Evapotranspiration

Steeven Imbaquingo[1,4], Selma Skoko Dobryansky[2,4], Shohreh Didari[3,4], and Hamidreza Norouzi[2,4]

[1]Manhattan Bridges High School, [2]New York City College of Technology, [3]Shiraz University, [4]CUNY CREST

ABSTRACT

- The way evapotranspiration works is by using latent heat, in which latent heat converts liquid water from oceans and vegetation to vapor. Latent heat comes from energy balance, which is an equation. I am going to be focusing on evapotranspiration in New York from 2000 to 2013. All the evapotranspiration files were obtained from MODIS and we downloaded and put the evapotranspiration files into MatLab. We want to see if the data has a pattern and explain why evapotranspiration has a pattern. However, energy balance is important to evapotranspiration because it helps agriculture increase, and leads to better crops, and helps to maintain water resources.

INTRODUCTION

All environmental processes are affected by the amount of available energy. The energy that comes from the sun is exchanged between the atmosphere and the earth surface.

Energy balance is an equation that has components called net radiation, sensible heat, and soil heat flux, and it is equal to latent heat.

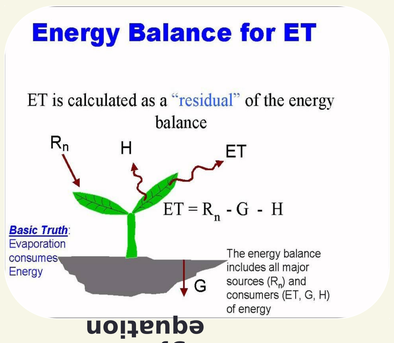


Figure 1: The energy balance equation

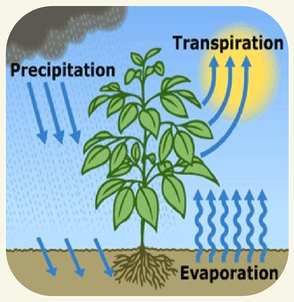


Figure 2: Evapotranspiration process

$R_n - G - \lambda ET - H = 0$

$Rn - G - H = \lambda ET$

Net radiation (Rn) is the net solar radiation coming from the

sun. Sensible heat (H) is the heat that the air carries. Soil heat flux (G) is when the soil or ground stores the sun radiation. The difference of all the components will be equal to latent heat (λET) which is the change of matter. **Figure1** shows the equation of energy balance,

Evapotranspiration is important to us in order to mange water resources. Evapotranspiration (**figure 2**) is the combination of evaporation and transpiration. Evaporation is converting liquid water to vapor from surfaces. Transpiration also converts liquid water to vapor from vegetation.

Remote sensors collect data by detecting energy that is reflected from earth. MODIS stands for Moderate Resolution Imaging Spectroradiometer and they have two types of satellites called Terra and Aqua. MODIS has different products to analyze Earth's environment.

OBJECTIVES

- What is energy balance?
- What does each component from energy balance mean?
- What is evapotranspiration?
- How has evapotranspiration changed in New York from the years 2000-2013?

METHODS

- Find the evapotranspiration data in MODIS product. I found the MOAD16A2 data, which is 8-day evapotranspiration data.
- MODIS data has a sinusoidal projection, which is shown in **figure 3**. We look for the New York tile which is h12v04. Then we download the data from 2000-2013.
- Create a MatLab code in order to analyze the evapotranspiration data.
- Find the average of evapotranspiration in every 8-day period for the whole region of New York, which then we plot.

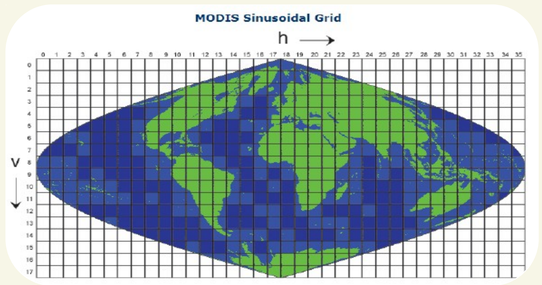
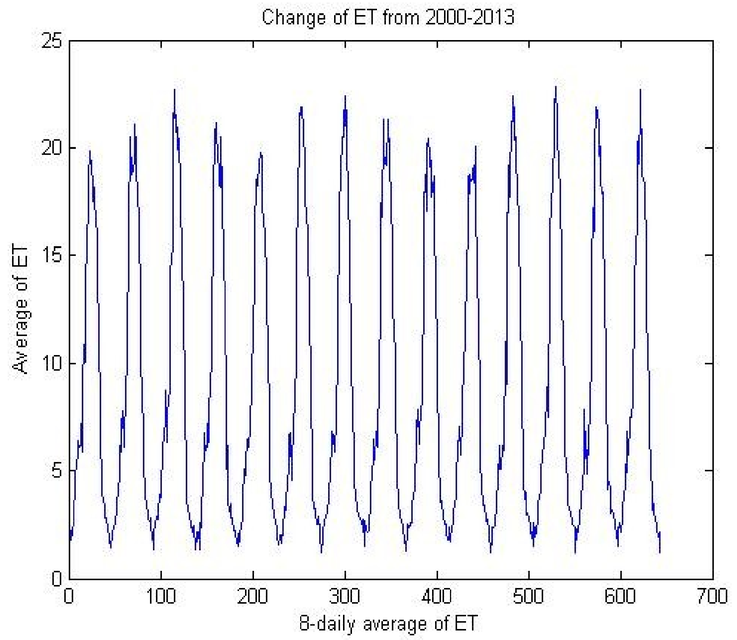


Figure 3: The MODIS sinusoidal projection

Focusing on New York State

RESULTS

- When I run the code, it gave me a line graph, and the picture below explains the 8-day average of evapotranspiration. It shows the pattern below because of seasonal changes. The graph shows high and low data because when it is summer there are high levels of evapotranspiration and when there are low levels of evapotranspiration it means it is winter.



CONCLUSIONS

- During the summer, evapotranspiration is higher and during winter is lower and that is why we see a pattern of high and low in New York from 2000-2013. The reason evapotranspiration is higher in summer is because the days are longer and we receive more solar radiation and the reason why it is lower in the winter is because the days are shorter and we receive less solar radiation.

ACKNOWLEDGMENTS

Thanks to my mentors: Selma Dobryansky, Shohreh Didari, and Professor Hamidreza Norouzi

This research was support-ed by NOAA CREST (NOAA CREST–Cooperative Agreement No: NA11SEC4810004) and funded by The Pinkerton Foundation.