

Remote data processing inside the ASPECT analysis tool

Kodi Neumiller¹, James Gallagher¹, Emmanuel Njinju², and D. Sarah Stamps²

¹OPeNDAP

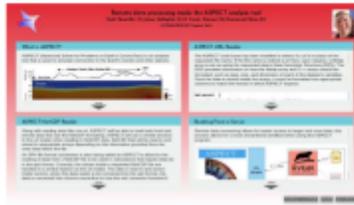
²Virginia Tech

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Abstract

ASPECT (Advanced Solver for Problems in Earth's ConvecTion) is an analysis tool that simulates convection in the Earth's mantle and other planets. The BALTO project has extended the ASPECT software so it can read data used to perform the simulations from the BALTO brokering server. These additions to the ASPECT codebase allow data to be remotely accessed and then processed as if the data were stored on the user's local computer. The additions to ASPECT can be split into two distinct sections: a URL reader and a netCDF reader/translator. The URL reader uses the Data Access Protocol (DAP) to access remote data from supported web servers. Data values are transferred from the BALTO broker and converted within the URL reader plugin to match the format that is expected by the rest of the ASPECT code. Similarly, the netCDF plugin reads data stored using netCDF from the BALTO broker and transforms these data into the sph file format required by ASPECT to perform global mantle convection. The netCDF plugin can use either local or remote data. Once the NetCDF data are read, the plugin combines and formats the required variables (longitude, latitude, seismic velocity, and depth). These newly formatted values are then converted into the sph internal representation to be used as spherical harmonic data by ASPECT. The conversion and processing of data all takes place within the ASPECT program. Both plugins have been integrated to allow the user to lookup remote data in a seamless fashion and broaden the types of data that can be requested by the user.

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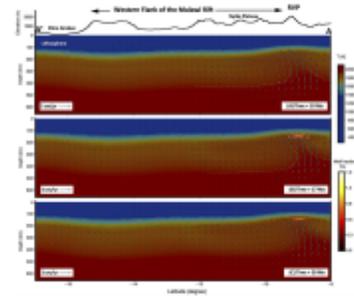


Kath Neuhoff (1), James Gallagher (1), D. Sarah Stamps (2), Emmanuel Njiru (2)
 (1) ONASAT (2) Virginia Tech

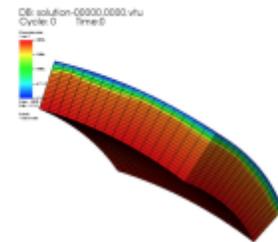


WHAT IS ASPECT?

ASPECT (Advanced Solver for Problems in Earth's Core/Tier) is an analysis tool that is used to simulate convection in the Earth's mantle and other planets.



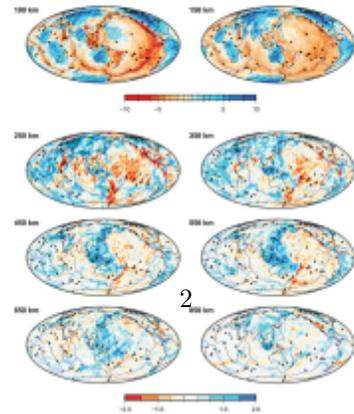
When running ASPECT, data files that are used for initial conditions in the computational models can be of a substantial size. Using the `libzip C++` software library and `libnetcdf` data access ASPECT is able to read data from remote servers and process this data for the end user. Data is run through the ASPECT program where several output files are produced in the `VTU` file format. The graphical output can then be visualized by using the `Vista` program.



ASPECT NETCDF READER

Along with reading data files via `url`, ASPECT will be able to read both local and remote data that use the `NetCDF` formatting. ASPECT will use a similar process to the `url` reader when reading in `NetCDF` data. `NetCDF` files will be read in and stored in appropriate arrays depending on the information provided from the meta data within the file.

An `SPH` file format conversion is also being added to ASPECT to allow for the reading of data from a `NetCDF` file to be used in calculations that require data to be in the `spg` format. Currently, the values inside a requested `NetCDF` file are handled in a similar fashion as the `url` reader. The data is read in and stored inside vectors, when this data needs to be converted into the `spg` format, the data is converted into columns according to how the `spg` converter function(s) expect to read them.



ASPECT URL READER

The ASPECT code base has been modified to detect if a `url` is in place of the requested file name. If the file name is indeed a `url` then, upon request, a `libzip` array is set up using the requested data's Data Descriptor Structure (DDS). The DDS provides information on how the `libzip` array and `C++` arrays should be formatted, such as `type`, `size`, and



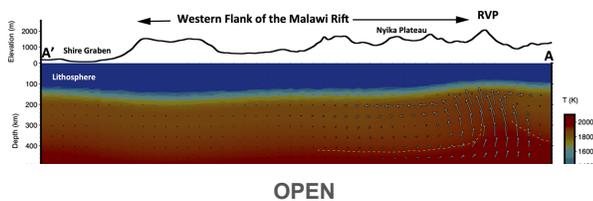
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ASPECT URL Reader

The ASPECT code base has been modified to detect if a url is in place of the requested file name. If the file name is indeed a url then, upon request, a libdap array is set up using the requested data's Data Descriptor Structure (DDS). The DDS provides information on how the libdap array and C++ arrays should be formatted, such as type, size, and dimension of each of

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ASPECT NetCDF Reader

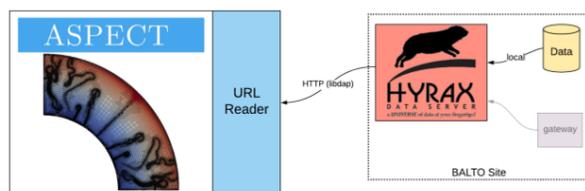
Along with reading data files via url, ASPECT will be able to read both local and remote data that use the NetCDF formatting. ASPECT will use a similar process to the url reader when reading in NetCDF data. NetCDF files will be read in and stored in appropriate arrays depending on the information provided from the meta data within the file.

An SPH file format conversion is also being added to ASPECT to allow for the

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Reading From a Server

Remote data processing allows for easier access to larger and more data, this process allows for a more streamlined workflow when using the ASPECT program.



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