Introduction

Microclimates are local zones where the temperature, wind speed, humidity *etc.* differ from the surrounding area. Microclimates may be as small as a few square meters (in the shade of a tree) or as large as many square miles (ex. an entire valley). Microclimates can be present near bodies of water, which have a cooling effect, or in urban areas man-made features absorb energy from the sun, heat up, and then return the heat back into the air in the form of infrared radiation.

You may already be familiar with microclimates yourself. On a hot summers day you may have sought the shade of a tree to cool yourself or during the winter you found shelter behind a windbreak.

This walk has been designed to expose you to different microclimates on campus that may be similar to those around your school or home. As you walk along, use your Kestral 4500NV weather meter to measure temperature, dew point, humidity, wind speed and wind direction and with the laser thermometer surface temperatures. Record your results in the table on the other side.

The Kestral 4500NV

Turn the device on with the button in the top right. Wait 3 to 4 minutes for the instrument to stabilize. Do not turn it off till you have finished the walk. Use the UP and DOWN buttons until you reach the category you are looking for. The four icons you will use on this walk to make your measurements are shown below:

You can also use the LEFT and RIGHT buttons to cycle betweens screens to see the current values and also the maximum, minimum and average. Once the instrument has stabilized, press the button that looks like a camera to hold your measurements while you record them. Bring along a narrow strip of paper tissue that you can use to determine the direction the wind is blowing. Figure 1 shows the location of the stops.

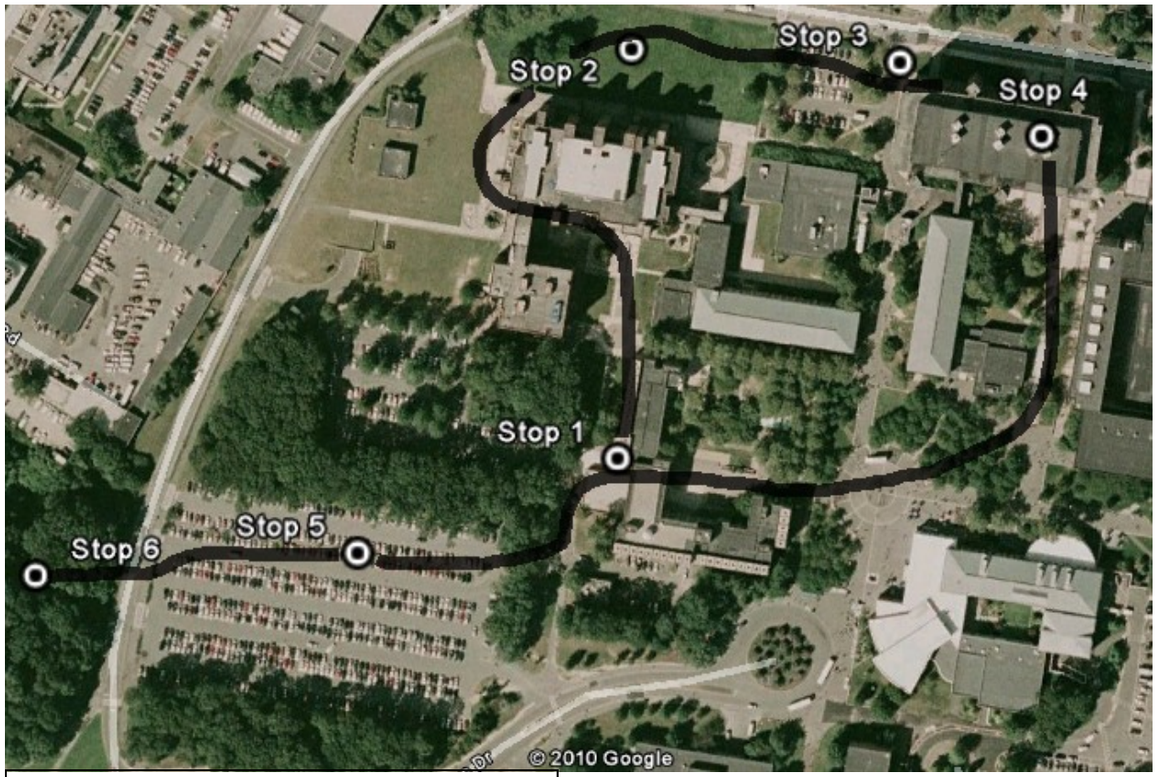

Figure 1 - The circles with the dots are the stops on this walk.(~Google Earth)

1. Bottom of ESS steps (at breeze way)

You should be standing at the bottom of the stairs now. This structure tends to allow the westerly wind to travel between the two parts of the ESS building. The faculty lot to the West is lined with trees in an east-west direction. This allows the west wind to spiral into the stair area producing a relatively high wind speed. This area gets more sunlight in the afternoon and therefore the temperature will depend on what part of the day it is but overall because of the amount of concrete, the temperature may be higher here compared to some of the other stops you make. Measure the surface temperature of the concrete. Now walk west to the corner of the building, has the wind speed changed here? How about the direction? What possible causes would there be for any differences? Measure the surface temperature at the top of the stairs. How might the difference in surface temperature affect the wind?

2. Grass field in front of Physics

This grass field is the most landscaped area on this walk. After collecting your data, what differences do you notice from the previous stop? The humidity here is usually higher. This is due to the grass that covers the area and the soil it grows in because vegetation and soil retain moisture. Water takes longer to heat than does air which is why its generally more comfortable to lay on the grass on a hot day. How would this location feel on a cold winter day when compared to a warm summer day?

3. North West Corner of Chemistry

You should be standing in the shade of the building at this stop (see Figure 2). What is the first thing you notice when entering this area? Is it colder or hotter? This location is generally cooler since it is shielded from the sunlight. The reason is that the Sun rises in the East and sets in the West; all while staying on the south side of the sky at our latitude. Hence this area remains shady most of the day. How about the wind? On a broad scale, a windy day is more dramatic in this area because the wind strikes the west side of the building and swirls around to where you are standing. This is similar to the effect you felt at stop 1.

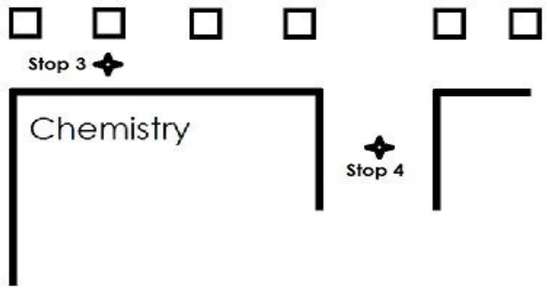

Figure 2 - More detailed locations of stops 3 and 4.

4. Breeze way under Chemistry

Compare your results here those at stop 3. What changed? A northerly wind allows for very high wind speeds in this area. This is similar to the wind tunnel effect you may have felt at the first stop.

5. ESS Parking Lot

This location is unique in physical characteristics when compared with any of the other stops on the walk. Can you tell why? What is

different here? This area has been completely paved over. The pavement blocks the lands natural ability to release the heat it receives throughout the day. The result? It will generally be hotter on a sunny day and colder here because of the lack of vegetation.

6. Stream Valley

What do you notice that is different at this location compared to the others? The area gets shade from the trees and has a stream. What effect does water have on the temperature? Water retains heat and helps to regulate the temperature, Are the humidity values higher at this spot? Why or Why not? Temperatures stay lower during the summer and warmer during the winter because of this regulation. Lastly, the winds may be lower than other stops because of the shielding provided by the trees and the valley walls.

Date:

Weather :
(sunny, cloudy, rainy, snowy)

Barometric Pressure (mb):

Stop	Time	T (^oF)	Surface T. (^oF)	Humidity (%)	Dewpoint (^oF)	Wind Speed	Wind Direction
1							
2							
3							
4							
5							
6							
1							

Stop 1 Comparison and Wrap-up

Return to Stop 1 (the ESS steps) and record your measurements again. Did you notice a change? In the time that it has taken to complete the walk there may have been changes, such as the angle of the Sun, the abundance of clouds, precipitation may have started or stopped etc...

- What changes did you see at stop 1 between the first and last measurements? If any, explain why.
- Given a different weather condition than has been seen today, what could you predict about the conditions at each of the stops?
- The barometric pressure on a standard weather day is 1013mb, lower pressure signifies poor weather while higher provides far weather, How does your reading for the day compare to that?

Green Design Implications

There are many things architects can do to use mother nature. Taking advantage of prevailing winds with turbines and placing solar panels on south facing walls and roofs could provide a source of renewable power. The energy from the sun could also be utilized for solar water heating to reduce electricity usage and the buildings carbon footprint.

In addition, rooftop planting encourages the return of carbon emissions back into vegetation and also stabilizes temperatures to reduce the Urban Heat Island effect in large developed areas. Can you think of any more ways to improve the energy consumption using the elements learned on this walk?

Definitions

Dewpoint - the temperature at which water vapor in the atmosphere will precipitate, in effect, as an air mass cools it is able to hold less and less water.

Humidity - the amount of water vapor in the air, expressed as a percentage of the maximum amount that the air could hold at the given temperature.

Dewpoint/Humidity Relationship - there is a direct relationship between humidity and dewpoint. As the dewpoint temperature increases, and the difference between temperature and dewpoint decreases, there is more water vapor in the air and so percent humidity increases along with it.

Urban Heat Island - the higher temperature found over and around an urban area created by the release of solar energy from the solid fabric of the buildings, roads etc., coupled with energy released by human activity such as lighting, heating, air-conditioning and/or vehicles and industry

Created for the Earth Science Research Project for Teachers of Earth Science and their students

Copies of this guide and guides to other science walks may be downloaded at www.geo.sunysb.edu/esp/

Microclimates of Stony Brook University

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