OASIS3-MCT_4.0 test_interpolation

The test_interpolation environment offers a practical example on how to use OASIS3-MCT_4.0 to pre-calculate (i.e. in a separate job prior to the "real" simulation) the remapping weight&address file.

All the documentation about the coupler OASIS3-MCT can be found on the OASIS web site at http://oasis.enes.org and in the OASIS3-MCT sources in the oasis3-mct/doc directory. The current OASIS3-MCT coupler uses internally the Model Coupling Toolkit (MCT) developed by the Argonne National Laboratory (http ://www.mcs.anl.gov/mct) to perform parallel remapping and parallel exchanges of the coupling fields. Since OASIS3-MCT_4.0, a hybrid MPI/OpenMP parallel version of the SCRIP remapping library is available with the coupler sources.

To calculate the remapping weights and addresses in parallel, OASIS3-MCT_4.0 relies on the MPI parallel layout of the calling model but only enrols one MPI process per node. The number of OpenMP threads per node is set by a dedicated environment variable OASIS_OMP_NUM_THREADS; for optimum performance and to avoid hyper threading, it is recommended to set this variable to the number of cores of the node. Notice that, for most of the OpenMP implementations, the number of threads activated at run time is limited by the overall value set by the OMP_NUM_THREADS environment variable. If OASIS_OMP_NUM_THREADS is not set, it defaults to OMP_NUM_THREADS.

All details about the hybrid MPI/OpenMP parallel version of the SCRIP can be found in Piacentini et al. 2018.[1]

Test_interpolation can be used to get familiar with a hybrid MPI/OpenMP environment for off-line parallel calculation of the remapping weight&address file, but can also be adapted and used to efficiently calculate the remapping weight&address file for other couple of grids and other remappings.

Test_interpolation in the default configuration (FRACNNEI between torc and lmdz grids)

Test_interpolation couples two component models, model1 and model2, and evaluates the quality of the remapping between the source grid of model1 and the target grid of model2 by calculating the remapping error on the target grid. Only one coupling exchange is performed at t=0 when model1 sends its coupling field FSENDANA, which is received as FRECVANA by model2. The field values of FSENDANA are defined by an analytical function on model1 grid (torc). The remapping error is defined as the difference between the interpolated values of FRECVANA and the values of the analytical function on the target grid (lmdz) points, divided by the interpolated field (and multiplied by 100 to have it in %). As specified in the configuration file data_oasis3/namcouple, OASIS3-MCT performs a conservative remapping FRACNNEI between

[1] https://cerfacs.fr/wp-content/uploads/2018/03/GLOBC-TR-PIANCENTINI-cmgc_18_34.pdf

torc and lmdz grids. These grids are defined in the OASIS3-MCT grid data files “grids.nc”, “masks.nc” and “areas.nc”, in the subdirectory /data_oasis3 .

To run test_interpolation, first compile the toy model1 and model2, using the Makefile present in the directory. Note that this Makefile includes header_Makefile which itself includes the oasis3-mct/util/make_dir/make.inc that has to be adapted to your platform (see section 6.1 of the User Guide).

Then adapt the script run_testinterp.sh to your platform. For the first test, keep the SRC_GRID, TGT_GRID and remap as defined (respectivelytorc, lmdz, fracnnei). Of course, to run on another architecture then the ones already included (nemo Lenovo at Cerfacs and Météo-France beaufix), you will have to adapt all parts of the script, which are architecture specific.

Once these delicate steps are done, you can run the script, with “./run_testinterp.sh N_M_T” where

- N is the total number of nodes for the run
- M is the number of MPI tasks per node
- T is number of OpenMP threads per MPI task

Without argument, the script is run with N=2, M=1, T=1.

Results are in the $rundir directory as defined in the script. If the run is successful, the following files are present: the remapping file rmp_torc_to_lmdz_CONSERV_FRACNNEI.nc, the analytical field on the source grid torc file FSENDANA_model1_01.nc, the interpolated field on the target grid lmdz in file FRECVANA_model2_01.nc, and the error field as defined above in file error_interp.nc. You can find the minimum and maximum of the error and other diagnostics in the output file model2.out_101.

Test_interpolation for other couple of grids and other remappings

To adapt test_interpolation to your own grids and remappings, you have to go through the following steps

- Generate the OASIS3-MCT grid data files (i.e. grids.nc, masks.nc and areas.nc) with the definition of your own grids, see the User Guide section 5.1 for details. One can adapt sources in test_interpolation/create_grids_masks_with_F90 and test_interpolation/create_grids_masks_with_NCL to create grids.nc, masks.nc and areas.nc (based on "data/grid_model1.nc" and "data/grid_model2.nc"), with either with F90 or NCL.
- Adapt the namcouple configuration file in /data_oasis3 directory for your own grids and remapping, see User Guide Chapter 3 for details.
- Change the SRC_GRID, TGT_GRID, and remap values in the script test_interp.sh

You should then be able to run test_interpolation for your grids and remapping and evaluate the quality of the remapping by analysing the error field in error_interp.nc.

Defining what a “good” remapping precisely means is impossible. But at least, the test_interpolation environment should allow you to identify bugs (if any) and to compare the quality of different remappings.

Of course, you can also ask the OASIS developers for advice regarding your specific results!