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Combining TerraHidro and SISMADEN Open Source Systems to Warn Extreme Natural Disasters

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Climate changing and disorderly anthropic land occupations have caused social and economical damages by occurrence of extreme natural disaster situations. Understanding as these disasters happen before their occurrences is fundamental to avoid these damages. Computational tools had been created and are fundamentals to support works experts working to mitigate these damage situations. We present TerraHidro and SISMADEN [1] as open source systems, working in conjunction to prevent extreme disaster situations. TerraHidro is a platform to develop distributed hydrological models. Natural Disaster Monitoring and Warning System – SISMADEN is a computational system which provides the technological infrastructure required to develop operational systems for environmental risks monitoring and alert. SISMADEN provides alerts using data extracted from environmental remote databases, in real time. Alerts can be trigged by specific points, for instance, at the water quality sensor coordinate, or by regions as cities, hydrographic basins, or other region partitions. Here we use the hydrographic basin partitions. Both systems are being developed at Image Processing Division – DPI of the National Institute for Space Research - INPE, Brazil.

TerraHidro has a tool to extract local flows from DEM that uses the Priority First Search – PFS algorithm [2]. The next step is to calculate the accumulated area flow for each local flow, i.e., the number of upstream local flows that contributes to the considered local flow, multiplied by the grid cell area of DEM. Accumulated area flows are filtered to create the drainage network using a threshold value. All local flow with accumulated value area greater than the threshold will belong to the drainage. At the end, all the watersheds are delimitated for each river segment. The watersheds determination is flexible. The experts can choose several drainages using different thresholds that result in different watershed partitions, allowing different watershed sizes.

These watersheds are used by the SISMADEN system. Each watershed will represent a disaster alert area. In the flood case it is important to identify the watersheds with higher flood risks. To calculate the risk level of a region, the SISMADEN access remote databases containing climatic and environmental information regarding the specific disaster type that is been modeled by SISMADEN. Always that a database is updated the process that calculates the disaster is triggered and a model is executed and their results indicate the disaster level for each point or region, in our case, watershed regions.

As TerraHidro and SISMADEN share same local database structure, the watershed partitions defined in the TerraHidro can be used directly by the SISMADEN. Similarly, the alerts values generate by SISMADEN can be used by TerraHidro to study and analyze disaster behaviors in time/space. This synergy is possible because both systems use same software platform named TerraLib [3], also developed at DPI/INPE, that is an open-source GIS software library that supports coding of geographical applications using spatial databases, and stores data in different DBMS including MySQL and PostgreSQL. An example of the match between TerraHidro and SISMADEN will be presented.

Bibliography

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