

Object-oriented reinterpretation of internal data processing in GTOOL3: review for preparation of gtool4

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<http://www.gfd-dennou.org/arch/gtool4/>

The authors have been developing 'gtool4', collection of netCDF conventions, data analysis library, and tools (reported in the meeting in 2000, 2001, 2002). Current experimental implementation have Fortran interface for time-series data generation, data analysis tools such as element-wise arithmetic operations, and visualization tool using DCL. Meanwhile, Fortran interface for data analysis tools is still to be polished up so that netCDF attributes in the convention are generated as well as possible. Hereafter the authors will report on review of similar functionality in GTOOL3 and outlook for re-implementation in gtool4.

(Background)

'gtool4' is named to be successor of GTOOL3. Originally GTOOL3 was developed as I/O library and supporting tools for an atmospheric general circulation model AGCM5 since early 1990s, and employed in other GFD-Dennou Club models. (All software is freely available on the website of GFD-Dennou Club). GTOOL3 tools provide simple analysis such as subarray extraction or averaging, and line graphics visualization using DCL. The gtool4 is a project to improve data portability (also known as network transparency), extensibility, and program readability. The software is rewritten from scratch using Fortran 90 and netCDF.

(Review of GTOOL3 internals)

GTOOL3 file is based on unformatted sequential file of Fortran. It consists of pairs of records called header and data. Data record is a three-dimensional array, and header record (expressed as an array of character type) contains metadata of data record. Application like data analysis tool keeps combination of records pair, and gives them to

subroutines such as array operation or visualization. These subroutines shares common conventions of header management such as history fields, therefore the main program have only to describe essential operation (such as 'adding two data'), and many header fields are retained appropriately. In object-oriented terms, the header-data pair is a object of 'array with attribute', and many subroutines can be regarded as methods of the class. Even destructive and non-destructive (object-duplicating) subroutines pairs are found in th library.

(Outlook for future re-implementation)

Since a coding style for abstract data type using derived types in Fortran 90 in the experimental implementation of gtool4, object structure mentioned above can be expressed clearly and simply. However, simple mapping of single 'record-pair' class is not appropriate, because the new file is not sequential. Now attribute should be managed consistently in whole data array, while the record pair had to be separately self-descriptive in GTOOL3 file format derived from magnetic tapes of mainframe. There may be 'link' between subarray and whole array. The authors plan to implement these idea and improve the tools.

References:

DCL. <http://www.gfd-dennou.org/arch/dcl/>

GFD-Dennou Club. <http://www.gfd-dennou.org/>

GFD-Dennou Club Version of AGCM5. <http://www.gfd-dennou.org/arch/agcm5/>