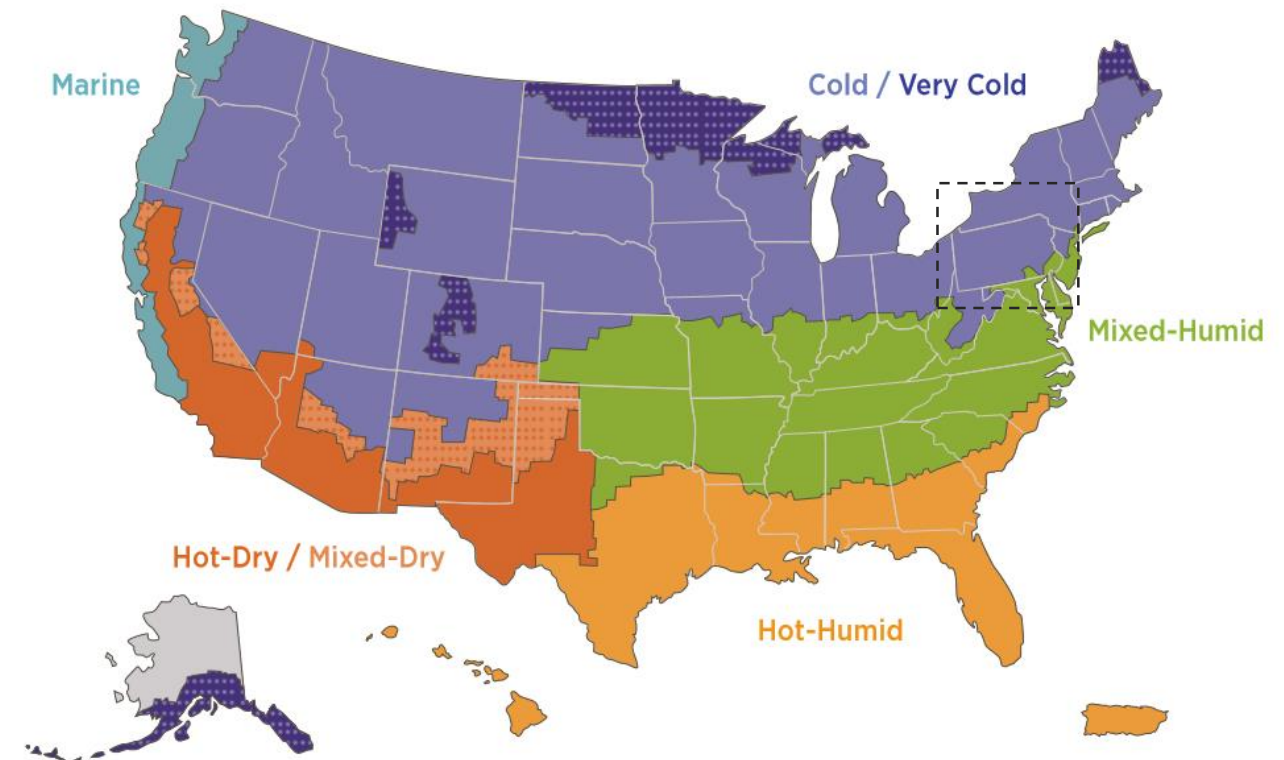


Climate Analysis for Thermal and Visual Comfort

Climate Analysis – Indoor Comfort Design Philadelphia

The Climate of Philadelphia comes under zone 4 which has very cold weather as a prominent feature. The main objective would be to tackle the effects of cold weather and create an optimum indoor environment.

Building America	IECC
Subarctic	Zone 8 (only found in Alaska)
Very Cold	Zone 7
Cold	Zones 5 and 6
Mixed-Humid	4A and 3A counties above warm-humid line
Mixed-Dry	Zone 4B
Hot-Humid	2A and 3A counties below warm-humid line
Hot-Dry	Zone 3B
Marine	All counties with a "C" moisture regime



Weather Data

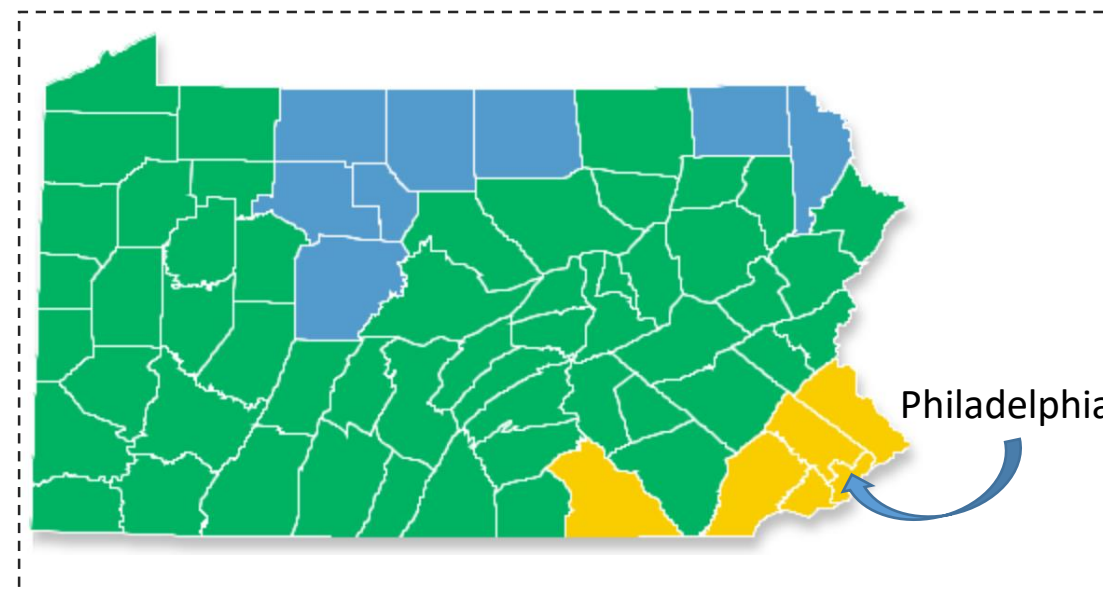
Philadelphia

Latitude : 39.57 (north)

Longitude : 75.10 (west)

Climate Zone : Zone 4 (except marine)

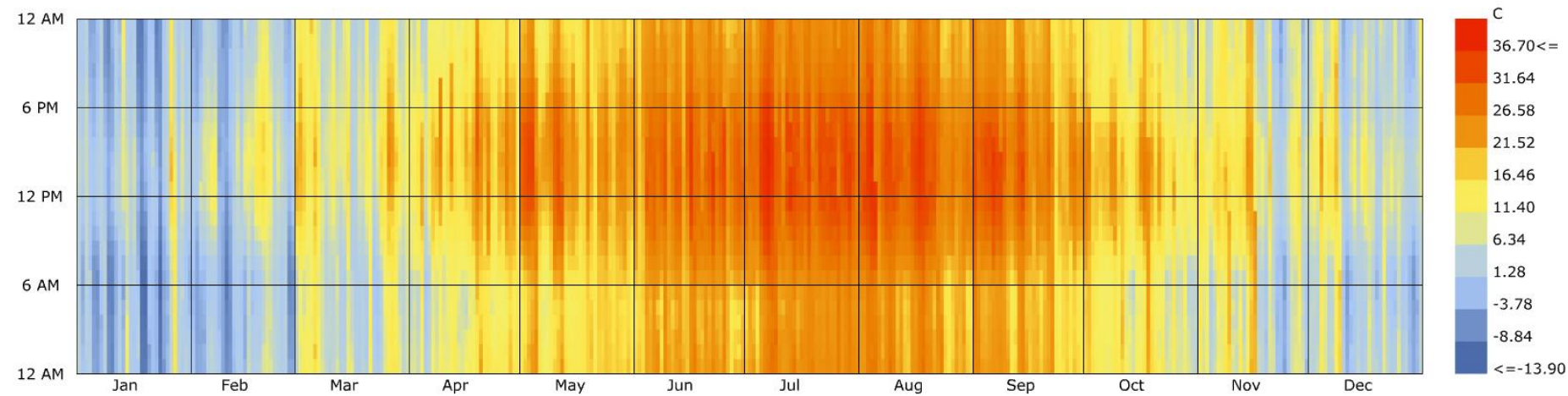
Characteristic : Cold / Very Cold



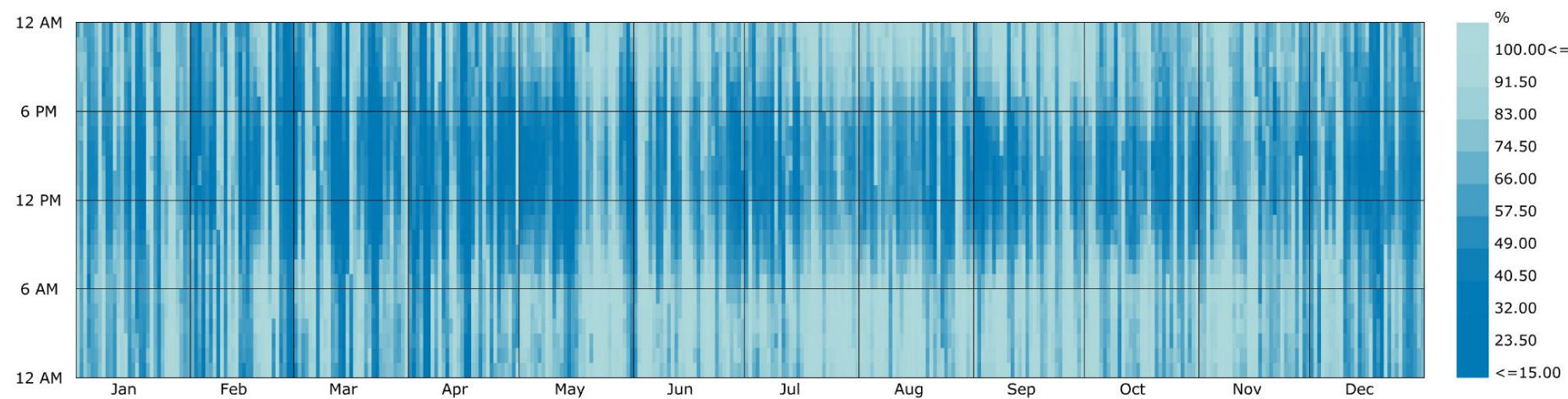
Climate Zone 4 (Except Marine)

Ceiling R-value	38
Wood Frame Wall R-value	13
Mass Wall R-value ⁱ	5/10
Floor R-value	19
Basement Wall R-value ^c	10/13
Slab R-value ^d , Depth	10, 2 ft
Crawlspace Wall R-value ^c	10/13
Fenestration U-Factor ^b	0.35
Skylight U-Factor ^b	0.60
Glazed fenestration SHGC ^{b, e}	NR

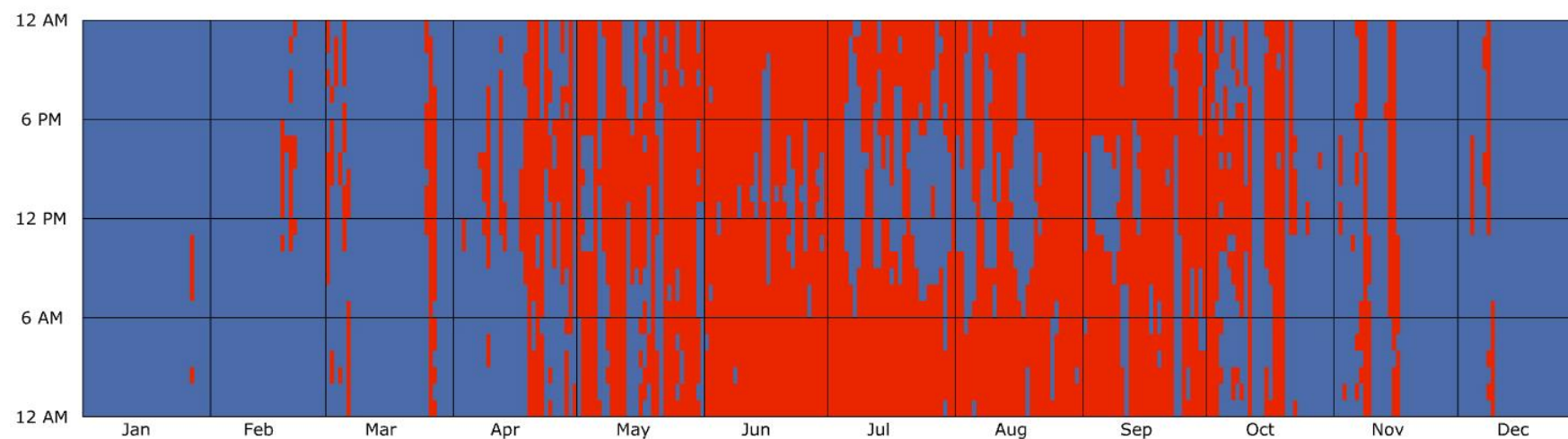
Climate Analysis – Indoor Comfort Design Philadelphia



Dry Bulb Temperature in Degree Celsius



Relative Humidity



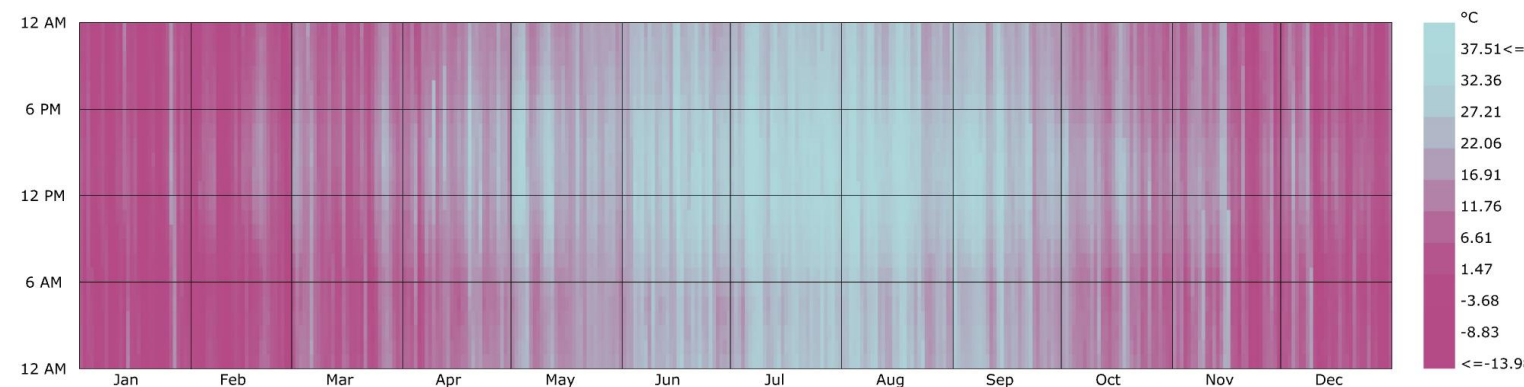
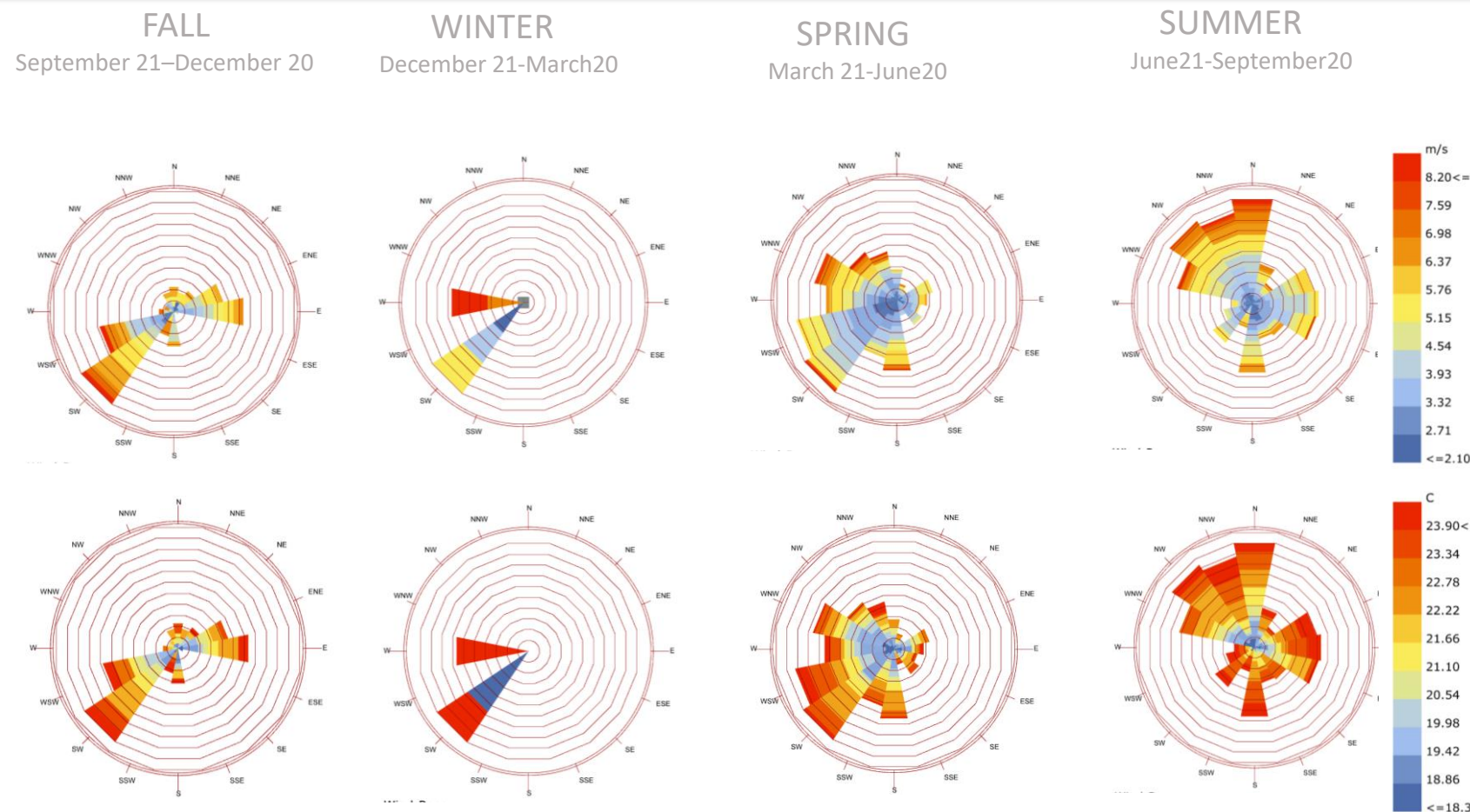
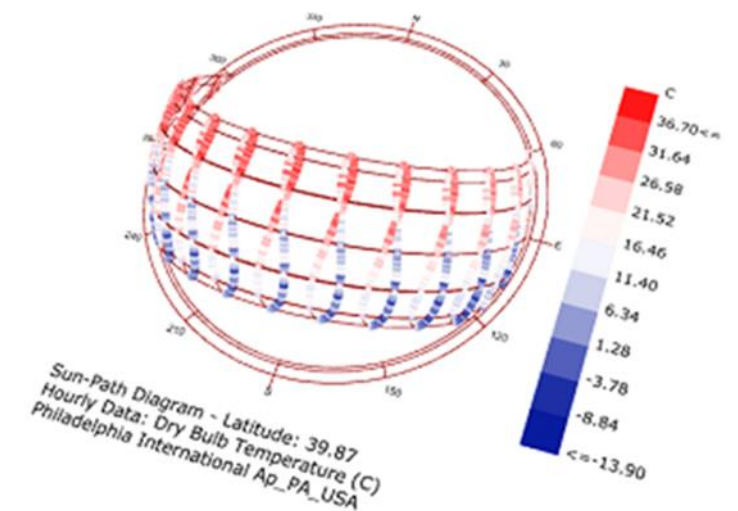
■ Comfortable ■ Not - Comfortable

The UTCI, or Universal Thermal Climate Index, meaning temperature of what the weather ‘feels like’. According to the UTCI, Philadelphia has around 41% of comfort, throughout the year. But as seen the crucial cold temperatures may go anywhere from -3 to -20 degree Celsius, between October to April. The humidity is high during the day time.

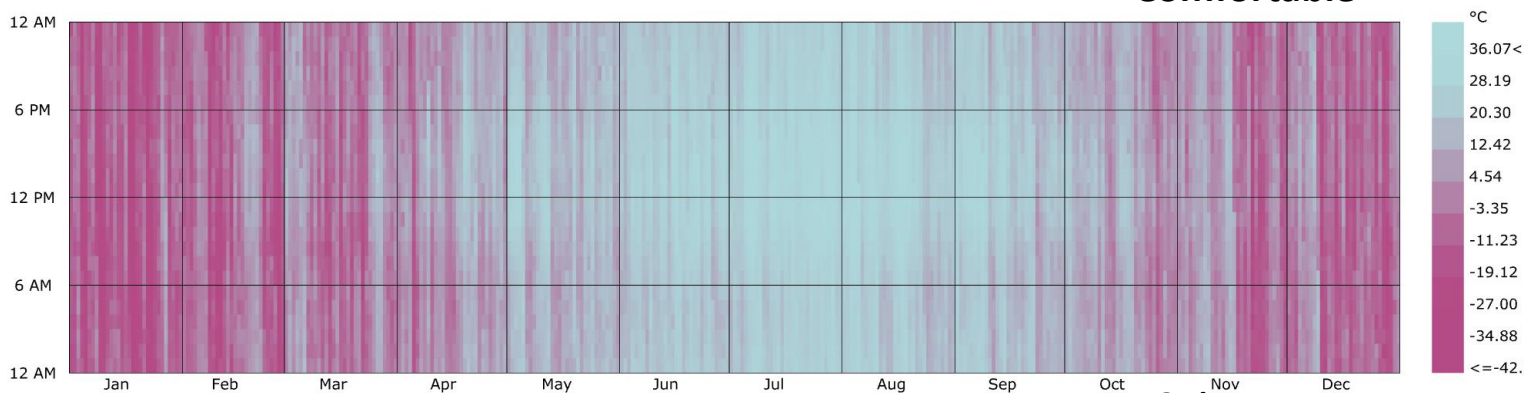
Climate Analysis – Indoor Comfort Design Philadelphia

The two UTCI mappings, show the difference in level of comfort with and without wind speed. The comfort level drops from 52 to 41 percent with the introduction of wind speed.

- North and North-west wind is prevalent in summer, whereas, during the rest of the year it is South-west winds which are prominent.
- The temperature of South-west winds during winter is low and thus, should be avoided.
- For the design of the building thus, a compact design with maximum sealed glass, and minimum openings would be preferred.
- The solar exposure needs to be capitalized during winter, whereas the exposure to direct sunlight needs to be reduced during winter.



41% Comfortable



52% Comfortable

With Wind Speed

Universal Thermal Climate Index (UTCI) in Degree Celsius (9-26 degree Celsius)

Without Wind Speed

Universal Thermal Climate Index (UTCI) in Degree Celsius (9-26 degree Celsius)

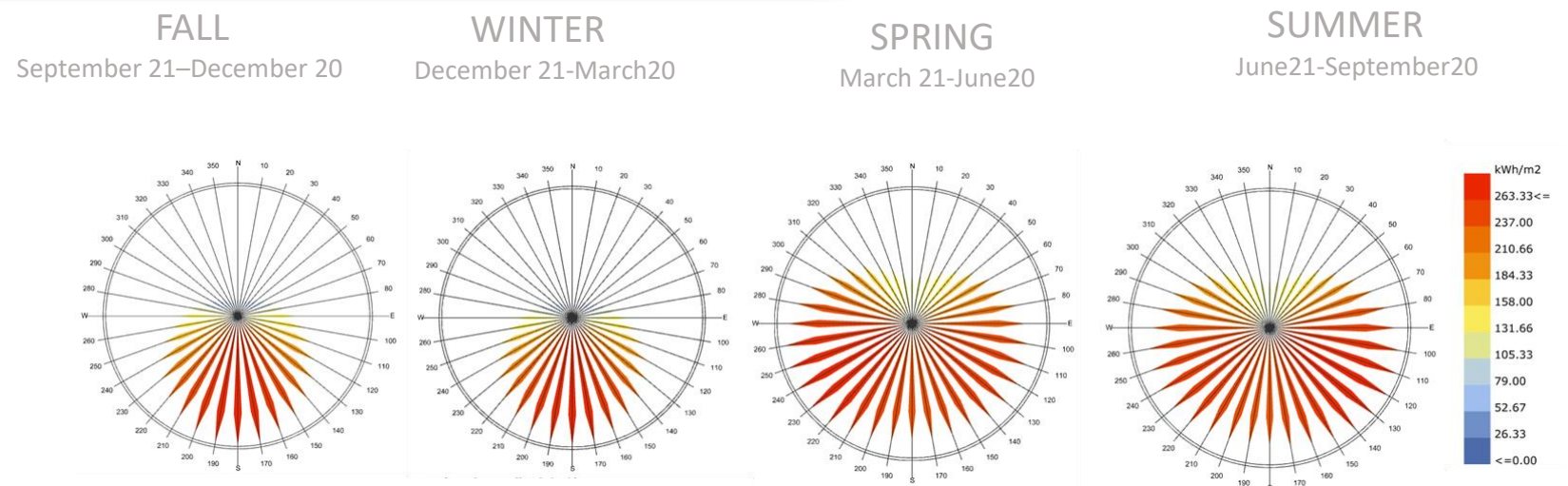
Climate Analysis – Indoor Comfort Design Philadelphia

The percentage of Comfort drops from 41% for outdoors to just 19% indoor.

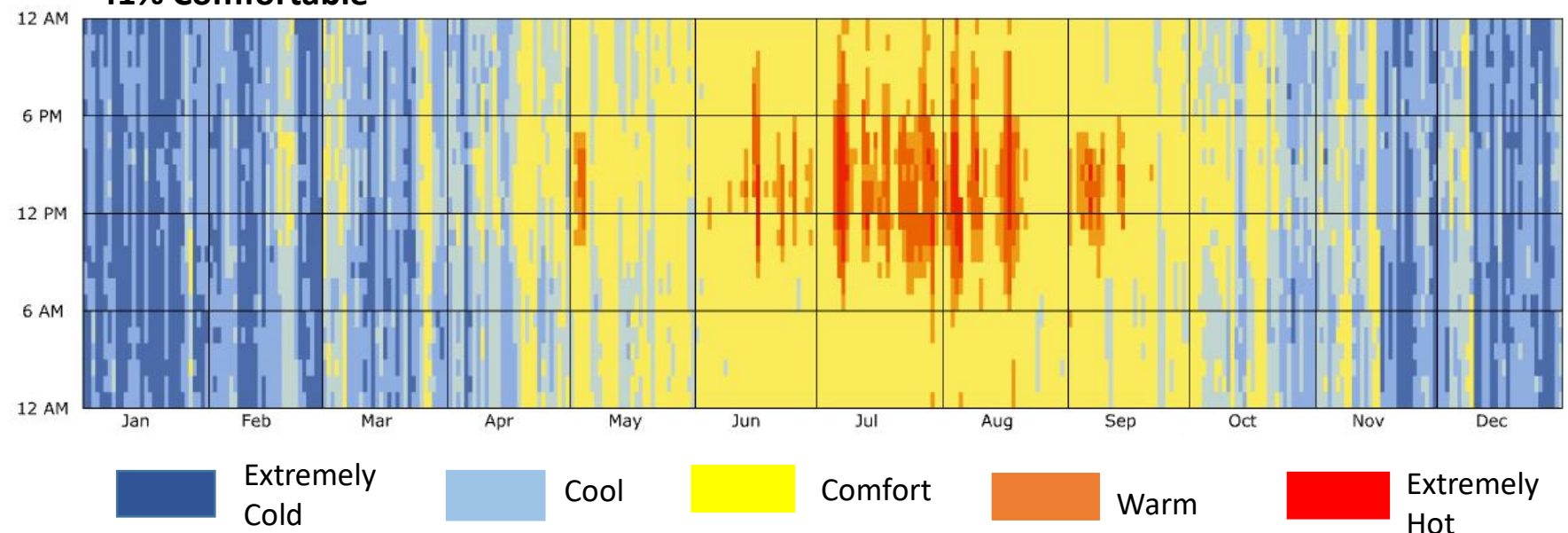
- Thus, to increase the temperature indoors, solar gains need to be maximized during the morning time, with hybrid methods (screens to keep the sun out during summers).
- As seen from the radiation rose, larger glass windows on South side can benefit from receiving the heat, but east and west sides need to be protected from sun penetration, as this can lead to uncomfortable environment during summer and spring.

Design Strategies

1. Compact planning of the building for minimizing heat loss.
2. Windows to be sealed majorly, partial openings to be provided on North and North west side to use ventilation during Summer.
3. Orientation – longer side preferably parallel to North – South direction, so as to increase direct solar heat gain during winter.
4. Horizontal shading on South façade, in the form of brise-soleil, light shelves and overhangs would contribute to building heating in winter.
5. Lovers, screens and blinds on East and west Façade to avoid afternoon Sun during Summer, these shouldn't be fixed rather adjustable by users, as in Spring the radiation can be used for increase in comfort levels.



Outdoor 41% Comfortable



Adaptive Comfort (Indoor) 19% Comfortable

