

Remote data processing inside the ASPECT analysis tool

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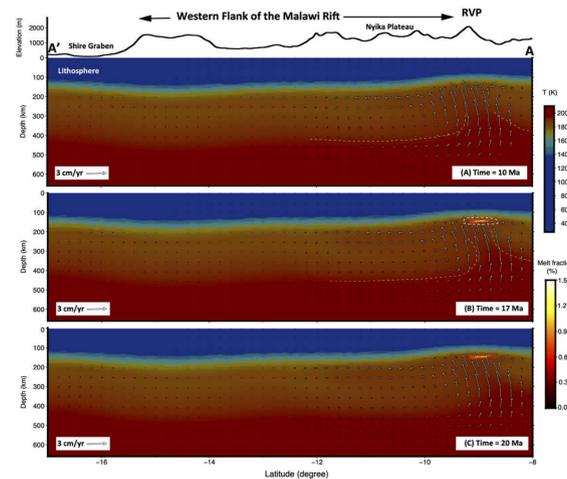


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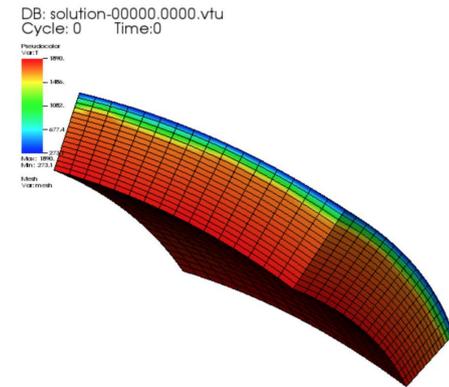


WHAT IS ASPECT?

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



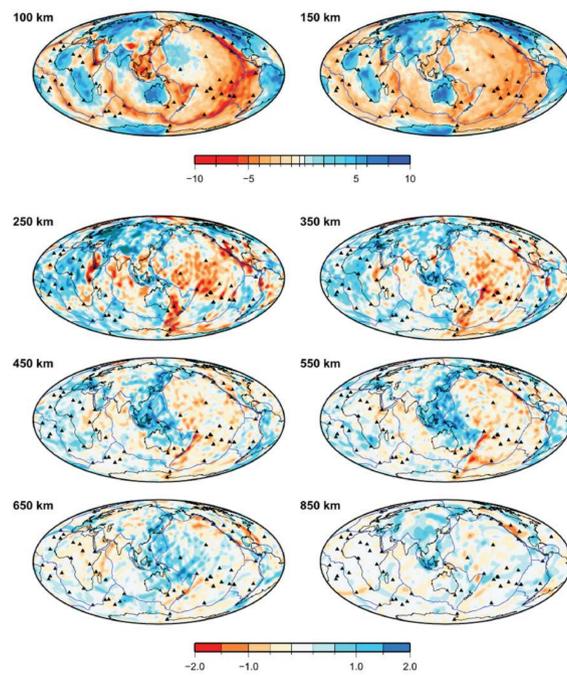
When running ASPECT, data files that are used for initial constraints in the computational models can be of a substantial size. Using the libdap C++ software library and OPeNDAP data access ASPECT is able to read data from remote servers and process this data for the end user. Data is run through the ASPECT program where several output files are produced in the VTU file format. The graphical output can then be visualized by using the Visit 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 be in the sph 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 sph format, the data is converted into columns according to how the sph converter function(s) expect to read them.

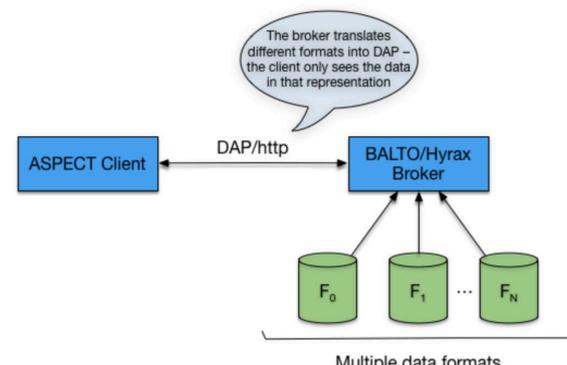


ASPECT URL READER

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 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 the dataset's variables. Once the data is stored inside the arrays, it must be formatted into appropriate columns to match the format in which ASPECT expects.

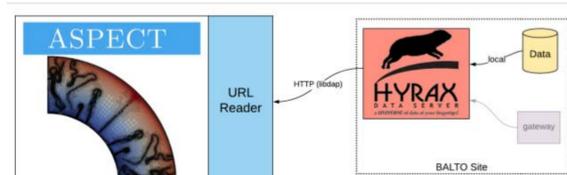
```
Dataset {
  String latitude[record = 48441];
  String longitude[record = 48441];
  String lithosphere_thickness[record = 48441];
  litho.africa.0.csv;
}
```

Data values from a url are initially read into the libdap array, but these values need to be transformed into values readable by ASPECT. To do this, each variable's values are stored in a libdap array, each libdap array is then converted to a C++ vector and stored as a column of data. In ASPECT data is taken from files and transformed into strings before it is passed on, the url reader does so as well. The columns of data are read row by row and passed into a stringstream so that ASPECT can take this string and process the data.



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.



The url reader puts the burden of processing data on ASPECT and the requested server. Users don't have to worry about the formatting or size of the file they want to process because it is handled by ASPECT at runtime. With the URL and NetCDF reader, users only need to know the address of the data, the processing and sorting of said data is handled by the reader.