

3- Working Progress 2nd Reporting Period

TECHNICAL REVIEW:

OASIS4_1beta (Deliverable 7.2):

- ✓ 2D parallel nearest-neighbour, bilinear, bicubic, conservative, user-defined
- ✓ Validated for ORCA2, MPI-OM, Gaussian Reduced BT42, LMDz (regular) for all types of partitioning including multi-blocks
 - Many regular test with different toy models (echam-nemo, arpege-nemo, user-defined, etc.)
 - Nightly regression testing with buildbot
 - Results regularly updated on OASIS4 wiki (each major revision)
 - Update User Guide
 - Current users:
 - EU GEMS project (ECMWF, Meteo-France, and KNMI): 3D
 - B of Meteorolgy, Melbourne, Australia: 2D regional ocean-atm
 - Alfred Wegener Institute, Germany: 2D global ocean-atm
 - SMHI (Sweden): 2D regional ocean-atm
 - Effort spent up to now: DKRZ: 22 pm, CNRS/CERFACS: 36 pm : already more than the 57 pm allocated in JRA1

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TECHNICAL REVIEW:

OASIS4_1beta (Deliverable 7.2):

But ... still many problems to solve and missing functionality:

- Not full reproducibility between mono and parallel cases for the conservative remapping (differences on few points)
- COSMO-CML (ETH-Zurich) : mysterious slow down in COSMO-CML coupling
- NEMO-WRF (Paris) : failures on parallel interpolation weight calculation for more than 128 cores when the nearest neighbour interpolation
- No value for target points falling into “holes” of the source grid
- No nearest-neighbour option for target cells intersecting only source cells (conservative remapping)
- No global conservation yet
- No support for unstructured grid

Conclusion: given the current resources, we set our sights too high trying to implement a coupler performing fully parallel online calculation of the interpolation weights and addresses (really needed only for adaptive grids).

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TECHNICAL REVIEW:

In July 2011, we decided to take a step back and focus on two solutions to remove the foreseen OASIS3 coupling bottleneck:

- **OASIS4 “user-defined” functionality**
- **OASIS3-MCT**, i.e. OASIS3 interfaced with the Model Coupling Toolkit (MCT) from Argonne National Laboratory (also used in NCAR cpl7 coupler)

Both solutions:

- use interpolation weights and addresses pre-computed offline
- perform the interpolation on the source or on the target processes as a parallel matrix-vector product
- perform the parallel redistribution of data between the source and the target processes (without going through central processes as OASIS3)

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TECHNICAL REVIEW:

Validation of OASIS4 “user-defined” functionality

- Toy coupled model atm (T359) – ocn (ORCA0.25) on CINES Altix ICE (Jade) with 1 coupling field, 1 coupling timestep
 - Successful run on 360 cores for atm and 500 cores for ocn (after much debugging !)
 - But new problem with memory deallocation for more than one timestep
- MetOffice toy coupled model atm (192x145) – ocn (ORCA1) toy coupled model on IBM Power 6 with 38 coupling fields
 - Successful run on 96 processes for atm and 20 processes for ocn (after much debugging !)
 - But poor performance observed, hanging and crashing depending on the processor configuratio

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TECHNICAL REVIEW:

Development and validation of OASIS3-MCT

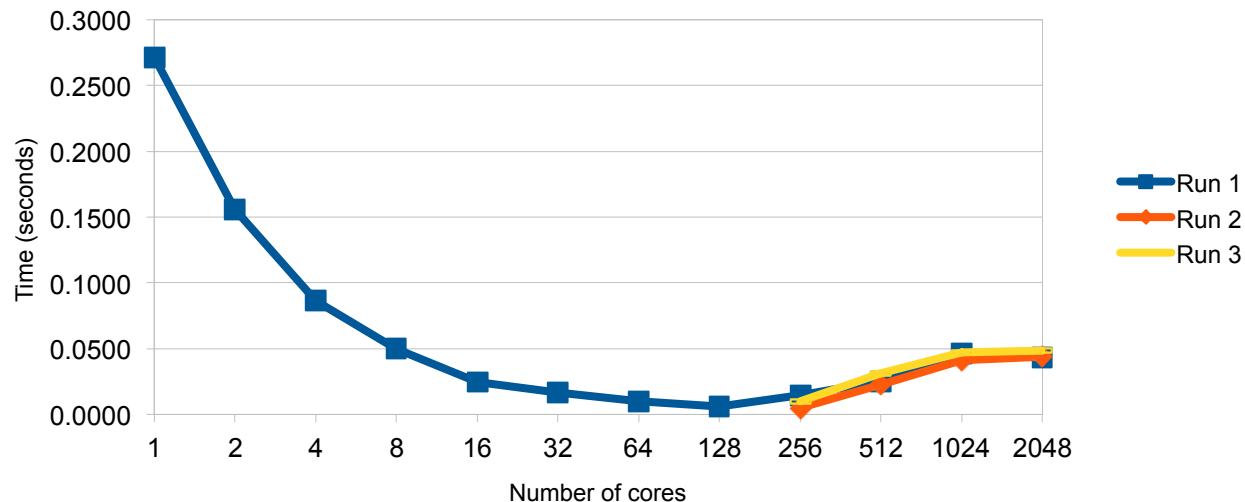
- Interfacing of MCT in OASIS3 done by Tony Craig (main NCAR cpl7 developer, now consultant for CERFACS) : ~ 2 months of work
- OASIS3-MCT “prototype” now available
- Very simple to use for traditional OASIS3 users:
 - No change wrt OASIS3 API in the models
 - In OASIS3 “namcouple” configuration file, put “MAPPING” and give the name of the weight-and-address interpolation file (SCRIP format)
- OASIS3-MCT has same flexibility than traditional OASIS3 (number of models, number of coupling fields, coupling restart files, etc.)
- **Very straightforward** testing and validation:
 - Toy model atm (T359) – ocn (ORCA0.25) on Linux PC and HP AMD cluster
 - EC-Earth (T799 – ORCA0.25) on Ekman AMD Opteron (Stockholm)
 - ARPEGE-NEMO (T359 – ORCA0.25) on Curie Bullx (Paris)

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TECHNICAL REVIEW:

Performance of OASIS3-MCT on curie (up to 2048 cores/component)

Time for one ping-pong exchange on curie (T799-ORCA0.25)



Very reasonable scalability (coupling exchanges involve mainly communication and matrix-vector multiplication; they are NOT expected to scale very well!)

At ~2000 cores/component, coupling overhead of ~12 seconds for a 10-day high-resolution coupled run with 1 coupling exchange every hour.