

Introducing Weather Data in GIS-Ready Formats

by Ron Sznaider, Senior Vice President, Research and Development of
DTN/Kavouras Weather Services

Kavouras is pleased to introduce the first ever availability of a significant variety of value-added weather data products designed especially for the geographical information system (GIS) community. Used by hundreds of thousands of organizations and agencies worldwide, a GIS manages information that has geographical locations associated with it to organize and solve a multitude of problems. Now Kavouras introduces real-time and forecast weather that will be able to be easily integrated into GIS-based decision support systems.

An impressive suite of Kavouras weather data is now available in Environmental Systems Research Institute, Inc. (ESRI), GIS data formats. ESRI, the world's largest GIS company with more than 220,000 clients worldwide, is the provider of the popular ArcView GIS and ArcInfo GIS software. Over the past 30 years, the ESRI data formats have become the de facto standard in the GIS industry. Kavouras can now provide real-time and forecast weather data that has been converted directly into the ESRI GIS data formats. With this new capability from Kavouras, GIS users will be able to immediately integrate live weather information into their applications.

Kavouras is the industry leader in combining weather data with GIS. Several years ago, Kavouras introduced the StormPro weather radar display and storm-tracking system built using the ESRI GIS applications development toolkit called MapObjects. Now used by broadcast TV stations, StormPro tracks storm systems, storm epicenters, and the areas they affect, and predicts the path of storms over time. Incredibly detailed and customizable map backgrounds are dynamically produced while on air. By embedding GIS components into StormPro, a more detailed analysis of the geographical position of the storm was made possible, giving users a better understanding of potential storm impact. Now Kavouras will lead the industry again by providing GIS-ready weather data for more general and widespread applications. We are being innovative and anticipating the needs of our increasingly sophisticated users.

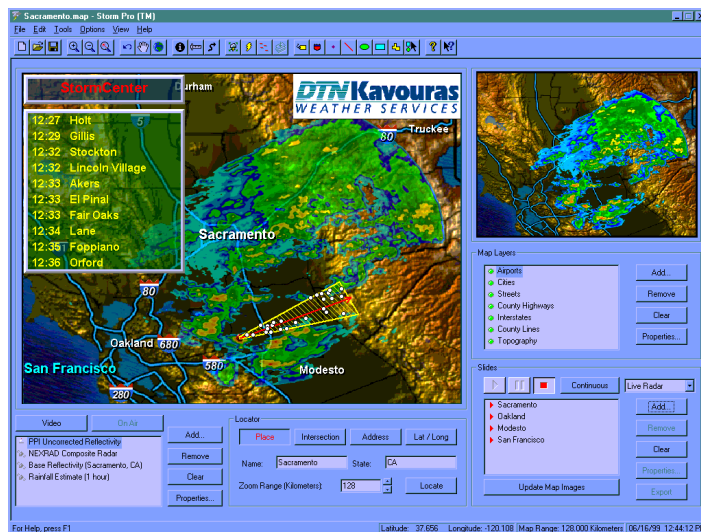


Figure 1

The Kavouras StormPro system is a GIS-based radar display and storm-tracking system used by broadcast television stations throughout the United States.

Combining real-time and forecast weather information with a GIS has very significant potential for improving weather-related decision support systems. This is because a GIS offers much more than a typical “display” of weather graphics; a GIS affords the possibility to combine the weather data itself with virtually any other geographically based information and then makes it possible to calculate meaningful value-added results. Kavouras's value-added weather data, combined with a GIS, can immediately unlock analytical potential that was previously incomprehensible.

“Real-time weather data has not been readily available to GIS users to date,” says Shawn Toscano, ESRI. “Kavouras will not only be formatting their weather data for use in ESRI software, but may also be creating applications for weather data integration including three-dimensional analysis. By bringing weather information into GIS, analysis tools can be used to solve more complex business problems.”

An example of improved weather-related decision support realized with the combination of weather data and GIS can be found in water resource management. An immediate calculation of instantaneous rainfall rate can be made from GIS-ready Kavouras value-added weather radar data products. This derived parameter is then immediately compared to the local geographical topography within the GIS. The result is an exacting determination of how much water is entering a particular watershed, where that water will flow (based on terrain slope and runoff characteristics), and how the rain will ultimately affect stream flow. Dramatically improved watershed management and flash flood forecasting can result from the merging of GIS and Kavouras value-added data products.

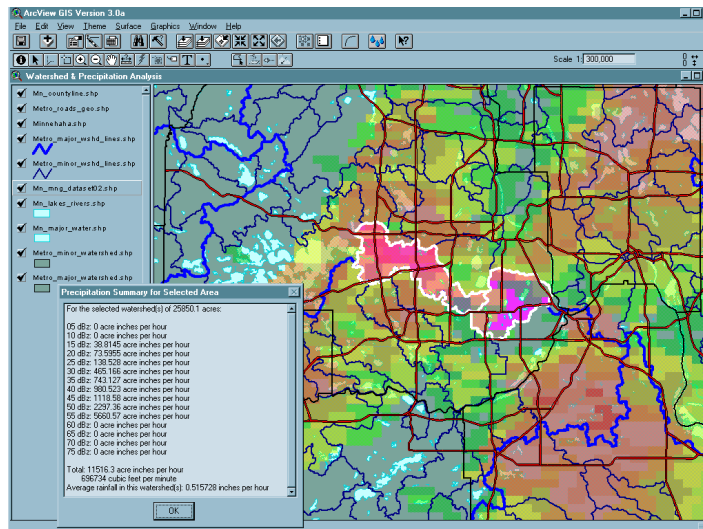


Figure 2

Merging real-time weather radar information with watershed boundary data within a GIS can make precise calculations of the volume of water that enters a particular watershed.

The merging of GIS technology with properly formatted value-added weather data from Kavouras may very well be the catalyst for an entirely new level of weather analysis capabilities, supplanting the attention given strictly to visualization. Others agree that great potential exists. "Kavouras is helping make it possible to broaden how weather information can be used by thousands of innovators in numerous markets," says Jack Dangermond, president, ESRI. "They already helped provide a number of ways to take advantage of this information, and now with the availability of this information in GIS format, the next generation of smart weather information for ESRI users is here."

The transportation industry, whether it is road, rail, or air, has specific weather requirements. The integration of real-time weather information into a GIS-based transportation management system is now not only possible but much easier and more practical to implement. Many applications are possible. For example, very accurate and immediate determinations of what sections of pavement are being affected by specific weather features can allow more accurate traffic metering, rerouting options, and fuel and safety management.

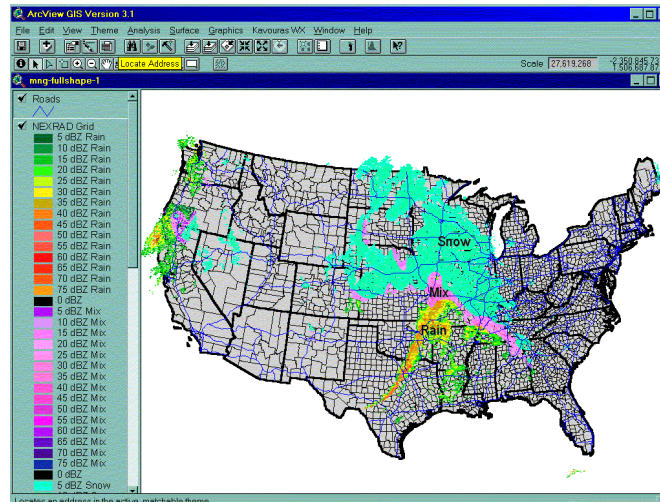


Figure 3

An updated mosaic of weather radar activity is available every five minutes.

Kavouras has been authorized by the National Weather Service to redistribute data from the NEXRAD national Doppler weather radar network. Kavouras has continuous access to all of these radar systems. Every five minutes Kavouras produces a mosaic of all of the precipitation activity in the country. Kavouras adds additional value by removing ground clutter and other false radar signals and by encoding the type of precipitation (rain, mix, snow). This data is made available in an ESRI polygon shapefile format.

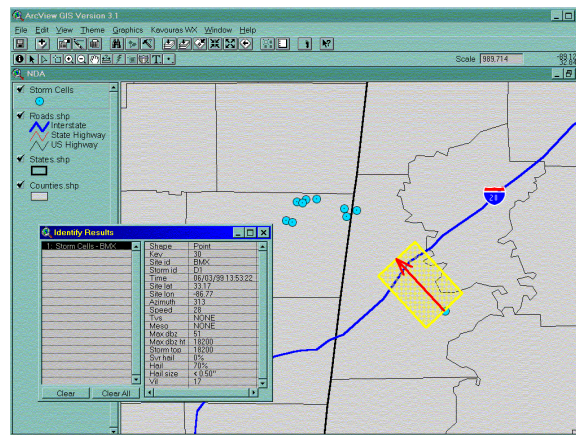


Figure 4

The path of individual storm cells can be tracked as they approach highways.

Emergency management agencies, already users of GIS technology for advance planning purposes, can now easily integrate Kavouras real-time and forecast weather data to improve decision making and allow faster response times during threatening weather situations.

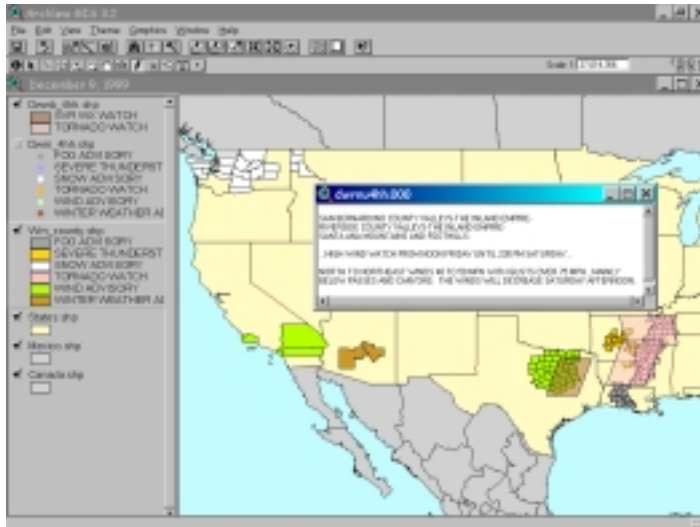


Figure 5

National Weather Service-issued severe weather watches/warnings/advisories can now easily be imported into GIS applications.

Agriculture professionals, so often dependent upon the weather, can, with access to GIS-ready weather, not only display but also objectively analyze the potential effects weather will have on their crops. The emerging field of precision agriculture can greatly benefit from having georegistered weather information that can, within a GIS, accurately map and calculate cropland section by section in conjunction with weather parameters. For example, the mapping of past precipitation derived from radar over a section of cropland, within a GIS, can easily be accomplished. Whereas individual rain gauges only measure precipitation at their point, radar-derived precipitation estimates converted into GIS formats afford the agricultural community, for the first time ever, the ability to easily and quantitatively evaluate the spatial and temporal variations of rainfall.

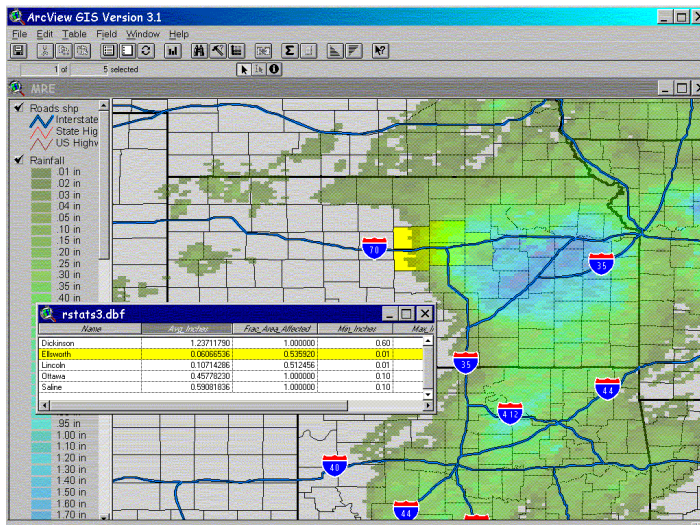


Figure 6

Kavouras's value-added products, such as radar-derived rainfall estimates, used in conjunction with GIS, allow much more precise calculation of the spatial and temporal variations of rainfall over sections of cropland than is possible with only rain gauges.

Kavouras became an ESRI business partner several years ago, and the two companies continue to work together to provide solutions for weather-related problems that can benefit from GIS technology. Kavouras will gradually increase the amount and variety of weather information that will be available in GIS-ready formats. How the weather information is used is also somewhat a function of the developers and users in the GIS community and how they will tailor software to their needs.

Kavouras has established a robust infrastructure to collect, prepare, and distribute high-quality weather information to the GIS community. Real-time and forecast weather data is collected from many sources, quality control is applied, and value-added products are produced at the Kavouras computer center in Minneapolis. The Kavouras weather data is then distributed via multiple communications satellites to customers worldwide. Upon receipt, the Kavouras MetWork FileServer manages this constant stream of weather data and now has the ability to convert the weather data directly into ESRI GIS formats on the fly. The weather data is converted into ESRI point shapefiles, polygon shapefiles, and grids. Many GIS-ready georeferenced bit map images of weather information are also available.

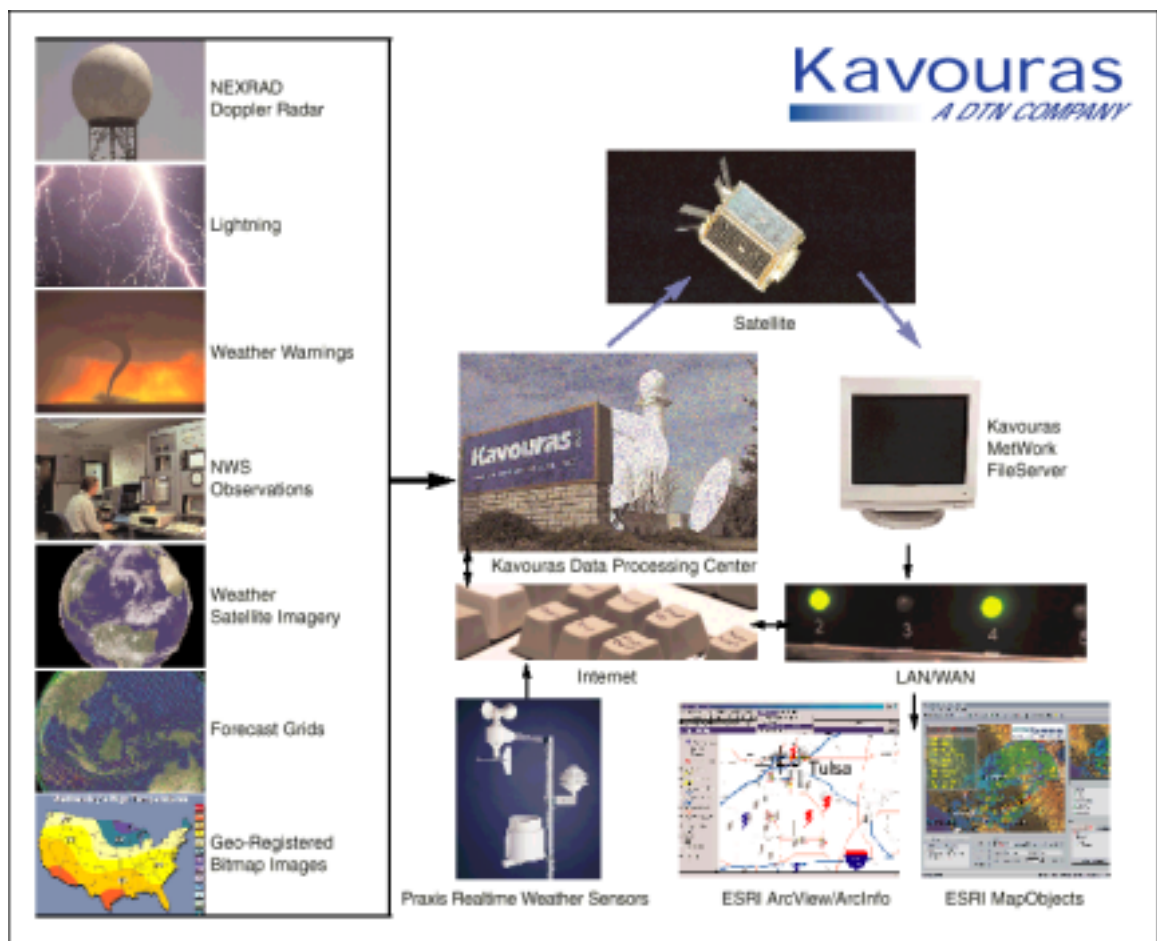


Figure 7
The general flow of weather data, from collection through processing and distribution, is depicted.

Many industries that have historically used GIS can gain new benefits from using Kavouras-supplied weather data in data formats that can be understood. For example, the electric

industry can now more tightly integrate high-resolution forecast weather information into their operations. Forecast weather information from state-of-the-art numerical weather prediction models at the National Center for Environmental Prediction, are now available from Kavouras in ESRI grid formats. One potential use of this type of data would be the generation of population density-weighted calculations of energy load versus forecast temperature for a potentially more realistic energy load forecast. Improved energy load forecasts help avoid power shortages and allow utilities to be more competitive when buying/selling excess power on the national grid.

Kavouras is also now able to provide national lightning information from Global Atmospheric Incorporated (GAI) in ESRI shapefile format. This will allow easy integration of lightning data directly into GIS applications. This can aid electric utilities in the tracking of lightning-related problems along their transmission lines. Outside of the energy industry, this will allow for the exacting calculations of the proximity of lightning strikes relative to golf courses, outdoor concerts, fuel storage facilities, or for that matter, any geographical point. The introduction of lightning data directly into GIS applications opens up new ways to provide solutions to weather-related problems.

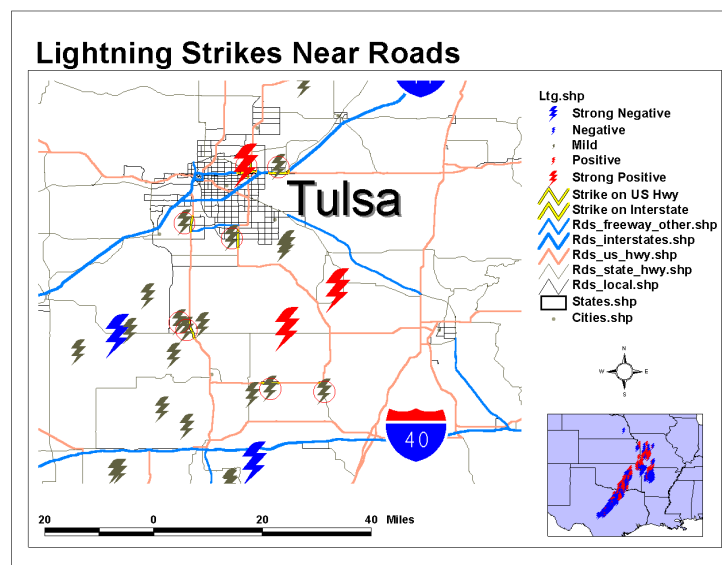


Figure 8

GAI lightning data, updated each minute, is now available in ESRI shapefile format from Kavouras, ready for direct integration into GIS systems.

GIS-ready weather data from Kavouras is available today via high-speed communications satellite delivery in conjunction with a properly configured Kavouras MetWork FileServer (with software revision 2.20 or greater). An inexpensive satellite receiver provides the raw weather data input to the MetWork FileServer. The MetWork FileServer then converts the raw weather data into ESRI GIS formats as selected by the user. The weather data, in ESRI GIS formats, can then be accessed over a local area network (LAN) and/or sent via file transfer protocol (FTP) directly to GIS users on the LAN.

The integration of truly real-time weather observations into a GIS, delivered directly from a network of weather sensors located at customer locations via the Internet, can also be demonstrated. This remarkable and innovative use of the Internet to bring essentially "live" weather directly into a GIS was made possible through the collaborative efforts of Kavouras,

ESRI, and Praxis Software. “The key here is that real-time weather data, updated as often as every three seconds, will be available for use with new or existing GIS systems,” says Shawn Toscano. “This is an information breakthrough that we at ESRI are very excited about because of what it means to Kavouras users, ESRI users, and to the many markets that will benefit.” Availability of more general GIS-ready weather data from Kavouras, via the Internet, will become a reality later this year.

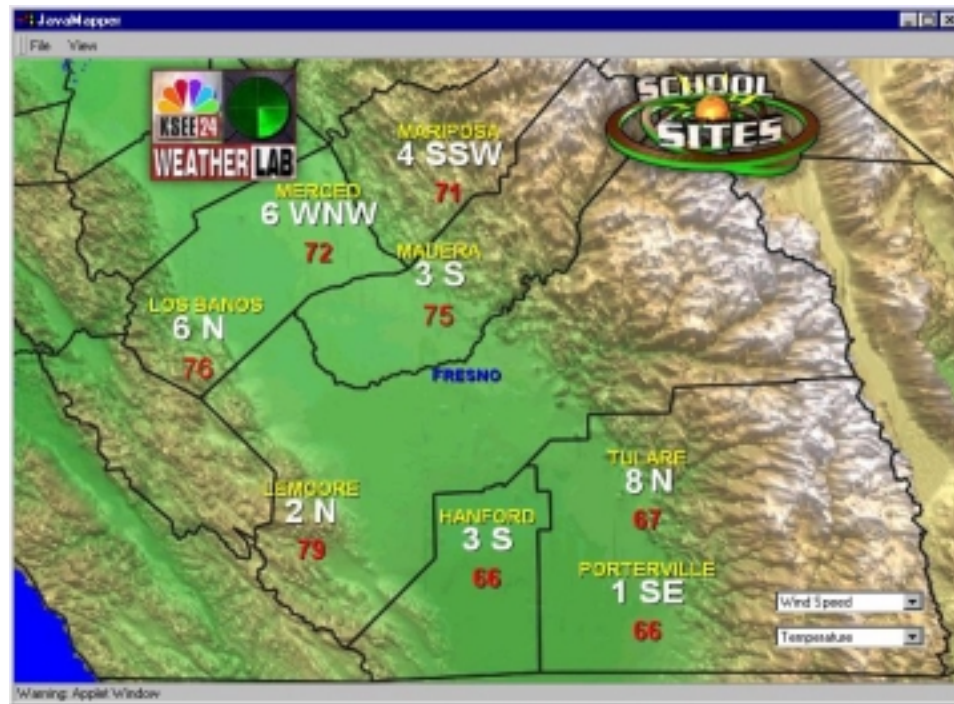


Figure 9

“Live” weather data from multiple sensors, delivered via the Internet and updated every one to three seconds, is a collaborative effort between Kavouras, ESRI, and Praxis Software.

The merging of Kavouras GIS-ready, value-added data products with GIS technology will make possible a new level of utilizing weather information to analyze and solve problems. This type of first-to-market offering can redefine an industry. Bringing weather data to the world of GIS is going to benefit users and drive new applications. This is a new paradigm—merging high-quality, up-to-the-minute weather information with powerful GIS analysis and visualization. Quite simply, it will give users the ability to do things they never could before.

For more information on this topic:

For more detailed information on the topic of merging real-time and forecast weather and GIS, feel free to contact the author directly via e-mail at rsznaider@kavouras.com.

For more information and downloadable sample weather data in GIS formats, visit the Kavouras Web site at www.kavouras.com.

For more information on ESRI, the world's leader in GIS, visit the ESRI Web site at www.esri.com.

For more information on Praxis Software, provider of Internet-delivered weather solutions, e-mail Rhonda Copley at rhonda@praxsoft.com or visit the Praxis Software Web site at www.praxsoft.com.

Kavouras sales representatives can be contacted at 1-800-328-2278.
DTN Weather sales representatives can be contacted at 1-800-485-4000.