Frameworks for geoscience data analysis and visualization

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We present a suite of tools developed at NCAR for analyzing and visualizing geoscientific data. The NCAR Command Language (NCL), a self-contained scripting language, now available as OSI-compliant open source, provides robust file input and output for a number of commonly used scientific formats, including NetCDF, HDF, HDF-EOS and GRIB versions 1 and 2. It provides hundreds of analysis functions and has easily accessed 2D visualization capabilities with hundreds of options for producing high quality custom-tailored graphical output. Its diverse and rapidly growing user base is spread among more than 75 countries of the world.

More recently, in order to reach a wider scientific and technical community, we have developed Python interfaces to the underlying capabilities of NCL. PyNGL and PyNIO are Python modules that provide access to essentially the same visualization and data I/O functionality as NCL. The programming style is remarkably similar, allowing users easily to move between the NCL and Python languages. Extensive online documentation provides step-by-step tutorials for quickly acquiring the basics and moving on to more advanced endeavors. Hundreds of examples show how to ingest, analyze and visualize many varieties of data. The tools are under continuous development, driven by a large and activity international community. Current priorities include support for the newest versions of the NetCDF and HDF file formats, and the ability to visualize vector data on triangular meshes.

These tools play essential roles in the post-processing infrastructure of a growing number of high-volume providers of atmospheric, ocean, and climate data. Development is currently funded and ongoing to integrate NCL and PyNGL/PyNIO with the U.S.

DOE and NSF-sponsored Earth System Grid (ESG), both as a member of a suite of server-side processing tools and as an ESG-enabled client with authenticated access to grid-provided data and services.