Monitoring Areal Snow Cover Using NASA Satellite Imagery

The objective of this project is to develop products and tools to assist in the hydrologic modeling process, including tools to help prepare inputs for hydrologic models and improved methods for the visualization of streamflow forecasts. In addition, this project will facilitate the use of NASA satellite imagery (primarily snow cover imagery) by other federal and state agencies with operational streamflow forecasting responsibilities.

A GIS software toolkit for monitoring areal snow cover extent and producing streamflow forecasts is being developed. This toolkit will be packaged as multiple extensions for ArcGIS 9.x and an open-source GIS software package. The toolkit will provide users with a means for ingesting NASA EOS satellite imagery (snow cover analysis), preparing hydrologic model inputs, and visualizing streamflow forecasts. Primary products include a software tool for predicting the presence of snow under clouds in satellite images; a software tool for producing gridded temperature and precipitation forecasts; and a suite of tools for visualizing hydrologic model forecasting results. The toolkit will be an expert system designed for operational users that need to generate accurate streamflow forecasts in a timely manner.

The Remote Sensing of Snow Cover Toolbar will ingest snow cover imagery from multiple sources, including the MODIS Operational Snowcover Data and convert them to gridded datasets that can be readily used. Statistical techniques will then be applied to the gridded snow cover data to predict the presence of snow under cloud cover. The toolbar has the ability to ingest both binary and fractional snow cover data. Binary mapping techniques use a set of thresholds to determine whether a pixel contains snow or no snow. Fractional mapping techniques provide information regarding the percentage of each pixel that is covered with snow. After the imagery has been ingested, physiographic data is attached to each cell in the snow cover image. This data can be obtained from a digital elevation model (DEM) for the area of interest. If

Graphical Language for Data Processing

A graphical language for processing data allows processing elements to be connected with virtual “wires” that represent data flows between processing modules. The processing of complex data, such as lidar data, requires many different algorithms to be applied. The purpose of this innovation is to automate the processing of complex data, such as LIDAR, without the need for complex scripting and programming languages.

The system consists of a set of user-interface components that allow the user to drag and drop various algorithmic and processing components onto a process graph. By working graphically, the user can completely visualize the process flow and create complex diagrams. This innovation supports the nesting of graphs, such that a graph can be included in another graph as a single step for processing.

In addition to the user interface components, the system includes a set of .NET classes that represent the graph internally. These classes provide the internal system representation of the graphical user interface. The system includes a graph execution component that reads the internal representation of the graph (as described above) and executes that graph. The execution of the graph follows the interpreted model of execution in that each node is traversed and executed from the original internal representation. In addition, there are components that allow external code elements, such as algorithms, to be easily integrated into the system, thus making the system infinitely expandable.

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