Environmental Monitoring and Evaluation of Flash Floods Risks using Remote Sensing and GIS Techniques - A Case Study of Wadi Firan, Sinai

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This contribution presents a model for the application of advanced technologies capable of identifying and analyzing climatic factors and various ground and that contributes to the understanding of the nature of the floods in Sinai environment, which is witnessing dynamic changes fail with old maps and traditional methods in the work of actual usefulness in responding to the dynamics of the floods and Urbanism Sinai Empirical studies. So you can rely on satellite imagery to determine all variables and infringements that occur on tracks small valleys and coral, and also must be determined for those hydrological transactions and raised areas on the floodplain and drainage networks.

Environmental monitoring and Evaluation of flash floods risks using Remote sensing and GIS techniques

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Abstract

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Wadi Firan

- It is about 90 km east of abou redis, sinai governorate
- It includes 47 principal settlements and 22 secondary settlements, it includes 7 thousands population
- It contains many historical sites

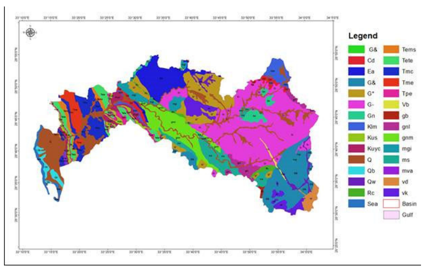
methodology

- **GIS database**
- **Watershed Hydrological characteristics**
- **Creating a DEM from remote sensing images**
- **Creating A Depressionless DEM**
- **Flow direction**
- **Flow accumulation**
- **Watershed outlet (pour) points**
- **Floods mapping**

GIS database

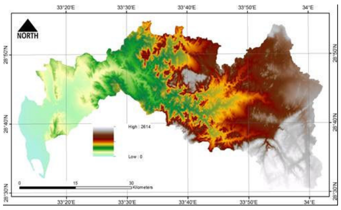
- Bands (1, 2 and 4) of Spot 5 remote sensing images (nov 2000 and april 2005) and bands (2, 4 and 7)landsat image were used for geological features analysis.
- These images were used for flood mapping and extraction of hydrological c/cs.
- These images were used also for detection of historical floods and impacted areas through infrared reflection that increases with the increase of floods and deposited clay.

Geological map



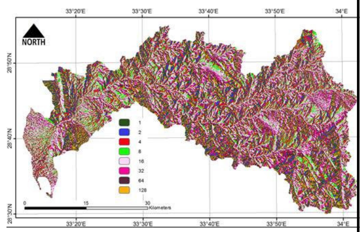
DEM

The ASTER sensor is part of the Earth Observation Satellite1, it offers nearly simultaneous capture of stereo images, minimizing temporal changes and sensor modeling errors. The visible and near infrared (VNIR) portion of the ASTER sensor includes two independent telescopes, a Nadir looking one and a backward looking one to help minimize image distortion during data capture. This simultaneous data capture provides true stereo coverage from which a DEM can be automatically extracted from using the stereopair option of ARCGIS program.



Flow Direction

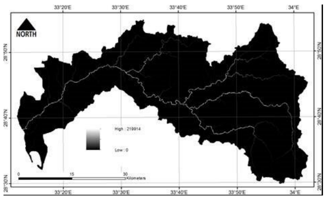
To calculate a drainage network or watersheds, a grid must exist that is coded for the direction in which each cell in surface drains. Flow direction is important in hydrologic modeling because in order to determine where a landscape drains, it is necessary to determine the direction of flow for each cell in the landscape. This is accomplished with the Calculate Flow Direction menu choice. For every cell in the surface grid, the ARCGIS grid processor finds the direction of steepest downward descent.



Flow direction is a focal function. For every 3x3 cell neighborhood, the grid processor stops at the center cell and determines which neighboring cell is lowest. Depending on the direction of flow, the output grid will have a cell value at the center cell, as determined by this matrix: If the direction of flow for a cell is due north, then in the output grid, that cell's value will be 64. These numbers do not have any absolute, relative, or ratio meaning, they are just used as numeric place holders for nominal direction data values (since grid values are always numeric).

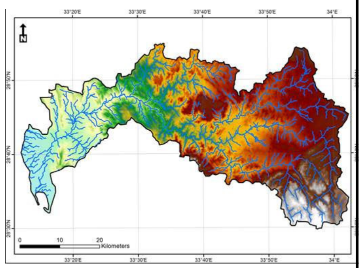
Flow Accumulation

Flow accumulation is the next step in hydrologic modeling. Watersheds are defined spatially by the geomorphological property of drainage. In order to generate a drainage network, it is necessary to determine the ultimate flow path of every cell on the landscape grid. Flow accumulation is used to generate a drainage network, based on the direction of flow of each cell. By selecting cells with the greatest accumulated flow, a network of high-flow cells can be created. These high-flow cells should lie on stream channels and at valley bottoms.



Floods Mapping

The last step in flood mapping is to perform the function of watershed dekineation itself. The grid processor needs three grid layers: pour points, flow accumulation, and flow direction. Here are the contour lines placed atop the watersheds. The watershed boundaries do a fairly good job of the following ridge lines. Watershed delineation has to be performed on an iterative basis while moving upstream. The first watershed will contain the entire study area. The second round of watershed delineations will create preliminary sub-basins. Then smaller and smaller sub-basins will be continued until the management study objectives are met (e.g., maximum sub-basin size, representation of all pour points, or delineation of entire study area).



CONCLUSIONS

- Current remote sensing and geographic information system technologies provide ways for rapid collection of field data and prompt data processing. This research presented a technique for extracting drainage flow directions, contributing (upslope) areas, and catchments from digital elevation models in Lake-dominated areas. The methodology was applied in Firan catchment, Sinai, Egypt as a case study.
- The results indicated that, this effort has successfully demonstrated that the used of remotely sensed data and open source available software provide an effective approach to develop accurate watershed analysis for various uses with a minimum amount of time, effort, and cost.
- Finally, more researches are needed for different terrain and different data to validate the current technologies for watershed modeling.