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Combining TerraHidro and SISMADEN Open Source Systems use as Warning for Extreme Natural Disasters

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Climate changes and disorderly anthropic land occupations have been causing social and economical damages due to extreme natural disaster occurrence. Understanding how these disasters happen before their occurrences is fundamental to avoid damages. Computational tools have been created and are fundamental to support experts who work to mitigate these situations. Therefore, we present TerraHidro and SISMADEN, open source systems, which work together to prevent extreme disaster situations. TerraHidro is a platform designed to develop distributed hydrologic 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 and to calculate the accumulated area flows 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. TerraHidro also extracts drainage network from accumulated area flows, as well as defines basins and sub basins. Basin determinations are flexible. Experts can choose several drainages using different thresholds that result in different basin partitions, and in different basin sizes.

These basins are used by the SISMADEN system. Each basin will represent a disaster alert area. In case of flooding, it is important to identify the basins with high flood risks. To calculate a region risk level, SISMADEN accesses remote databases containing climatic and environmental information regarding the specific disaster type that is being modeled by SISMADEN. Whenever a database is updated, the process that calculates the disaster is triggered and a model is executed.

As TerraHidro and SISMADEN share the same local database structure, the basin partitions defined in the TerraHidro can be used directly by SISMADEN. Similarly, the alert values generated by SISMADEN can be used by TerraHidro to study and analyze disaster behaviors in time/space. This synergy is possible because both systems use the same software platform named TerraLib, also developed at DPI/INPE. It 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, emphasizing the basin division of the Liguria Mediterranean region.