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Interactive comment on "C-Coupler1: a Chinese community coupler for Earth System Modelling" *by* L. Liu et al.

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Thanks a lot for the comments and suggestions. We will consider them when revising the manuscript. We'd like to reply them one by one.

1. After reading the manuscript it is still not clear to me whether the C-coupler is a piece of software, a library . . . could help the reader to get a better insight

Response: In our point of view, the C-Coupler can be viewed as a coupler platform which contains a library to provide coupling functions with APIs and also contains a model platform (named C-Coupler platform) with scripts and configuration files for configuring, compiling and running models. In detail, the coupling library is the runtime software system. We combine the coupling library and model platform together in the

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Interactive Discussion

Discussion Paper

C-Coupler because we find that we must co-develop them in order for the general design introduced in Section 3 of the manuscript. We will think how to restructure the manuscript and may make the introduction to the C-Coupler platform (section 4.3) as a section. We only briefly introduce the C-Coupler platform in the manuscript because its users' guide is available for more details.

2. It is worth mentioning that the OASIS3 and OASIS3-MCT namcouple configuration file . . .Here the configuration is described in a xml file.

Response: We want to refer the term of "namcouple" to the meaning of specifying how to couple in configuration files. We know that OASIS4 uses XML formatted configuration files. Similar to the OASIS3, the C-Coupler1 designs the ASCII formatted configuration files with its own parser. We note that XML is more and more common in developing models. In the next version C-Coupler2, we will upgrade the configuration files into the XML format. For this manuscript, we will correct the statements about the "namcouple" and "XML" when revising the manuscript.

3. Furthermore, OASIS4 is not a 3D version of OASIS3 but a complete rewrite . . . In which way does OASIS3-MCT inherit the 3d coupling function from OASIS4 (P3895, L10)?

Response: In the manuscript, we mentioned that "OASIS4 is a 3-D version of the OASIS coupler" but not a 3D version of OASIS3. The statement "the OASIS3-MCT (Valcke et al., 2012b, 2013b), which inherits the 3-D coupling function in OASIS4" in the manuscript is inaccurate. The OASIS3-MCT can handle 3-D coupling due to the integration of the MCT. We will correct the statement when revising the manuscript.

4. In your section about MCT you make a very different statement, which is that the user is responsible for providing appropriate weight matrices.

Response: The MCT reads in remapping weight matrices from NETCDF file to achieve data interpolation utility in coupling. The software SCRIP can provide weight matrices

for 2-D interpolation. However, rare software can provide 3-D remapping weights to MCT.

5. How does the codecouple of CPL6 and CPL7 compare with the OASIS3(-MCT) namcouple and the MCT codecouple?

Response: The CPL6, CPL7 and MCT use codecouple. Compare to the MCT code-couple, the codecouple in the CPL6 and CPL7 manages more utilities, such as flux computation and the processor layout in the CPL7. The codecouple approach is not flexible enough for constructing various coupling models with an identical code version of the coupler. For example, if we want to couple a land ice model into the CCSM3, the old version of CPL6 must be modified and a new code version of CPL6 is produced. Then we will encounter a difficulty that how to merge these two code versions into one. As the C-Coupler targets to be used for any kind of coupling models, it must achieve the identical code version in various model versions. Therefore, we prefer the approach with configuration files, similar to the namcouple in OASIS3(-MCT) and the XML con-figuration in OASIS4. The configuration files can be viewed as the input parameters of a model version.

6. One the other hand I asked myself to which extent such details are really rele-vant to understand your approach . . . reader to understand and classify your C-coupler development.

Response: we will consider how to improve Section 2 especially Section 2.7 when revising the manuscript.

7. P3898 L14: I think your statement is not correct (or I misunderstood your point). Even with OASIS* the characteristics of the coupling . . . I would still claim that OASIS* is also managing the algorithms for the processing of coupling fields.

Response: We confirm about the flexibility of coupling introduced by the OASIS3 nam-couple and the OASIS4 XML configuration files. The context P3898 L14 - P3898 L19

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Discussion Paper

in the manuscript is in order to illustrate the shortcomings of codecouple approach. In the context P3898 L22 - P3898 L25, we mean that the configuration files in the OASIS coupler cannot specify external algorithms. We should modify these contexts to avoid misunderstanding when revising the manuscript.

8. P3904 L14: A matter of taste, but I found the analogy more confusing than helpful.

Response: We can remove this analogy if it is not helpful for understanding.

9. P3908 L19: I really did not get what you mean by " ... that require equation group solving to support, such as spline". This needs to be rephrased.

Response: There two major steps for spline interpolation. The first step is to solve tri-diagonal equations and the second step is matrix-vector multiplication. We use the Thomas algorithm to solve the tri-diagonal equations with low time complexity $O(n)$, where n is the number of equations. If we use matrix-vector multiplication to solve the tri-diagonal equations, the time complexity will be $O(n^2)$. We will improve this context when revising the manuscript.

10. P 3908 L25: What is unique in your approach concerning your time, data, and restart manager? Isn't this something which is provided by all coupling software used for Earth system modelling. Could you indicate where you go beyond existing solutions?

Response: We think that the timer manager functions similar to that in other couplers. The data manager has some features beyond existing solutions. First, each field is labeled with a grid and a parallel decomposition. This implementation reduces the cost for describing the parallel decomposition for 3-D fields. For example, given a 2-D parallel decomposition, the MCT must use a 1-D global index space (linearization) to represent the whole 3-D index space, while the C-Coupler can still use the 2-D parallel decomposition to describe the parallel decomposition for 3-D fields. Second, the data manager unifies the management of different kinds of fields, such as with

different grids, different parallel decompositions, and different data types. As a result, the data transfer algorithm can transfer different kinds of fields at the same time for better communication performance. We note that, the MCT each time can only transfer a kind of fields with the same grid, same parallel decomposition and same data type. Third, the data manager helps improve the reliability for model coupling. For example, the remapping manager will examine whether the grids of source fields and target fields match the grids of remapping weights. We noted that, the MCT rarely did such kind of examination. For the restart manager, a remarkable feature is that it can automatically detect the fields that are necessary for restarting (as mentioned in the manuscript). For example, in the coupled model version FGOALS-gc (as introduced in Section 5), no fields in the coupler component is explicitly marked as restarting fields, and the whole FGOALS-gc can be restarted (achieving the bit-identical result in initial run and restart run).

11. P3911 L18: What makes the internal parallel decomposition that much different from the target decomposition ... I am not 100% sure what you mean by "reduction for sum between multiple processes").

Response: The internal parallel decomposition is corresponding to the source grid of the data remapping algorithm. It is determined by the parallel decomposition corresponding to the target grid and the remapping weights of the data remapping algorithm. For example, given that global cell y of the target grid is on process p, and given a remapping weight <x,y,w> where x is a global cell in the source grid and w is a weight value, the internal parallel decomposition for process p will include the global cell x of the source grid. After rearranging the fields according to the internal parallel decomposition, process p can interpolates the fields locally. We will improve the corresponding context when revising the manuscript.

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