



**NIV|5** GEOSPATIAL

**IDL®**

Extract meaningful visualizations  
from complex numerical data

# DISCOVER WHAT'S IN YOUR DATA

A key foundation of scientific discovery is complex numerical data. If making discoveries is a fundamental part of your work, you need a tool to help you understand what your data means, and how to apply that knowledge effectively; a tool to help you discover what's in your data. Using a powerful, modern programming language lets you transform numbers into dynamic visual representations, so you can interpret your data, expedite discoveries and deliver powerful applications to market.

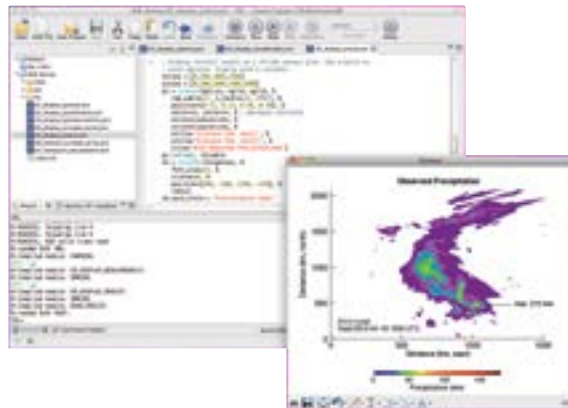
**IDL IS THE PREMIER SOLUTION TO GET INFORMATION FROM DATA, REGARDLESS OF YOUR PRIOR PROGRAMMING EXPERIENCE.**

IDL is the trusted scientific programming language used across disciplines to create meaningful visualizations out of complex numerical data. From small scale analysis programs to widely deployed applications, IDL provides the comprehensive computing environment you need to effectively get information from your data.

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**IDL is a cross-platform solution, providing advanced visualization and analytical tools for solving a wide variety of problems.**

In these images, IDL was used to create a contour image of the observed levels of precipitation in the plains of Texas.

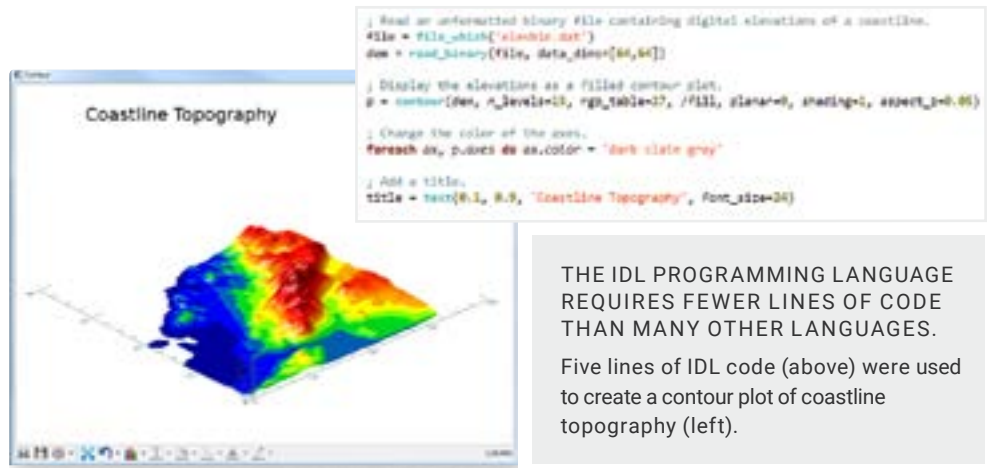


## HIGHLIGHTS:

- > A rich library of high-performance, multi-threaded routines to analyze your data
- > The ability to add your own specialized routines to the library by writing procedures more quickly than other languages
- > Simple syntax, dynamic data typing, and array-oriented operations
- > Built-in functionality suitable for many data trends, with tools for two – and three-dimensional gridding and interpolation, routines for curve and surface fitting and the ability to perform multi-threaded computations
- > Intuitive language for analysis
- > Powerful, interactive graphics system
- > Easy-to-navigate development environment
- > A robust analysis engine

# THE IDL LANGUAGE

When you need to transform complex scientific data from numbers into visualizations that convey meaningful information – you need a programming language that is intuitive, powerful and that doesn't require excessive time and effort to produce expert-level results.



THE IDL PROGRAMMING LANGUAGE REQUIRES FEWER LINES OF CODE THAN MANY OTHER LANGUAGES.

Five lines of IDL code (above) were used to create a contour plot of coastline topography (left).

## DYNAMIC TYPE SYSTEM

IDL is a dynamically typed language – meaning you can change variables and values at runtime rather than creating new variables and values, recompile and then re-execute your code, as is required with a static language. The dynamically typed nature of IDL gives you more flexibility in your programming, which saves you valuable time and allows you to focus on data analysis and visualization, rather than on programming details.

## INTUITIVE RULES AND CONVENTIONS

The IDL language is based on rules and conventions that are intuitive and easy to learn, regardless of the languages you've used before, or even if you have no programming experience at all. Using IDL you can create visualization programs and even full-blown applications with fewer lines of code. With an extensive library of prebuilt analysis and visualization routines, IDL is the choice for programmers of any experience level.

## ACCESS VIRTUALLY ANY TYPE OF DATA

IDL provides built-in support for the data sources, data types, file formats and file sizes you use. Use IDL to access common formats like TIFF, JPEG, PNG and hierarchical scientific data formats like HDF, HDF-EOS, CDF and NetCDF as well as custom binary and ASCII formats. And, because IDL is designed for large, multi-dimensional data no job is too complex. Receive data, from remote servers or write files to a disk at a remote location using common protocols. IDL acts as a client to HTTP and FTP servers, and provides access to common Open Geospatial Consortium (OGC) servers such as Web Map Service (WMS) and Web Coverage Service (WCS).

IDL is the programming language choice of scientists and engineers because it's easy to learn, easy to use and requires fewer lines of code than other programming languages. Getting from data to discovery is easier and faster.

# THE IDL DEVELOPMENT ENVIRONMENT

Creating ad-hoc visualizations or engineering large, widely-deployed applications requires a programming environment that allows you to easily develop. The IDL workbench provides an intuitive, modern interface that will allow you to quickly create programs and build applications with all the programming tools you need readily available.

## INTUITIVE INTERFACE

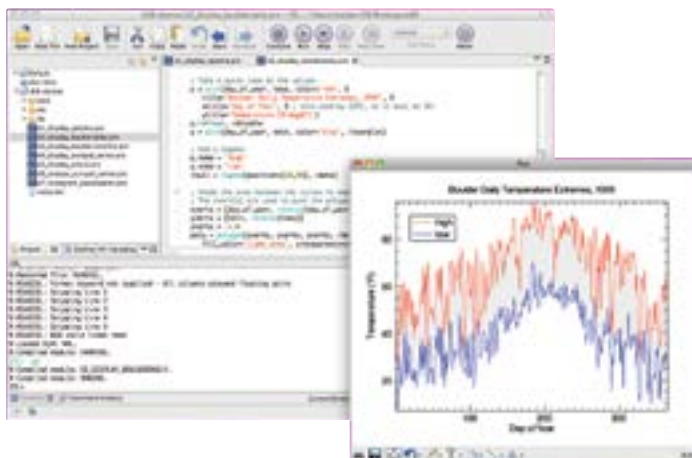
IDL provides an intuitive interface that allows you to focus on analysis with user-friendly features like an easy-access toolbar that includes buttons for your most used programming tools.

## FLEXIBLE DEVELOPMENT FEATURES

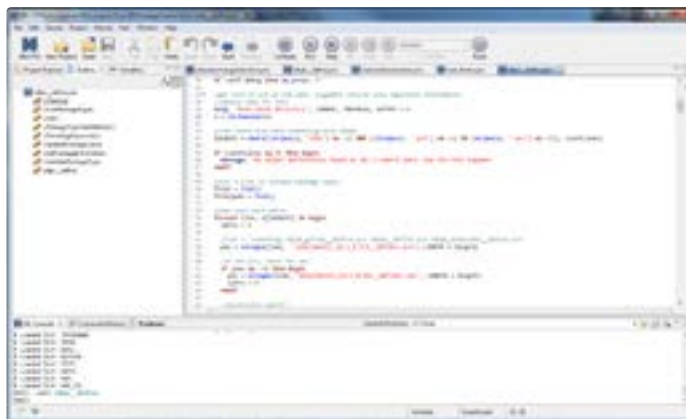
IDL makes developing easier than other languages. Quickly develop small programs or large applications using time-saving features like content assist, auto complete, color coding and hover help. And, code templates make creating your plots, graphics and other visualizations easier than ever.

## ROBUST HELP SYSTEM

IDL Help is an example-based system that helps you solve specific tasks. Thumbnail examples, text links and a visual navigation paradigm all make finding help for your problems fast and easy.



The IDL development environment is intuitive and streamlined, making it easier for you to create visualizations on the fly or develop feature-rich scientific applications.



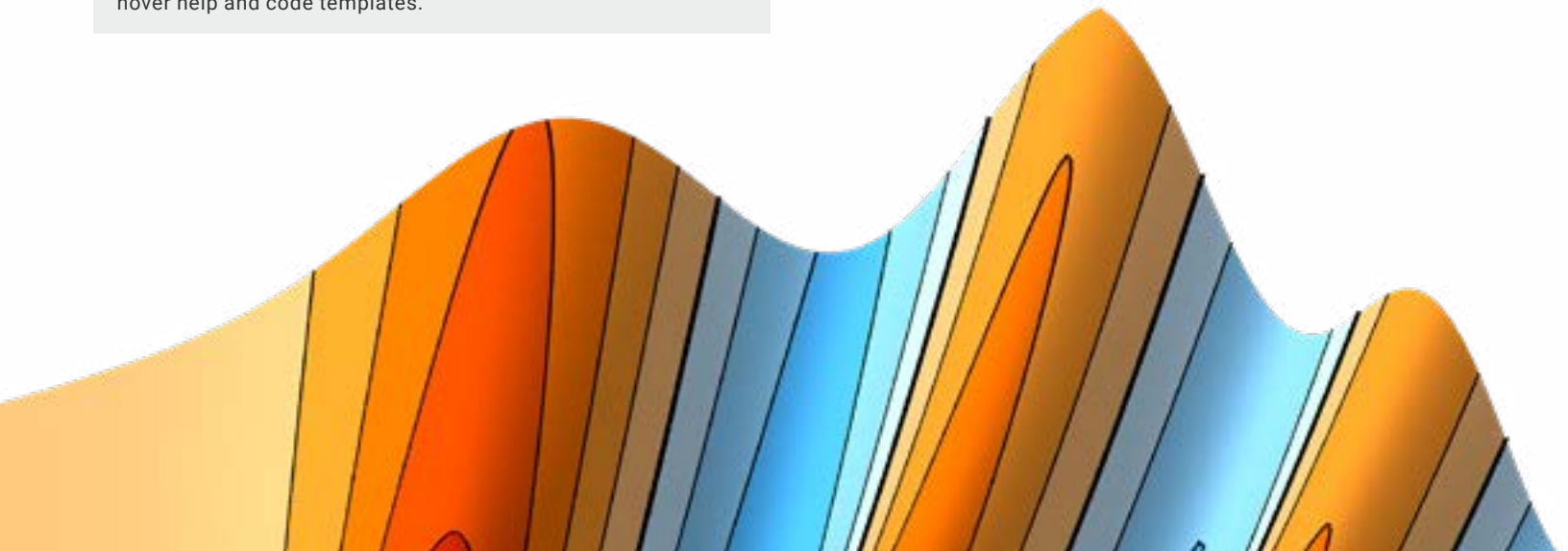
## INTEGRATE WITH OTHER APPLICATIONS

IDL is a flexible and extensible language that supports two-way interaction with other applications, including those developed in C, C++, Java, Visual Basic and more. Get the most from your existing code by easily calling other applications from IDL or calling IDL into other applications.

## SHARE YOUR PROGRAMS AND APPLICATIONS

IDL allows you to share your small program or full application code with colleagues who use IDL. For runtime distribution of applications to users who do not own an IDL license, IDL Virtual Machine is a no-cost option to run compiled IDL programs. In situations where the developer requires greater flexibility, IDL runtime licensing is available.

With the IDL development environment, you have quick access to programming tools to speed development such as color coding, hover help and code templates.

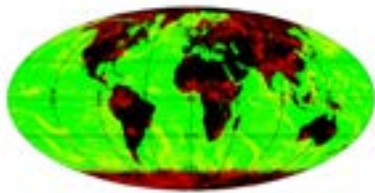




# Creating visualizations for complex numerical data is the key to unlocking the information in your data.

## THE IDL GRAPHICS SYSTEM

The IDL graphics system is powered by the intuitive IDL language syntax, giving you the flexibility to create the high-quality graphics you need to interpret your data or share publication-quality results with colleagues. And, because IDL is easy-to-use, you can start producing powerful graphics quickly and easily.



USE IDL TO CREATE VARIOUS TYPES OF MAP PROJECTIONS INCLUDING MERCATOR, CONIC, CYLINDRICAL AND MORE.

The example to the left displays a map projection of ocean temperatures around the globe. IDL also has direct support for GOES-16 data.

### EASILY CREATE PRESENTATION-QUALITY GRAPHICS

The scriptable nature of the underlying IDL language makes it easy to quickly create powerful graphic visualizations, ranging from two-dimensional plots, graphs, maps and image displays to complex, interactive, three-dimensional representations. The powerful IDL graphics engine is designed to leverage OpenGL hardware acceleration for rapid rendering. This means IDL can efficiently handle large data sets and output the graphics you need.

### CUSTOMIZE INDIVIDUAL GRAPHIC ATTRIBUTES

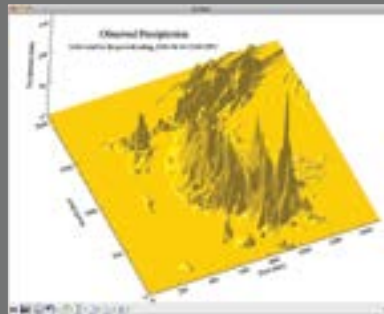
The interactive IDL graphics system allows you to customize how your graphics look, whether you're using it for an office presentation or an international publication. While other programming languages require you to reprogram or regenerate results to make a change, with IDL you can modify line styles, symbols, annotation, font style and color on the fly and save the code to recreate the graphic.

### OUTPUT TO VIRTUALLY ANY IMAGE FILE FORMAT

Programmatically or interactively output to a variety of standard image formats, like GIF, JPEG, PNG, etc. or import graphics into PowerPoint, Keynote or HTML presentations. Additionally, graphics can be output to PostScript or PDF for inclusion in a journal article, TeX or Word document. With so many standardized output options, you can easily share your findings with colleagues for review, secondary analysis or a verification study.

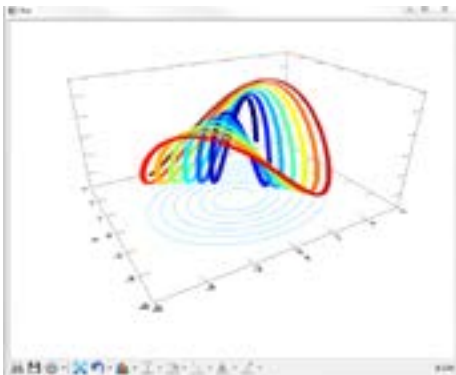
IDL GRAPHIC VISUALIZATIONS ARE DYNAMIC AND ALLOW YOU TO CUSTOMIZE INDIVIDUAL GRAPHIC ATTRIBUTES LIKE LINE STYLE, COLOR, FONT AND MORE.

The 3D plot to the right was created with different line colors to help effectively distinguish between different data sets.



THIS IDL VISUALIZATION OF 'OBSERVED PRECIPITATION' TO THE LEFT WAS CREATED FOR A KEYNOTE PRESENTATION.

Labels have been used to identify location, amount of precipitation and the time period of when data was collected.



# THE POWER OF IDL ANALYSIS

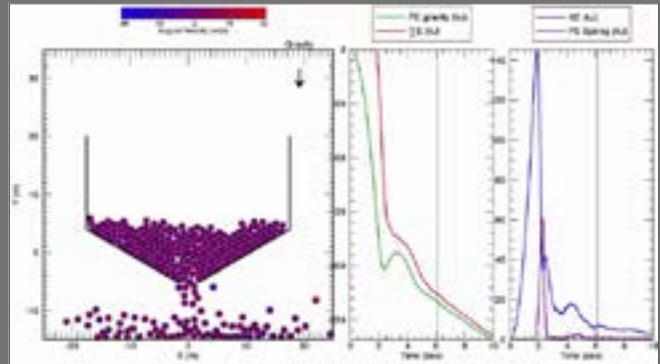
## IMAGE PROCESSING AND MAP PROJECTIONS

If you need to convert raw images to information, IDL contains an extensive library of image processing and analysis routines. IDL allows you to extract useful information from nearly any type of digital image with tools for transforming image geometry, mapping, masking and statistics, warping, analyzing regions of interest, and contrasting and filtering.

## SIGNAL PROCESSING

IDL has advanced tools for processing signal data, including transforms for signal decomposition, windowing algorithms, routines for smoothing, convolving and applying digital filters to remove noise, and correlation and covariance techniques to analyze signals with random components. IDL also has a built-in wavelet toolkit that provides GUI and programmatic wavelet analysis of multi-dimensional data.

IDL includes a powerful and robust analysis engine so you can get the specific statistical and numerical information you need from your data.



The graphic above shows the locations of particles in a physics simulation and tracks the total energy over time. With visualizations like these, IDL makes it easy to verify the behavior of complex algorithms or models and, with temporal datasets, allows you to easily export the results as animations.

## MATH AND STATISTICS ROUTINES

The IDL Advanced Math and Stats Module is an add-on solution for when you need to quickly add advanced mathematical and statistical functionality to an IDL application. It combines advanced data visualization and analysis capabilities with the comprehensive mathematical and statistical routines of the IMSL™ C Numerical Library – a set of pre-written mathematical and statistical algorithms that can be embedded into your program.

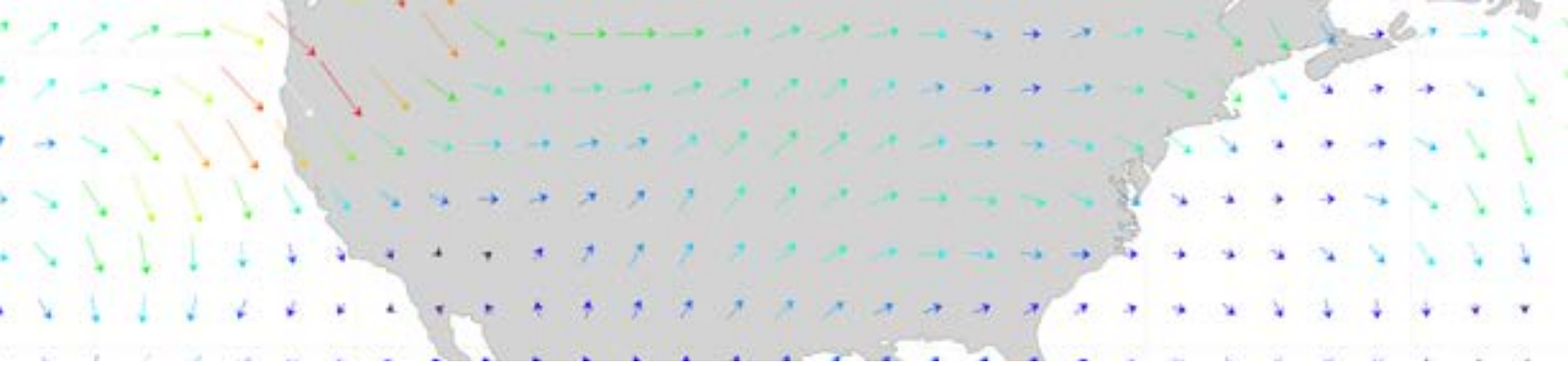
## MACHINE LEARNING

Data analysis has never been easier with access to machine learning algorithms in IDL. Create classifiers using neural networks, Softmax, Support Vector Machine (SVM), K-Means and autoencoders. IDL allows you to read in data from virtually any format and classify it with machine learning algorithms. Advanced users can even use the IDL-Python bridge to access TensorFlow or Keras to further extend your IDL applications.



USE IDL TO EASILY TRAIN AND VISUALIZE THE PERFORMANCE OF MACHINE LEARNING ALGORITHMS ON IMAGES OR OTHER DATA.

The image above is an example that utilizes IDL's autoencoder neural network for unsupervised classification on an image which creates a reusable classifier that can then be applied to different datasets.



# A MODERN LANGUAGE FOR A MODERN WORLD

## IDL PACKAGE MANAGER

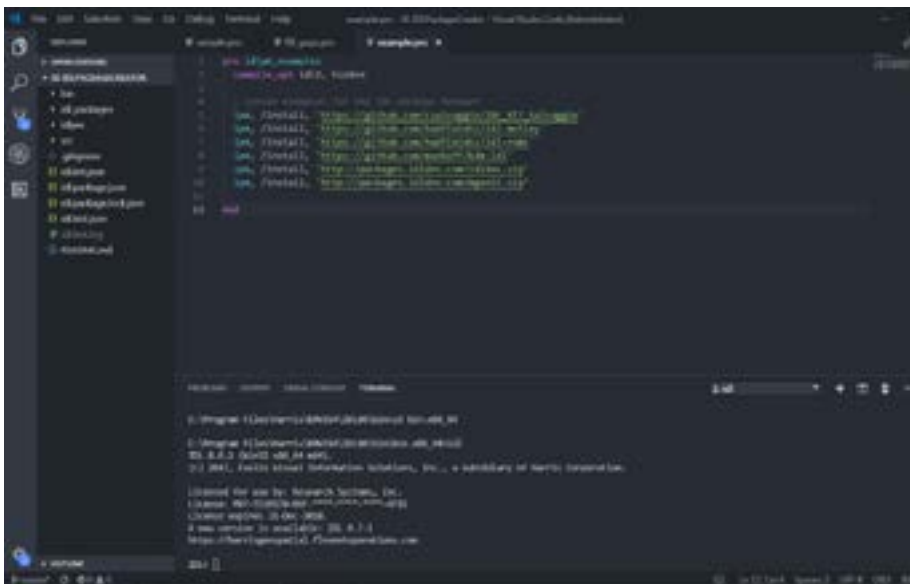
New to IDL 8.7.1, the IDL Package Manager makes it easy to create collections of IDL code that can be shared with other users and accessed with a few lines of IDL code.

## VISUAL STUDIO CODE EXTENSION

If you are a fan of Microsoft Visual Studio Code you can view and edit IDL programs with syntax highlighting using the IDL Interactive Data Language extension. Featuring syntax highlighting, text snippets for PRO code, ENVI Tasks and IDL Tasks, you'll never have to leave your favorite editor to write IDL programs.

## IDL PYTHON BRIDGE

Easily call existing libraries written in Python from IDL and vice-versa. The IDL Python bridge makes it easy to connect to powerful, open-source libraries that can extend IDL's capabilities to a limitless potential. The bridge allows users to call Python from IDL and IDL from Python, using the same, familiar routines and syntax that makes IDL what it is today.



A look at the IDL extension for Visual Studio Code with examples of how you can use the IDL Package Manager to pull down packages into your IDL session is shown above.

IDL has all the tools you need to easily develop and integrate open source packages into any IDL session, making it easy for users to collaborate and rapidly develop prototype applications.

# BEYOND ENGINEERING

## STAY CONNECTED:

[www.NV5GeospatialSoftware.com/IDL](http://www.NV5GeospatialSoftware.com/IDL)

## CONTACT US:

Email: [GeospatialInfo@NV5.com](mailto:GeospatialInfo@NV5.com)

Phone: 303.786.9900

## TECHNICAL SUPPORT:

[www.NV5GeospatialSoftware.com/Support](http://www.NV5GeospatialSoftware.com/Support)

## LEARNING OPPORTUNITIES:

Attend a live web seminar or watch a recorded web seminar – the perfect way to learn about the latest product developments right from your desk.

[www.NV5GeospatialSoftware.com/Learn](http://www.NV5GeospatialSoftware.com/Learn)

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