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Vertex Transitive Graphs to Understand the CohesiveEffect of a Storm Surge

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Abstract: Transitive graph theory deals with network graphs to study certain topologies in real dimension elements or bodies structuring them. This paper intends to put up an approach with the help of graph theory to understand the cohesive effects over a particular water body in the part of an oceanic domain when affected by a storm surge. The paper also introspect a certain case study related to the Indian subcontinent influencing the theory.

Keywords : Vertex Transitive graphs, Storm Surge, climate change.

1. Introduction

Vertex Transitive Graphs : A category of a graph when every pair of its vertex is equivalent to some element of an automorphism group is identified as a node symmetric graph or to be vertex transitive. Talking about its automorphism group to be transitive gives a clear link to this graph being vertex transitive. There are other forms of these patterns to form edge transitive in the case that graph has a line graph which is vertex transitive. We shall see some patterns of vertex transitive graphs with simple graphs having nodes n =1,2,. and so on.

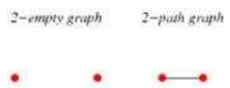

Diagram 1.1

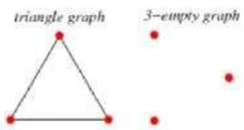

Diagram 1.2 simple planar graphs

Further we see some advance graphs forms of the above patterns.

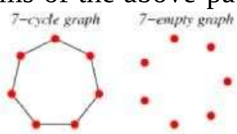

Diagram 1.3 multi vertex transitive forms

This ideology shall be used to identify structures being affected by the storm surge over breaking the cohesive forces of water bodies near a coastal belt thereby causing large catastrophe. We shall inthe later part of the paper deal in detail about how it may be collated with the understanding of the water

bodies during a particular surge.

1.1 Storm surge.

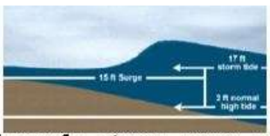

Diagram 1.4 lateral view of a storm surge approaching the coast

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As known a storm surge is a specific climatic condition appearing in the oceanic belts due to a sudden change in the temperature of the sea and its atmosphere. A peculiar condition when a sudden drop in the surface of the ocean body that primarily causes the hurricane storm results a surge in the form of a wave as a secondary result. This wave carries out an energy form in the perpendicular direction that flows out in circulation with the effect of the hurricane orientation.

Diagram 1.5 aerial view of a hurricane

The main aspect of formation of a hurricane storm lies in the oceanic currents flowing through the different temperature zones and various pressure belts. This further result in various other catastrophe one of which is the surge that is the climax form of the hurricane orientation

Diagram 1.6 Graphical orientation of a hurricane path

There are numerous mathematical approaches to study various climatic conditions like the one in the example we see above. We intend to apply a graphical approach towards study of one such similarwork on the storm surge with the intent of cohesive forces over a water body.

1.2 Cohesive force on a water body.

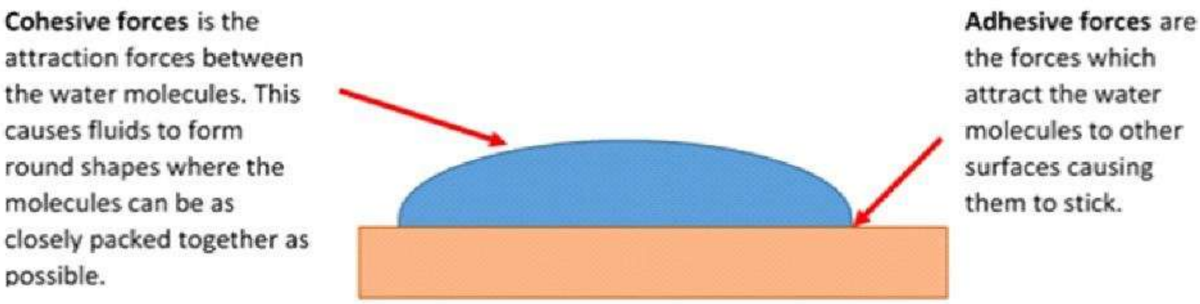

Diagram 1.7 Dynamics of a water molecule and the cohensive force

As seen in the diagram the cohesive forces of water are those that sustain the molecular attraction and keep it intact to sustain a compound, however these forces are still intact as long as the external conditions surrounding the water molecule may not change to a considerable

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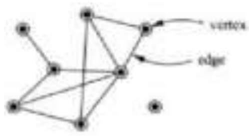
level. These conditions may also vary with a period of time the external forces like pressure and temperature developing over a particular area.

The question is does the forces of climatic change affect the cohesive forces of a water molecule and its body overall to further cause the surge. The detailed study shall involve a case study of certain geographical locations that have resulted in the past and also will be treated with certain graphicaltheories. When talking about these kind of inter molecular forces of water and the strong forces of the climatic change we shall see how it affects the large amount of water body as it affects the molecular forms.

2. Problem Evaluation and Methodology.

Problem Statement : As seen in the above part of the paper there are three different

terminologies that surround the ideology of understanding a particular climatic change



parameter. The need of the study is to focus on how to create a parallel approach towards the study involving an effect of stormsurge over a dynamic water body. Even though the study has limitations towards analysis and further interpretation of the catastrophe, there shall be merely an approach that is being developed in this attempt Diagram 1.8 the relation of a hurricane and the formation of the surge.

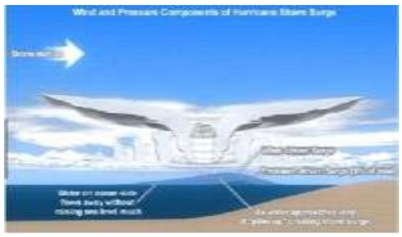


Diagram 1.9 Basic form of a vertex graph

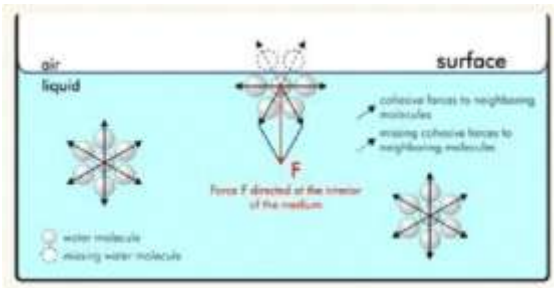


Diagram 2.0 Overview of cohesive forces on water surface.

The prime motive of this research work is to involve three different theories to understand their interrelation and thereby reconnect both the components of cohesive forces being affected by the storm surgewith the help of vertex graphs.

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1.1 Methodology of research.

1.1.1 The flow pattern of a Storm Surge.

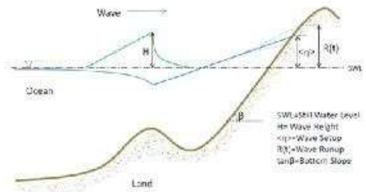

Diagram 2.1 The flow pattern of a Storm Surge

In the above figure we see the flow pattern of a particular surge wave. This pattern is further fitted with a graphical vertices and nodes in order to convert the flow directions as directed forms affecting the body.

surface of the water body at a macroscopic level.

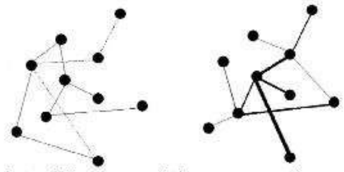

Diagram 2.2 Weighted and non-weighted forms of the surge flow and the cohensive force over a water

2.2.2 Coarsened influence graph.

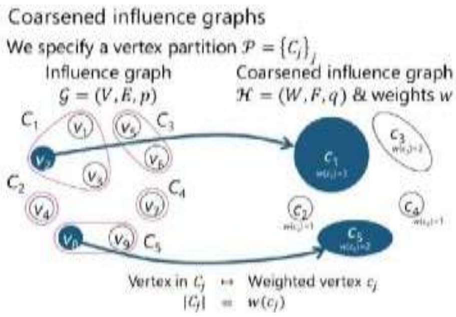

Diagram 2.3 Coarsened influence graph

We link both the theories of independent graphical forms by the help of influenced graphs coarsened over a particular trait. This influence thereby is analyzed mathematically below.

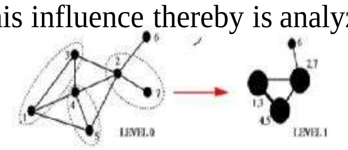

Diagram 2.4 Coarsening scheme

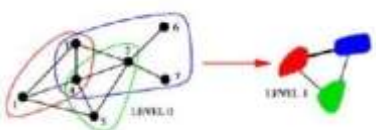

Diagram 2.5 final coloring schemes

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$$P_{iI(j)} = \begin{cases} w_{ij} / \sum_{k \in N_i} w_{ik} & \text{for } i \in F,\ j \in N_i \\ 1 & \text{for } i \in C,\ j = i \\ 0 & \text{otherwise} \end{cases}$$

2.2.3 **Final Assignment:** The course of introducing edges influencing the sub graphs in the above shows coherence in the final convoluting edges. The color schemes do overlap as well. The final assignment is that statement which justifies the existence of a vertex from the coloring scheme influenced graph formed of the storm surge that has a pre-position in the planar graph of the cohesive force of the water body. We assign a coarse edge from the vertex sharing part of both the graphs convoluted accordingly. The coarse also formulates the probability association in the below part accordingly.

$$\mathcal{P}_0(i) = \sum_{k \in N_i, I(k) \in \pi_0} P_{iI(k)}$$

Conclusion and discussions:

From the above results we conclude the following results:

Network graphs can be structured on the outlines of a storm surge.

These network graphs can be converted to vertex transitive when convoluting with other forms. The patterns formed over a general water body do act as vertex transitive under coloring schemes. These schemes when associated with the vertex graphs form a coarsened graph under special influence graphs. The influence graphs act as an association element in various other patterns to study the course of the flow of the energy of the surge when acting on the water body macroscopically in accordance to the cohesive forces. This study creates a scope of analysis to understand real time and historical data of such stormsurge and the cohesive forces of the water body.

Limitations of the research work.

The current work only focuses on the association part of the cohesive forces and the storm surge mathematically.

The mathematical study of graph theory is used for this course of work, whereas the analysis partis not well treated as a major parameter of this work.

The current work deals with the theoretically obtained results and not real time case studies. There is scope of working on historical data with this theory to create case studies for further development of the literature work.

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