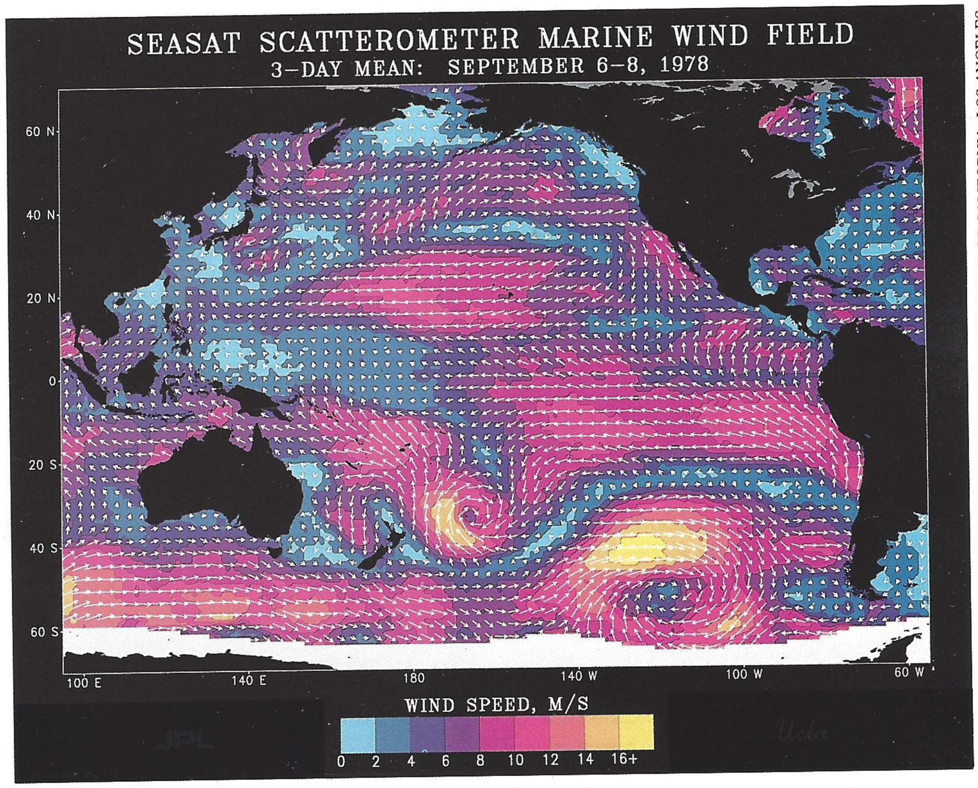
ORION

NATURE QUARTERLY

$4

Published by the Myrin Institute in association with Conservation International · Spring 1990



Telling Earth's Story

by Edward H. Backus

Exploration of earth has been going on since the first time a hominid climbed a hill to gauge the wind and view the surrounding terrain. Through the millennia, the questions we have asked about our planet have become larger and more complex, and our technology has expanded to help us find answers.

During the last few decades, new scientific tools have brought an explosion of information about earth systems and processes. One result is the emergence of a new scientific discipline that combines *in situ* exploration with information from sensors orbiting the earth via satellite, and with the analysis and synthesis made possible by new, high-powered computers. The discipline is called earth system science; its focus is global change.

Satellite-based sensors orbiting around the earth can penetrate clouds, "see" at night, sense temperature variations (even those below ground), and cover millions of square kilometers over months of time, to provide broad-brush pictures of global change. Or they can focus in on events such as the thermal release of a Chernobyl nuclear accident.

Earth system science deals with extensions of time as well as space. As one of many examples—this one from on-site research—ice caps trap contemporary atmosphere as they form; analysis of dated ice cap samples yields a profile of the atmospheric history of the planet.

Computers are able to organize, integrate, analyze, and display satellite-generated and other data and use it to create models of large-scale, complex earth processes. For instance, NASA's Tropical Rainfall Measuring Mission (TRMM) will employ four satellite sensors to carry out systematic measurements of tropical rainfall on a worldwide basis. Because tropical rainfall releases the energy that helps power global atmospheric circulation, modelling it increases scientists' ability to predict weather and climate changes.

By monitoring earth systems and the effects of human actions on them, earth system science gives us the opportunity to modify our behavior and technologies in order to make them more harmonious with natural systems and processes. But if scientific understanding is to help shape policy, it must first be absorbed by policy-makers and citizens.

InterNetwork Inc., led by biologist/artist Payson Stevens, is one group working toward that end. Trained in the earth sciences at the Scripps Institution of Oceanography, Stevens has been working with agencies such as NASA and NOAA to communicate earth-related issues in print and electronically to a broad public.

Stevens and his staff have created a new presentation mode that uses Hypercard, a powerful software introduced by Apple in 1987, to display and analyze large-scale earth processes. The presentations incorporate single-frame images, animation (often employed to clarify processes through time), written text, and sound, in a form known as hypermedia. The graphics help make complex data intelligible, and the forceful beauty of many of the satellite images inspires as it informs. Hypermedia is rapidly coming into wide use, but InterNetwork is one of the few groups that apply it to earth system science.

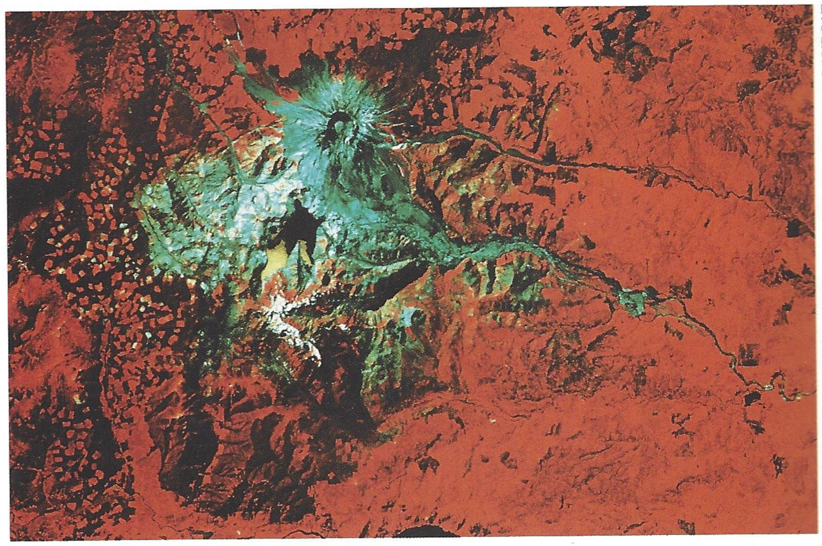
Stevens's presentations are in increasing demand. He gave one at the Greenhouse Glasnost conference at Sundance last year and another to a group at the U.S. Senate. Senator Albert Gore, Chairman of the U.S. delegation to the Interparliamentary Conference on the Global Environment, commented that Stevens's work was particularly appropriate "to the needs of a broad range of legislators representing many countries and speaking many languages."

"Reflections," the presentation that so impressed Senator Gore, blends ordinary photographic images, Landsat images, still and animated charts, written text, and sound. Dwelling on themes of population and pollution, and the basic resources of soil, air, and water, the presentation juxtaposes images, key words, and sounds in ways that raise questions and make suggestions, but leave viewers to draw their own conclusions. The movement of the piece is associative rather than linear, more like metaphor than logic. According to Stevens, this associative approach is particularly useful to the process of creative hypothesis and discovery.

InterNetwork's other earth systems piece, "Earth: Vital Signs" is interactive; that is, it allows the viewer to "navigate" through the data and stop at any point to ask for more details. It makes it possible to compare, for instance, the amount of polar ice in January 1974, with the amount in January 1975. For students and scientists, this kind of database is like an encyclopedia containing sound, animation, and images as well as words, available for cross-referencing at the touch of a key. InterNetwork is currently working with the U.S. Geological Survey to develop a prototype for a digital electronic science journal.

"The computer is our medium," says Stevens, "but the earth is our message." The "Earth Gallery" of images assembled for *Orion* by Stevens from NASA, NOAA, and other agencies suggests the combination tion of information and beauty that earth system science is able to convey.

Edward Backus is Informations Systems Coordinator for Conservation International. His work will be the subject of a future Orion *article.*



These satellite images represent an earth gallery on different scales of space and time—from local to global, from days to months. Remote sensing provides a continuous record of our planet's vital signs. The data will eventually serve as the basis for models that will assist scientists and policy makers in evaluating the global impact of human and natural activities.

Displayed opposite is a field map of global winds for the Pacific Ocean. These winds are thought to play an important role in the distribution of solar heat. The arrows point in the direction the winds blow, with longer arrows indicating higher wind speeds. The winds are contoured and color-coded for emphasis: light winds blue, strong winds yellow. The continents are black and the Antarctic ice pack white.

Above: Kuskokwim River, Alaska: A synthetic radar aperture (SAR) sensor from NASA's Sea Satellite shows filamentary patterns related to the height of surface waves, which vary with changes in water depth.

Below: Mt. St. Helens after the 1980 eruption: In this false-colored image from a land-remote-sensing satellite (Landsat), white-blue regions indicate forest denudation.

Back Cover: An image of the global biosphere is pictured.