

Princeton University Ecologist Uses PV-WAVE® in Pioneering Biodiversity Research



INDUSTRY Education

APPLICATION Analysis of Automated Radio Telemetry Data in Ecological Systems

PRODUCT PV-WAVE®

The Automated Radio Telemetry System Initiative coordinated by Dr. Martin Wikelski, Associate Professor at Princeton University, is a pioneering effort that permits the automated radio-tracking of tagged animals, a feat never before accomplished on a large scale in a tropical forest.

“We could not have achieved our project objectives without using PV-WAVE. PV-WAVE is the only visual data analysis solution that met our requirements for analyzing large amounts of animal location data.”

– Dr. Martin Wikelski, Associate Professor, Princeton University

Quick Facts

- Dr. Wikelski has implemented a first-of-its-kind automated radio telemetry system for gathering animal location data on a second-by-second, 24/7 basis.
- To analyze the large amounts of data and smooth out location discrepancies, PV-WAVE was the ideal solution.
- PV-WAVE has allowed Dr. Wikelski to analyze the animal location data in 1/100th the time of a manual process.

The Problem

Dr. Martin Wikelski strives to understand factors affecting biological diversity in the tropics. At his research site on Barro Colorado Island in the Republic of Panama, Dr. Wikelski and his team use their automated telemetry system to conduct pioneering work through automated radio-tracking of tagged animals, a feat never before accomplished on a large scale in a tropical forest. Through this cutting edge telemetry system, Dr. Wikelski’s team currently tracks the locations of 20 animals on a 24-hour, 7-day a week basis. They work to understand animal population dynamics in the wild to gain insight into important issues such as disease and dispersal, spatial ecology, species interaction, physiology, and activity cycles.

The telemetry system plots the bearing data for each animal from 0 – 360° on a second-by-second basis and stores it in a data base. The system then triangulates the bearing information to identify the exact location of each animal. The telemetry system can produce faulty bearing information at times when, for example, a taxicab driver is driving on the outskirts of the study area, and the driver’s 2-way radio causes interference with the readings. Dr. Wikelski therefore must examine the data for these types of anomalies. The large amount of data makes manual examination virtually impossible - sifting through masses of spreadsheet data would be prohibitive.

The Solution

To visually identify the faulty data from the telemetry towers, Dr. Wikelski began using PV-WAVE from Visual Numerics. PV-WAVE made it possible to process the massive amount of bearing and time data and also allowed Dr. Wikelski to visually examine and smooth out the discrepancies.



KEY BENEFITS

- Faster time to results
- Efficiently processes large amounts of data
- Identifies anomalies in the data for more accurate analysis
- Easy to use interface speeds analysis

Specifically, PV-WAVE plots the data with the date/times on the x axis and the degree location on the y axis. Through array manipulation and indexing, PV-WAVE allows Dr. Wikelski to use a mouse to manipulate the data, such as by smoothing the anomalies. Dr. Wikelski puts tremendous value on this human examination: "There is no substitute for the human eye's ability to see unrealistic situations in the data. If an animal is in one location at a point in time, it's unrealistic for it to be a mile away in the next instance. These discrepancies cannot be identified by software, but can be quickly and easily identified by the human brain with the help of PV-WAVE." Dr. Wikelski uses a PC to run PV-WAVE and conduct the visual data analysis. So instead of hypothesizing about how animals might interact, they now have a clear view of how the 20 animals actually interact with each other and other environmental factors. Having an accurate picture of where the animals are at any point in time gives the team insights into important ecological relationships, such as how ocelots eat agoutis (tropical rodents) or how toucans transport seeds around the region and what changes occur in animals when they are affected by disease.

The findings from the animal tagging research can have further implications into other ecological studies and even bioterrorism. Dr. Wikelski believes that the findings from Barro Colorado Island could become an integral part of the National Ecological Observatory Network (www.NEONinc.org), the first national ecological measurement and observation system with an interdisciplinary approach to answer regional and continental-scale questions. Gaining a clearer understanding of how living things respond to disease could help drive procedures for responding to bioterrorism attacks too. More about Dr. Wikelski's research can be found at www.princeton.edu/~wikelski/research/biology.htm

Return on Investment

Using PV-WAVE takes approximately 1/100th the time of examining the data manually, according to Dr. Wikelski. It is entirely possible that the amount of collected data is so massive that manual analysis would have been impossible. In this way, PV-WAVE along with the automated radio telemetry system is equipping Dr. Wikelski and his team to present their findings with greater confidence and greater credibility.

World Class Products, Services, and Support

Visual Numerics has provided technical software solutions for numerical analysis and visualization for over three decades. The company's software products help users understand complex data from a variety of sources and build business-critical applications. Visual Numerics offers two product lines: the IMSL™ Numerical Libraries for powerful mathematical and statistical analysis and the PV-WAVE® visual data analysis development environment. Visual Numerics also offers customized professional services for applications that involve mathematical, statistical, or visual data analysis to meet today's business analytical needs.



The IMSL Numerical Libraries - which include the IMSL C Library, IMSL C# Library for .NET, IMSL Fortran Library and JMSL™ Library for Java™ applications - are the industry standard for numerical analysis. They deliver developers with the breadth and depth of core algorithms allowing for the rapid development of any application. Whether developing applications in C, C# for .NET Fortran, or Java, or on UNIX, Windows or Linux, the robust IMSL Libraries provide the reliable foundation and the building blocks developers need.

The PV-WAVE family of products - which includes PV-WAVE, TS-WAVE, and JWAVE - delivers engineers with the development tools to efficiently and accurately meet their visual data analysis needs. PV-WAVE solutions allow users to rapidly import, manipulate, analyze and visualize data. The PV-WAVE family also includes robust time series analysis software as well as the ability to share analysis results across the enterprise with a Java-based solution. And, unlike other products, PV-WAVE Advantage includes a sophisticated set of analysis routines based on the industry-standard IMSL Libraries.

In addition, Visual Numerics' Professional Services combine technical expertise, decades of hands-on experience and a combination of powerful products to create the highest quality solutions possible for your visual data analysis needs.

Visual Numerics unique combination of products and services rapidly enhance ROI by delivering the highest efficiency, greatest accuracy and maximum performance.



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