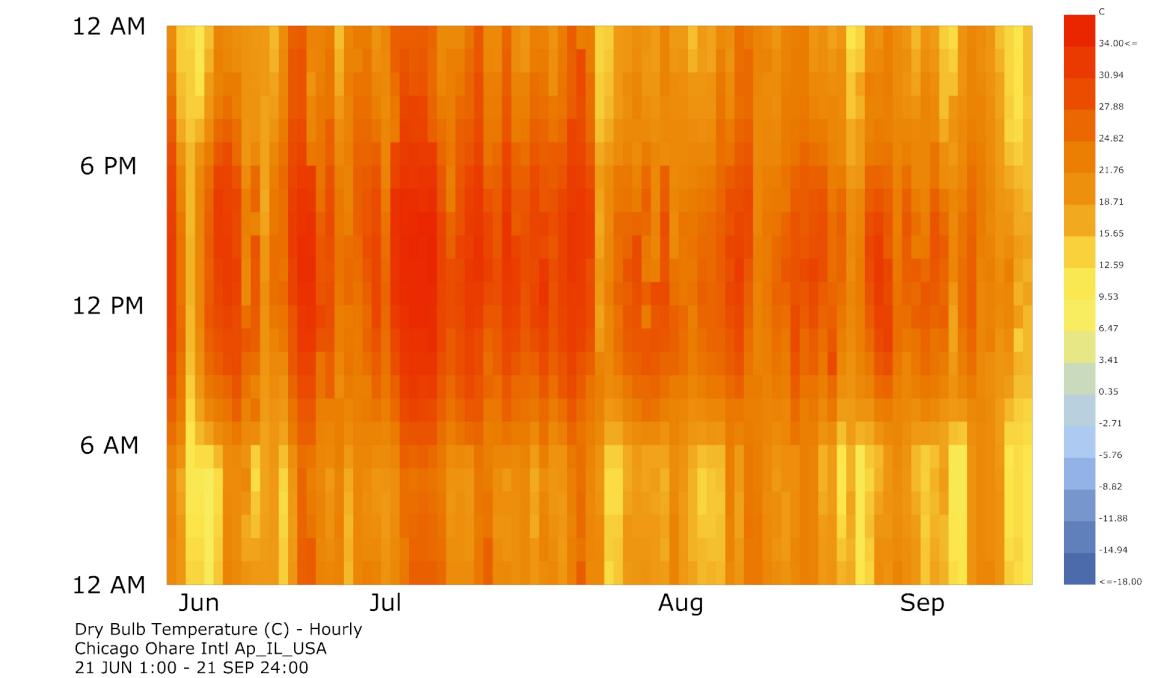
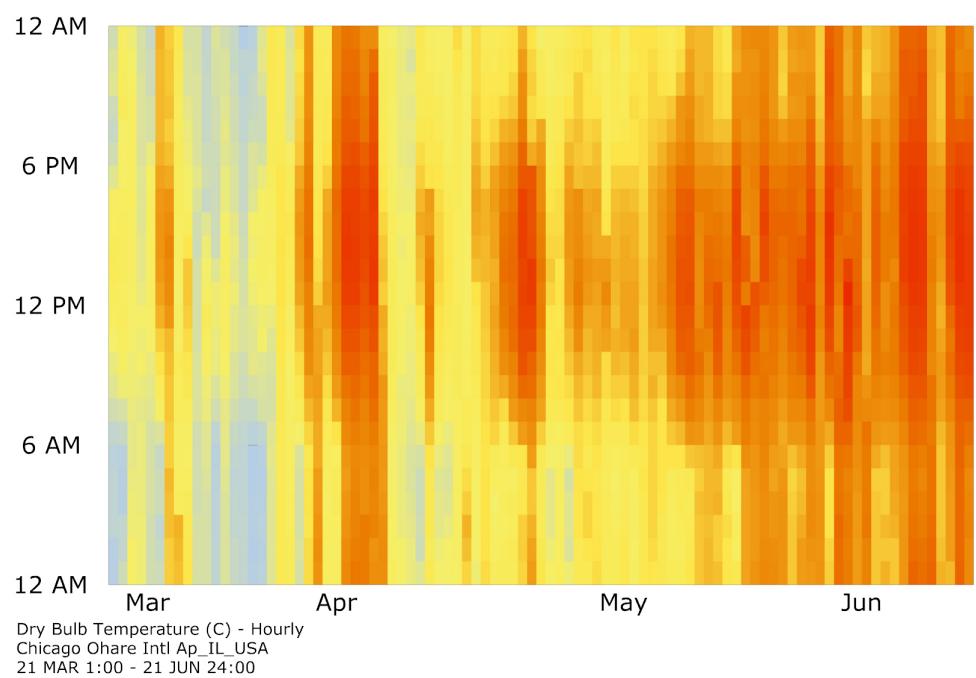
Summer: 1m/s

< v < 5m/s

Winter: 3m/s

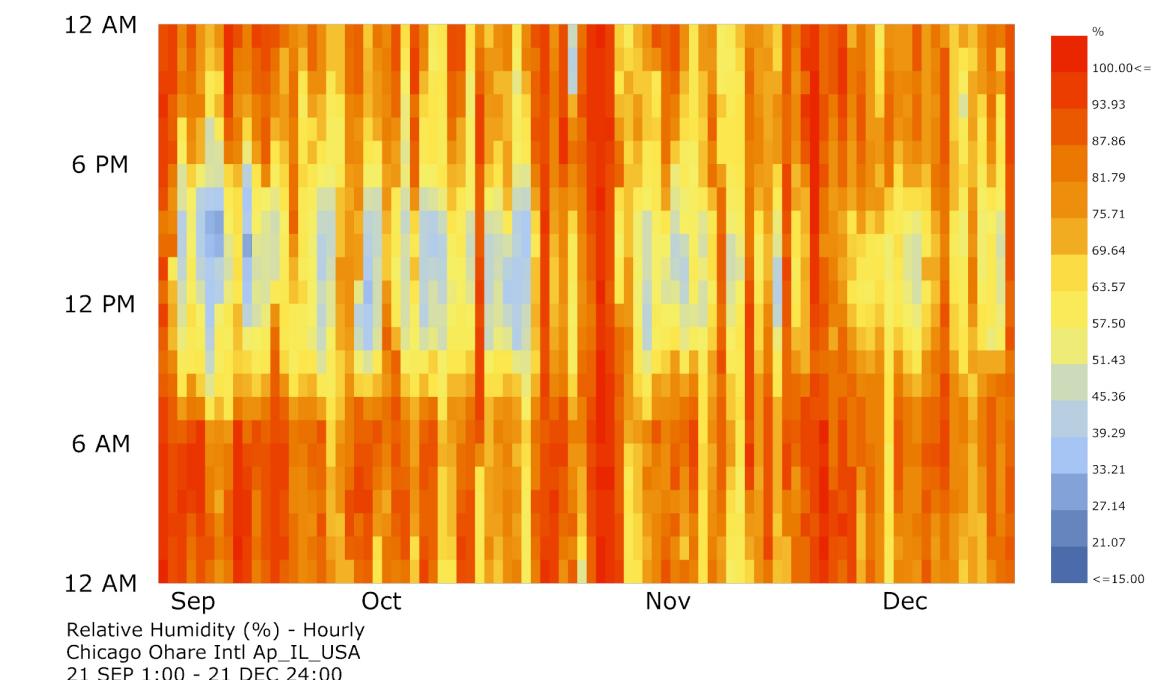
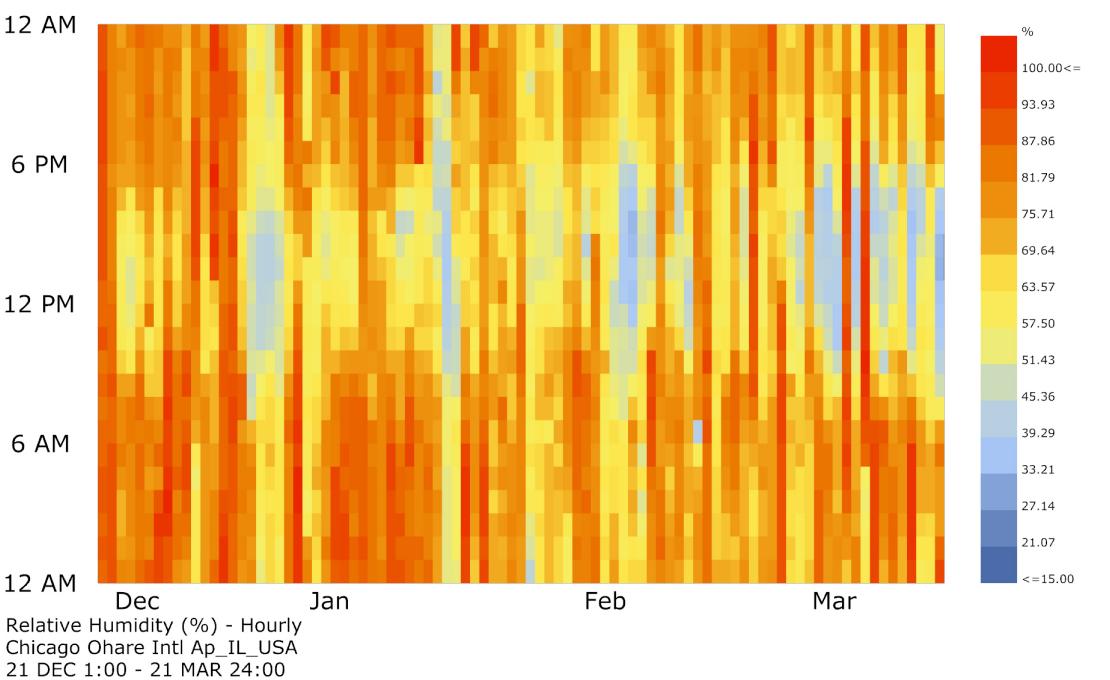
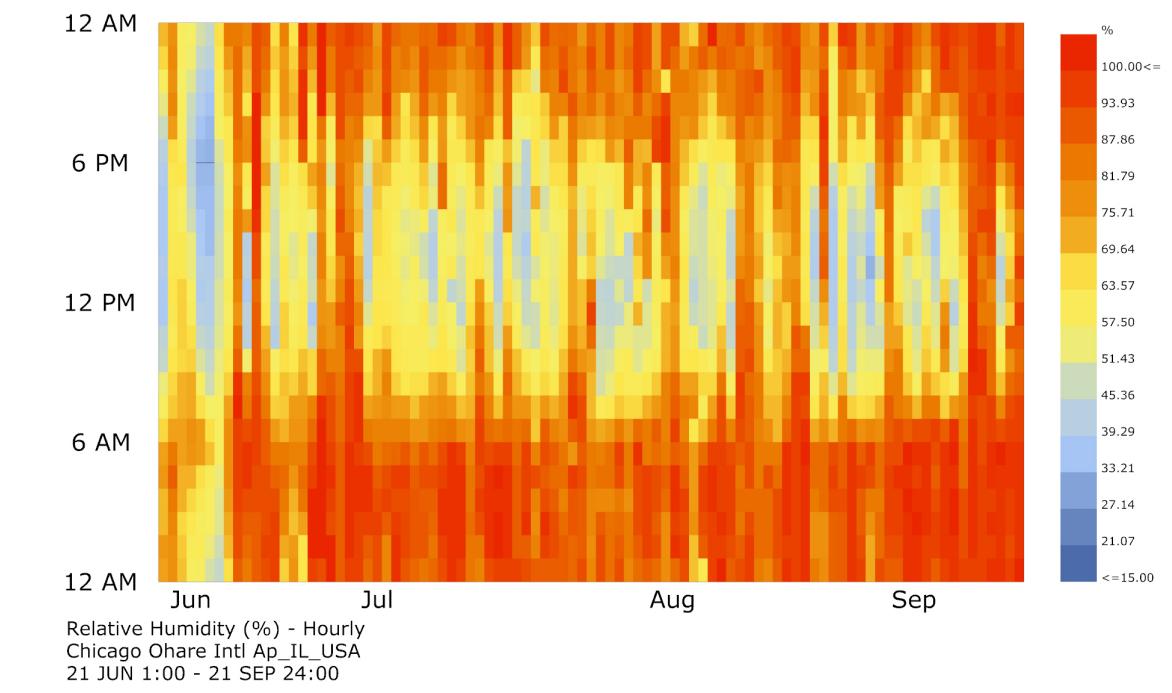
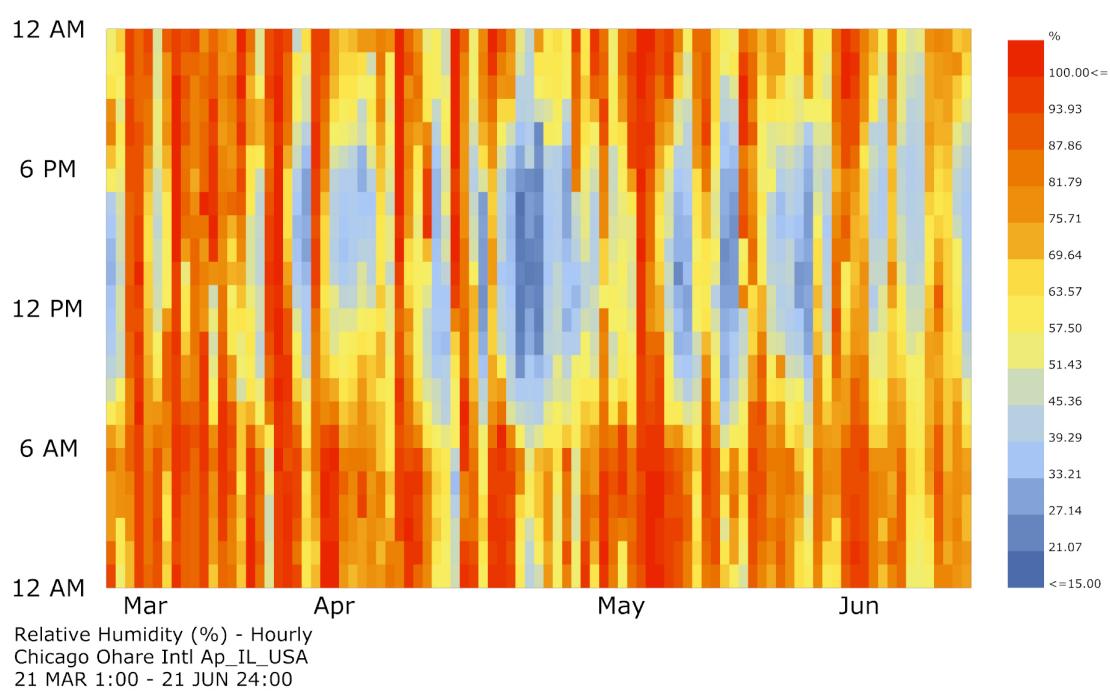
< v

During the year, most of the uncomfortable wind comes from the south direction. In spring



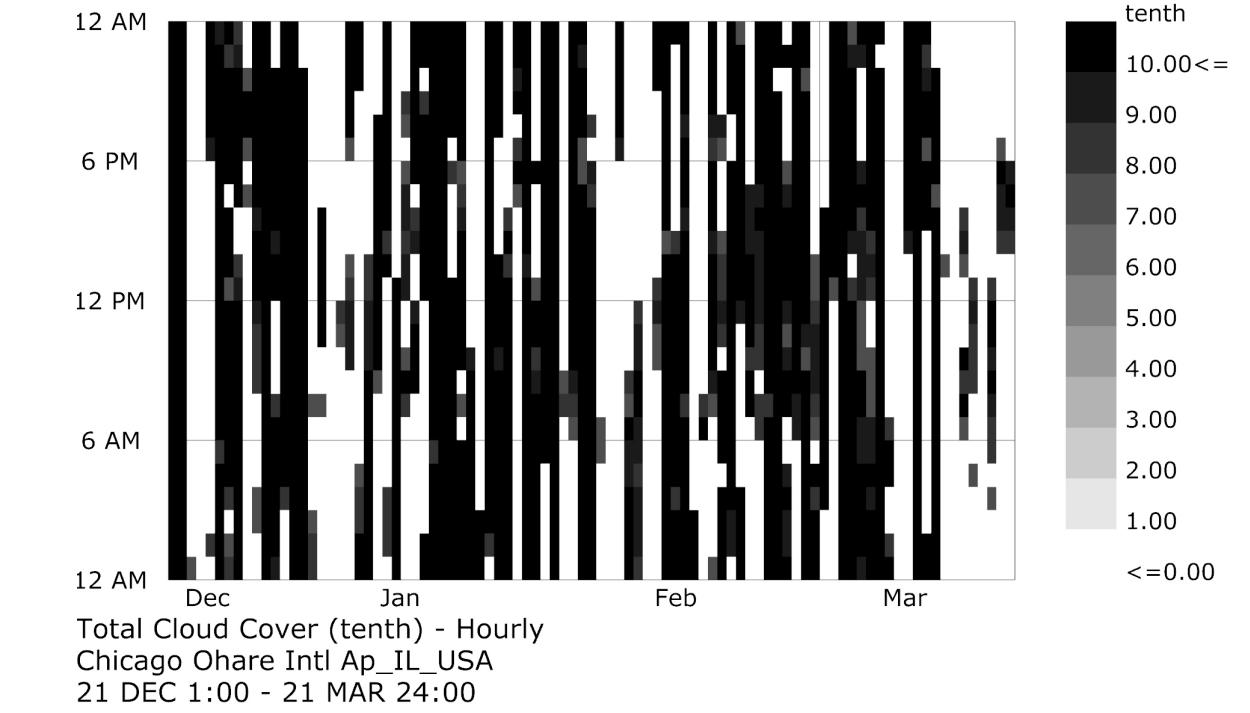
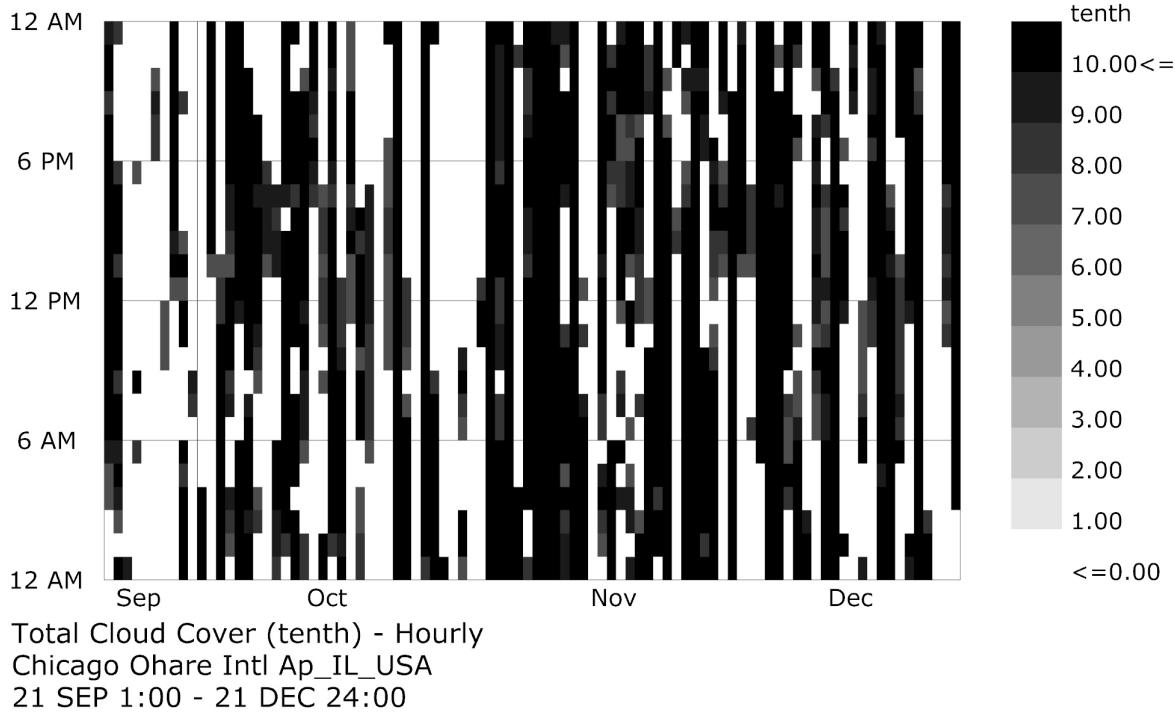
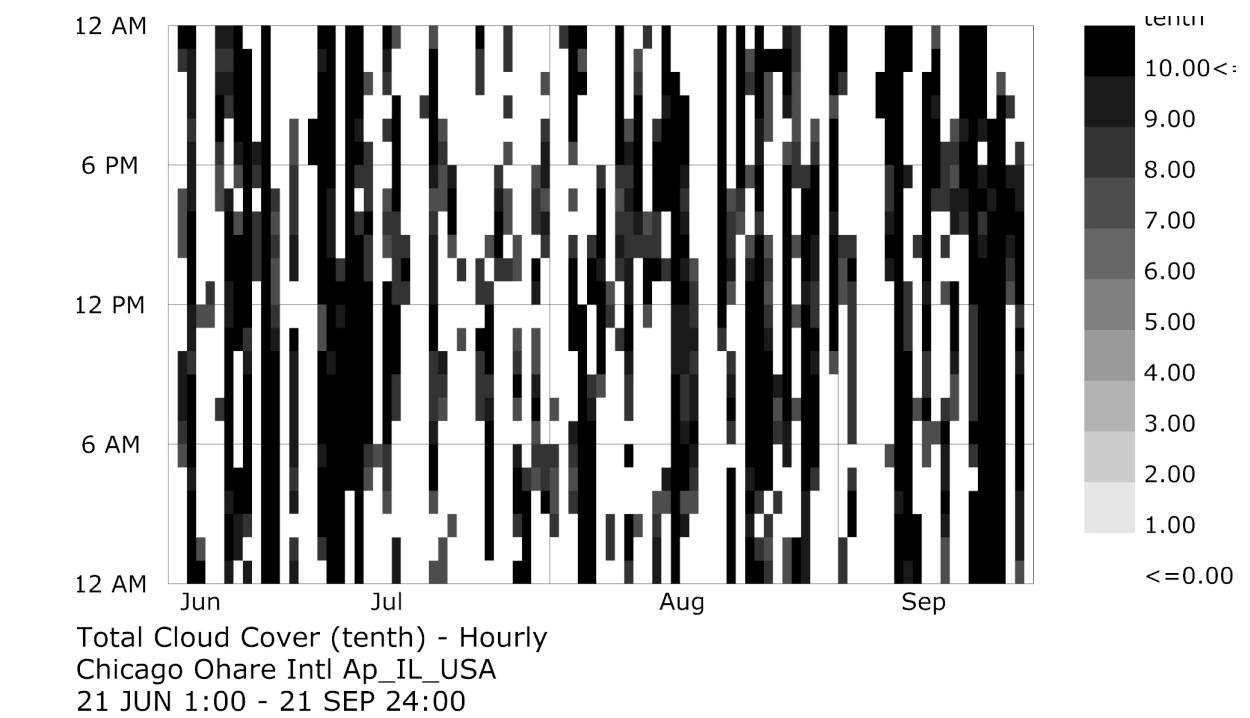
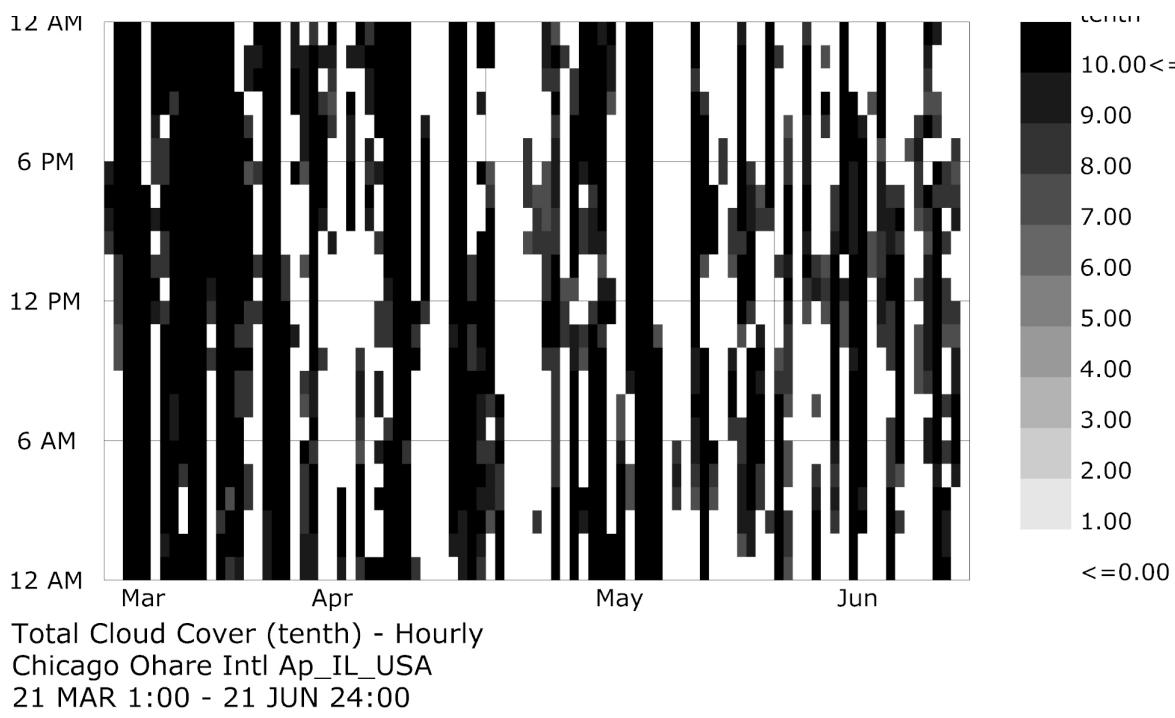
Relative Humidity

In a day, noon is always the dryest time. Spring is the driest season with almost 25% time when the humidity is less than 30%. Summer is the most humid season with more than half of the time when the humidity is over 70%



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.



Comfortable Condition Study

The comfortable condition for human is defined as:

$18^{\circ}\text{C} < T < 24^{\circ}\text{C}$, $2 \text{m/s} < \text{Wind Speed} < 8 \text{m/s}$

$20\% < \text{Humidity} < 80\%$

As the analysis shows, most of the comfortable condition appears during June and August. From December to February, there are no comfortable conditions existing in natural environment.

