

# What You See is What You Get? Data Visualization Options for Environmental Scientists

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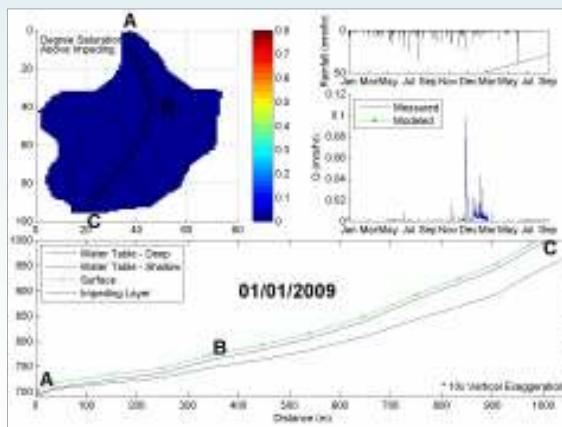
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## Introduction

Grand challenge environmental science problems involve very large data sets that span multiple spatial and temporal scales, yet analytical methods that transcend scale are not well understood. The **VISualization of Terrestrial and Aquatic Systems** (VISTAS) project is a three-year interdisciplinary collaboration among ecologists, computer scientists, and social scientists. VISTAS will enable scientists to better understand and communicate grand challenge environmental science through visual analytics, in particular regarding real world phenomena.

Our preliminary study of visualization options for environmental scientists explored:

- Which visualization tools ecologists currently use
- Which visualizations work best for which purposes
- Strengths and weaknesses of each tool considered



2-D hydrology visualizations use different graphical modes to display spatial and temporal attributes.  
Image courtesy of Kellie Vaché.

## Methodology

Our visual analytics needs assessment survey of U.S. LTER Information Managers\* asked two questions:

- What top three tools do scientists at your site use for visualizations?
  - How effective are these tools in meeting their needs to better understand their data?
- During spring and summer 2011, we conducted long-form qualitative interviews with four environmental scientists\*\* and addressed:
- Visualization tools they use
  - Strengths and weaknesses of those tools in displaying the phenomena they study

## Initial Findings

Survey results reveal that LTER scientists rely on a variety of tools for visualization; the most commonly referenced included ArcGIS, SAS, MATLAB, SigmaPlot, R, and Microsoft Excel. Visualization needs include:

- Ability to subsample large data sets
- Pattern recognition
- Photorealistic 3-D animation
- Combining spatial and temporal information onto a single canvas

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\*LTER Information Managers: John Chamblee (CWT), Don Henshaw (AND), Eda Melendez (LUQ), Margaret O'Brien (SBC), John Porter (VCR), Linda Powell (FCE), Inigo San Gil (LNO), Mark Servilla (LNO), Wade Sheldon (GCE), Kristin Vanderbilt (SEV), Theresa Valentine (AND).

\*\*VISTAS Collaborators interviewed for the long-form survey: John Bolte (OSU), Bob McKane (EPA), Christoph Thomas (OSU), Kellie Vaché (OSU).



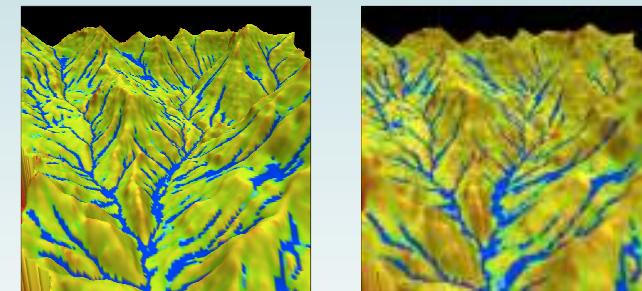
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## Preliminary Visualizations

Our initial survey and interview findings inform the development of a proof-of-concept visual analytic software tool that will either stand alone or connect to existing programs. VISTAS aims to address gaps left by current ecological visualization tools and prompt new understanding of ecological data.

The VISTAS prototype currently creates 3-D images and animations of environmental data that display changes over time and space.



Above: Still shots from VISTAS 3-D hydrology animation. Soil moisture for March 2, 1994 (left), and March 10, 1994 (right). High values are blue, low values are red.

