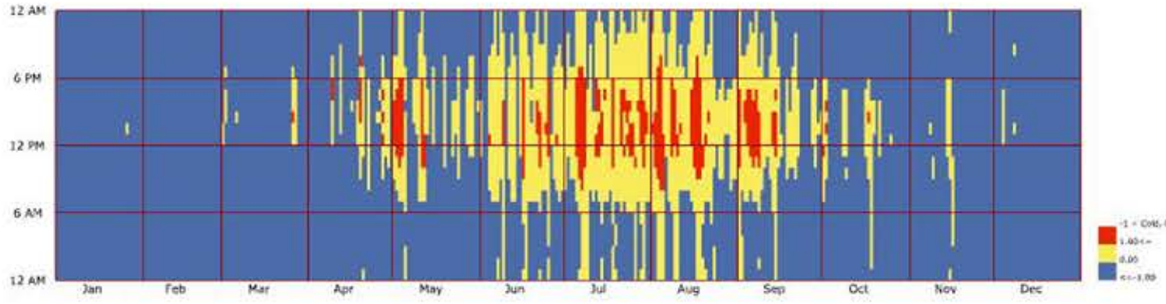
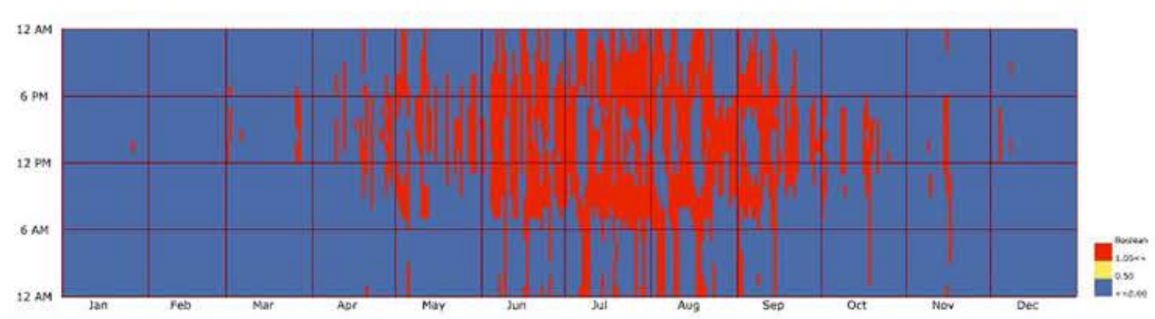
Analysis of Philadelphia's Weather Based on Thermal Comfort

Based on thermal comfort calculations and comfort charts using ladybug, it seems that people in philadelphia are not much comfortable in general. With regards to the climate, cold weather is more problamatic than hot weather since the amount of times which is colder than the comfort zone is much more than hot days. So design strategies should be more allocated to perevent cold weather than to provide solutions for hot weather.

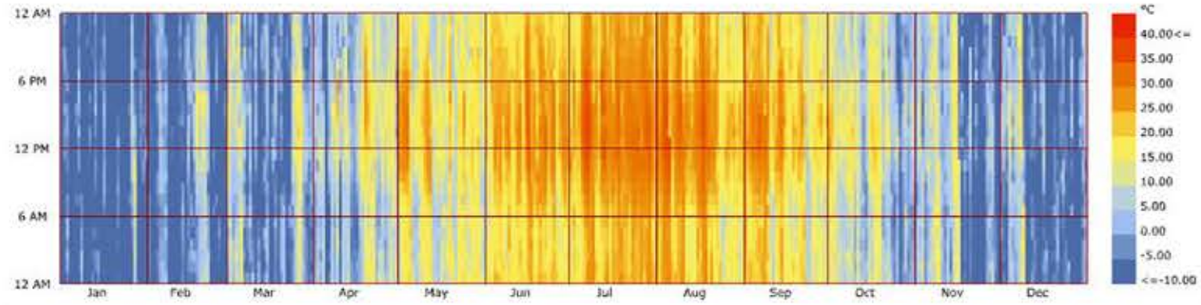


Adaptive Comfort

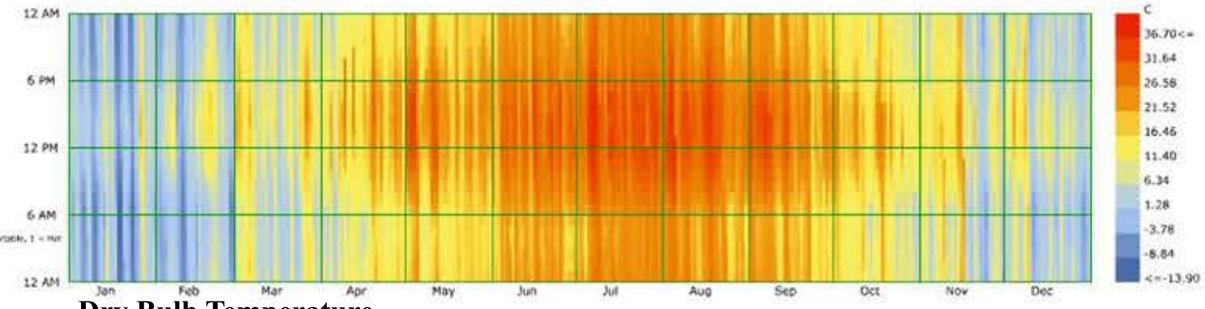


Comfortable or not

According to calculations, only about 20% of times people are comfortable. As it is shown in the adaptive comfort chart and comfortable or not figure, Fall and Winter are the seasons which has brought uncomfortable situation for residents. There is almost always uncomfortable situation in these seasons, so the effort should be put into provide better condition in these seasons.



Universal Thermal Climate Index

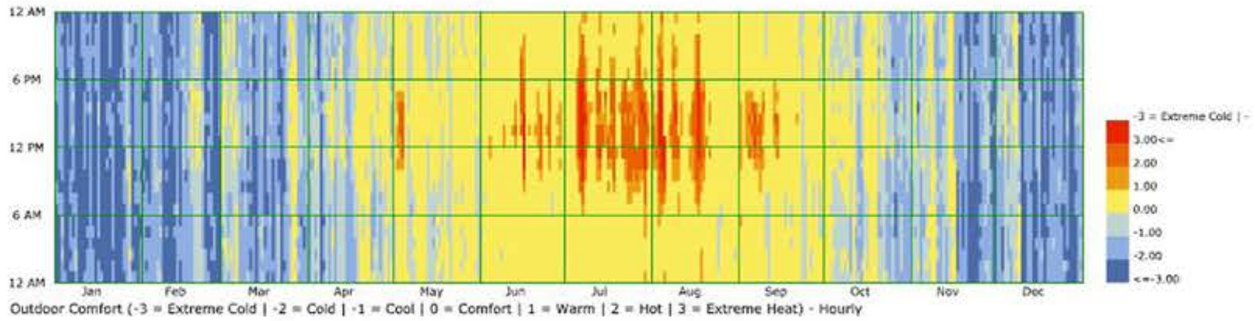


Dry Bulb Temperature

Here we can see a comparison between the actual Temperature and Universal Climate Index Temperature which is in fact, the feels like temperature. Universal Climate Index Temperature is a parameter to understand the temperature which people feel rather that what it is. In Philadelphia, it feels cooler than it seems. In cold seasons, it is a bit colder than the actual temperature and in hot seasons there are less times in which the weather gets really hot.

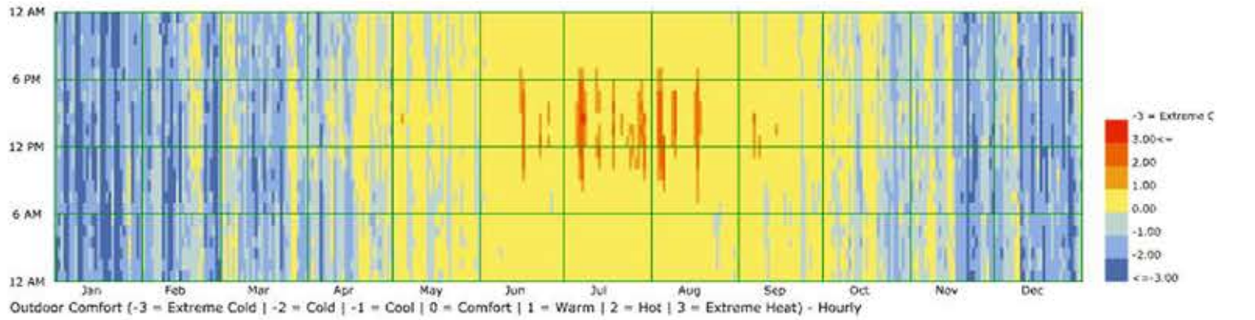
So in the design strategies, these differences can be taken into consideration. As a result we should think of a way that we can get more sun in the houses in Winter and Fall and the solution may be to use larger windows with automatically controlled shadings so that when needed the shading would protect occupants from the sun and in cold seasons, the shadings would allow the sun light to warm the houses.

As in outdoor comfort and the comparison between outdoor comfort with and without solar radiation, it seems that when solar radiation is taken into account, it is much more better than the percentage of comfortable hours become higher. Apparently, during Summer and Spring it is pretty much comfortable outside but in Fall and Winter it is mostly colder than what is considered as comfortable zone.

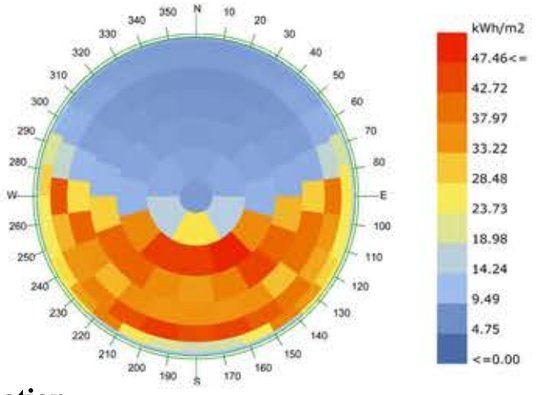


Outdoor Comfort without Solar Radiation

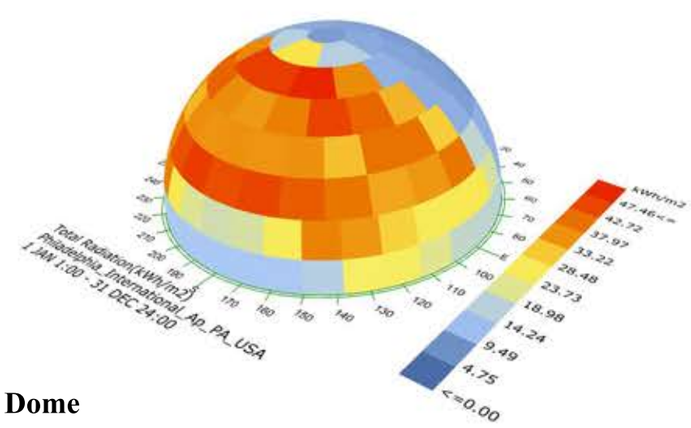
With regards to solar radiation, the highest radiation can be seen in the south. And it north nearly there is not any radiation. There is an overall diffused radiation towards all directions, but direct radiation mostly happens in south and east-south and west-south. So in the design strategies, it is important to locate windows and even solar panels towards south when we want to use solar radiation and sun light.



Outdoor Comfort with solar radiation

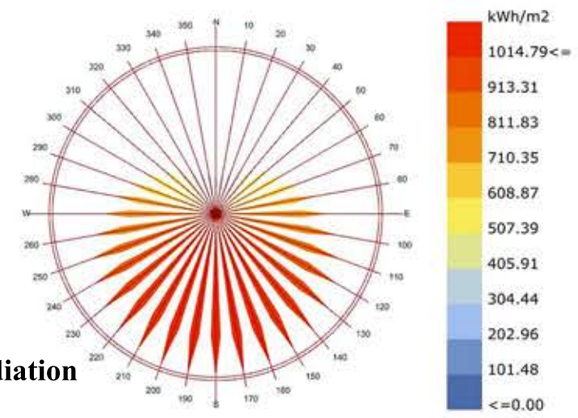


Total Radiation

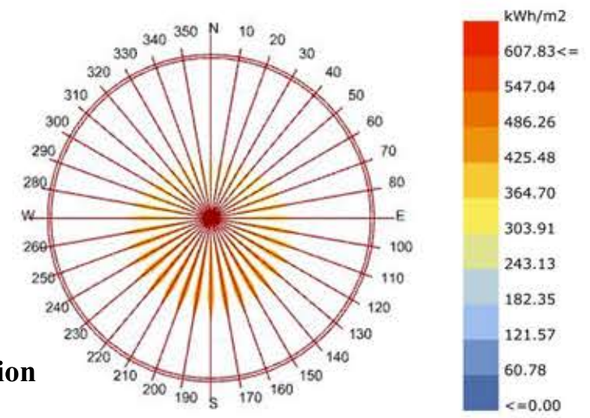


Sky Dome

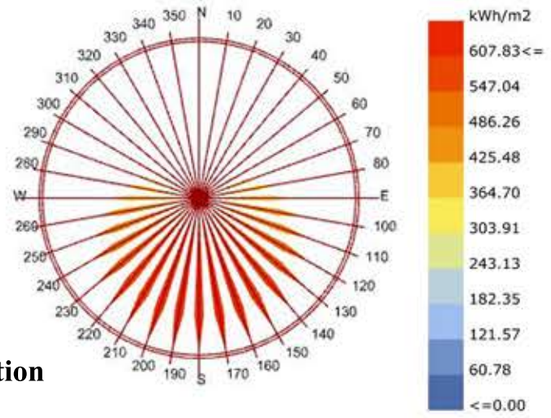
As it can be figured out from the Sky Dome, althought the direct radiation is mostly from the south, but the angle of sun is higher than radiation from east and west. Consequesntly, we should be more concerned about west and east radiations. On the other hand, when it comes to using sunlight, south is the best direction to think of.



Total Radiation



Diffused Radiation



Direct Radiation