**Geoscientific
Model Development
Discussions**

Interactive comment on ""Gtool5": a Fortran90 library of input/output interfaces for self-descriptive multi-dimensional numerical data" *by* M. Ishiwatari et al.

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Replies to the comments by referee #2

Thank you for your a valuable opinion about our manuscript. Followings are the replies to your comments.

- The first point is a missing clear description on the use of the CF-convention and its used version. It is not clear in how far referring to gtool4 is helping the reader in understanding how the inheritance/development has been done or is

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  based upon. Directly related to this issue is the introduction of extensions to the CF-convention which is not comprehensible.

[reply]

The gtool4 conventions started to be developed and have been maintained since 2001, when CF conventions were not present. In 2006, since CF-1.0 became popular, we reviewed our conventions and concluded that:

- gtool4 conventions were compatible enough to CF conventions in pragmatic sense of the time,
- some features missing in CF conventions were useful or deserved future testing, and
- hence it is too early to decide migration into CF conventions.

The two conventions have little difference so that most data can circulate only with changing "Conventions". Actually, the slightly modified output of our GCM "dcpam5" was tested successfully by the online checker for CF convection (the output of the checker is shown in the response to the first referee).

The most notable extension to CF conventions (and its predecessors) is meaning of "positive" attribute. We generalized it to specify system behavior instead of description of coordinate represented by the variable. The attribute can be attached to any coordinate variables to specify "default direction of rendering". The default value positive="up" stands for bottom-to-top or left-to-right direction of coordinate, and "down" for the opposite.

This could look far distant from CF, but seldom causes actual difference, since pressure coordinate and depth under the ground or sea surface are the only known "down" axes found around geophysical fluid dynamics.

These statements were described in "3.1 Gtool5 data format".

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- The second point is the mentioned parallel support which is not explained in any way. As full-grown GCMs are mentioned as one of the target models, it is inevitable to have a clean perspective of this library component.

  [reply]

  MPI-1 is originally implemented in the present version of gtool5 library so that, in parallel computations, you can realize separate input/output from each processor or bulk output by collecting data into a single processor even when you use NETCDF-3 library without parallel functions.

  We are now improving the gtool5 library to use parallel API of netCDF-4. Since the gtool5 API would not be changed, present models can achieve better parallel functionality only by relinking the new version of the libraries.

  These statements were described in "Conclusions".

- As it is not crucial to have performance issues mentioned, it would be nice to get a performance estimated for certain problem sizes.

  [reply]

  Thank you for your valuable comment. As a matter of course, we should have taken care of performance issues, which are important check points for software development.

  We tried to estimate necessary computational time for output of data with 8 GB size (100000x1000 two-dimensional array with double precision) using gtool5 API, and found that it takes about 50 % longer time compared with that with raw netCDF API. Moreover, data input takes about twice longer time.

  Since the computational cost of data IO is sufficiently small in actual numerical computations of our models with gtool5 API, we have considered that performance of gtool5 library has not been a serious matter practically, and benefits of

the library, such as simplification of programming and improvement of readability, has been provided satisfactory.

However, the performance check suggests potential possibility that data IO with gtool5 library may become a bottleneck in model calculations on a massive scale. We are now starting to improve performance of data IO of gtool5 library.

These performance issues were described in "Conclusions".

- p3693:

  - l 22-23 The netCDF library cannot contain metadata but allow adding and manipulation of those.

    [reply]

    We replaced the setntence with "its manipulation library can handle metadata contained in netCDF data".

- p3694:

  - l 8 leave out "the" from "the technical"

    [reply]

    It was corrected following to the comment.

  - l 19 leave out "other" from "other ground processes"

    [reply]

    It was corrected following to the comment.

  - l 26 models can only be validated but not verified as they represent only an approximation of what our understanding of the real world is

    [reply]

    We completely agree with your opinion. Our usage of the English terms was unclear. We corrected the sentence as "should be checked independently".

- p3695:
    - l 3 grasp sounds a bit like slang: better use understand or realize
    - l 11 see remark for this page's l 3
    - l 25 see remark for this page's l 3
      [reply]
      We corrected them by choosing "understand".
    - l 9 "verify the validity" - see previous remark for p3694 l 26
      [reply]
      We corrected the phrase as "check the validity".

- p3696:
    - l 5 coordinate variables - information is not needed
      [reply]
      It was corrected following to the comment.
    - l 11 "we need an input/output"
      [reply]
      It was corrected following to the comment.

We hope that the revised manuscript will be suitable for publication in GMD.