

Monitoring Nearshore Stormwater Runoff within the Great Lakes

by

NASA DEVELOP - Wise

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Opening statement:

Great Lakes, the largest supply of fresh water on Earth. It is a system of five lakes: Lake Superior, lake Michigan, Lake Huron, Lake Ontario and Lake Erie. And it is a home to more than 30 million people in the United States and Canada. It also provides habitat to thousands of species of plants, fish, waterfowl, birds and mammals.

In spite of their large size and a magnificent system, with more than 10,000 miles of coastline and 30,000 islands, the Great Lakes are sensitive to the effects of a wide range of pollutants and are now threatened by serious environmental problems.

Introduction:

Hi, my name is Sindhu Ethamukkala and I am working as an Intern for the NASA DEVELOP program to study the impact of stormwater runoff on the Great lakes. This study would be useful for the policy makers in establishing a baseline for future sustainable growth.

Great Lakes Water:

Great lakes waters are adversely affected by the ever increasing urban growth and agricultural practices. Some of the sources of pollution include: The runoff of soils and farm chemicals from agricultural lands, waste from cities, discharges from industrial areas and Leachate from disposal sites.

Addressing the issue:

With all the damage done to the lakes, do we still stand a chance of restoring the priceless treasure back to its original form?

Yes, but with dedicated efforts.

For that we first need to analyze the condition of the lake and identify the factors causing the damage. Next, we need to take necessary decisions and implement them meticulously. In this regard, our project started by analyzing one of the lake's areas of concern and will be further extended to the remaining areas in the coming terms.

Area of Concern:

Our area of concern is located at the Mouth of the Maumee River which drains into Lake Erie. Lake Erie experienced early and intense development of its lands for agricultural and urban uses. It was the first of the Great Lakes to demonstrate a serious problem of eutrophication because it is the shallowest, warmest and naturally most productive.

Maumee River discharges more tons of suspended sediments per year than any other tributary to the Great lakes. This is due to the high percent of cultivated crops. A portion of this sediment is trapped in Maumee Bay, demanding annual dredging to keep the Port of Toledo open.

Analysis:

To analyze the amount of sediments and the type of pollutants that are entering into Lake Erie, we try to calculate the stormwater runoff volume from various catchments in the Lower Maumee watershed.

To do this, data from various sources have been collected and processed. And the process involves: Delineating the Lower Maumee watershed using Hydrological unit data, generating drainage line by applying ArcHydro tools to DEM data, identifying catchment areas and drainage points and finally calculating water runoff using winTR-20 model.

The inputs to the model include parameters like precipitation data, land cover data, time of concentration and others. Also, three precipitations events from the years 2000, 2005 and 2011 are identified.

And to do the comparison, we need the Chlorophyll data to be collected before and immediately after the precipitation event has occurred.

Results:

The analysis done for this term derived the following results: Hydrographs for each precipitation event for the Toledo area catchment, chlorophyll-a data before and after the three events and comparison of runoff values to chlorophyll content

The three hydrographs are derived from the winTR-20 model for the three rainfall events. Each hydrograph has a peak which describes the peak discharge at a particular time. As the intensity of the precipitation increases the peak discharge and the runoff volume increase proportionally.

Hydrograph displayed here shows a peak discharge of 760 cubic feet per second during the year 2000 rainfall. This area in the plot clearly indicates that a significant amount of water has been

discharged into the lake. Nutrients carried by the runoff into the water body have increased the chlorophyll content which can be observed in the 2nd chlorophyll data graph.

Conclusion and future work:

By looking at the results, it is evident that the runoff has a major role to play in affecting the water quality of Lake Erie. To further promote our results, research has to be conducted to determine runoff values from all the catchments in the watershed and analyze the type of nutrients and sediments that are carried by the runoff water.

Finally, the project should be extended for the following areas of interest.

For more information on this project, please visit our website.

Thank you