Debriefing from WP4/NA3-HPC

Jean-Christophe Rioual & Mario Acosta

Work progress - Main achievements

Significant results and activities for each task, including deviations from Description of Activities:

- **Task 1 :Development of a new Quality assurance approach for the NEMO consortium**

  - *Nothing done yet and not expected until 18-24 month at least (IPSL)*

- **Task 2 : Building a new community around a European Platform for Sea Ice modelling in NEMO**

  - *Completion of milestone M4.1 (**submitted report in December 19**) : Organisation of a workshop devoted to the future direction of sea ice modelling to help inform the development strategy of the new European Platform for Sea Ice modelling. (MetO & IPSL)*

  - *The SI3 model available in the NEMO4.0 version has been implemented in the ocean-sea ice CMCC configurations at eddy-permitting and eddying resolutions. (CMCC)*

- **Task 3 : Computational evaluation of complex Earth System Models**

  - *First collection of CPMIP metrics from internal and external partners done (BSC&Partners)*

  - *Strategies to integrate CPMIP collection automatically for Autosubmit and CMCC model (BSC, CMCC)*

  - *Improving LUCIA to collect more information to improve coupling cost evaluation (BSC)*

Debriefing from WP4/NA3-HPC

Jean-Christophe Rioual & Mario Acosta

Work progress - Main achievements (page 2)

Significant results and activities for each task, including deviations from Description of Activities:

- ***Task 4 : Machine Learning and Technology Tracking***

    - *Tracking and networking activities related to workshops, talks and technologies for/about ML/IA for Earth Science community (UNIMAN, CMCC, MetO).*

    - *Evaluating possibilities for ML/IA workshop.*

- ***Task 5 : Community Workshops***

    - *Preparation of coupling workshop 23-25 March 2020, Toulouse (<u>Postpone due to COVID-19</u>) until September/October 2020.*

- ***Task 6 : Innovating with software and HPC industry***

    - *No real work done yet ; some innovations tasks have been collected for future discussion and evaluate possibilities with partners/vendors.*

Task 3, 4 and 6 will be discussed during the Models&HPC BO session on Friday, come to know more details about WP4 activities.

Next steps with focus on key issues to be addressed

<u>*Next steps and issues to be addressed by the end of RP1 (mo18 – June 2020)*</u>

- *Final decision about ML/IA joint activity between ESiWACE2 and ISENES3*
- *Evaluate roadmap and strategy among CERFACS, BSC and CMCC for task3 activities*
  - Investigation of strategies to improve the measurement of the energy consumption (e.g. RAPL through the powercap interface or PAPI libraries as interface to RAPL raw counters available on the Intel processors)
- *CPMIP first analysis and ES-DOC update*
- *Writing up a report from the Iceland sea ice workshop for submission to BAMS (expected in March 2020) and contributing towards a sea ice model development review paper, which will be based upon the workshop discussion/outcomes.*

<u>*Next steps and issues to be addressed during RP2 (July 2020 - December 2021)*</u>

- *Start the new quality assurance tests for NEMO.*
- *Definition of strategies for achieving the best load balance among model components in a range of OASIS-based coupled components.*
- *Final CPMIP collection for CMIP6 experiments, ES-DOC final update and final analysis.*
- *Coupling workshop report (D4.1): <u>Delayed due to workshop postponed</u>*

Work progress - Main achievements

Significant results and activities for each task, including deviations from Description of Activities:

Task 1: Level 1 services: Maintaining and monitoring the ENES ESM resources

- ES-DOC: Model information updated for CMIP6
- ENES portal update: Model information updated for CMIP6

- Issues for Level 1 services:
  - EC-Earth and NorESM not yet visible at ES-DOC due to (i) late arrival of model information and (ii) technical problems on ES-DOC side
  - Model information on ES-DOC not comprehensive in general
  - ENES portal update incomplete
    (CMIP5 information prevalent, CIM links not updated)

Task 2: Level 2 services for European ESMs

- KPI selected: Released versions, active contributors, issues opened/closed, mails/forum messages exchanged
- KPI reported for first and second 6m period: EC-Earth, NEMO, NorESM, HadGEM/UKESM

Work progress - Main achievements

Significant results and activities for each task, including deviations from Description of Activities:

Task 1: Level 1 services: Measures to overcome issues

- Continuous contact with ES-DOC staff to sort out publishing delays
  (since 2/2020, ongoing)

- Sort out technical issues on ENES Portal with portal admins
  (since 2/2020, ongoing)

- Portal layout: decide where to keep CMIP5 info
  (to be done)

- Contact modelling and tools groups and request portal update
  (3/2020, waiting for replies)

Work progress - Main achievements

Significant results and activities for each task, including deviations from Description of Activities:

Task 3: **Services for European infrastructure tools**

- KPI selected: same as for models

- KPI reported for first and second 6m period: OASIS, Rose/Cylc, XIOS, ESMValTool

- Three dedicated supports provided to OASIS users thanks to our TNA:
  - interface upgrading of a CPU-GPU regional coupled model
    (ETH, Switzerland)
  - ocean-atmosphere coupling including a zoom
    (GEOMAR, Germany)
  - computationally efficient ocean-ice coupling
    (Met-Office, UK)

Work progress - Main achievements

Deliverables and Milestones: indicates the delayed ones, and the next ones to completed before RP1

- **D6.1** First periodical report on service statistics for models and tools (M18)
  (**on time**, all KPIs and reports for ODUS completed)

- **M6.1** ENES ESM resources updated, RP1 (M18)
  (**expected on time**, pending remaining ES-DOC updates and ENES portal technicalities)

- **M6.2** Reviewer for services appointed (M18)
  (**to be discussed** at the GA)

Next steps with focus on key issues to be addressed

Next steps and issues to be addressed by the end of RP1 (mo18 – June 2020)

- Provide OASIS dedicate support to 3 other laboratories
  (NERCS Bergen, GEOMAR Kiel and BTU Cottbus)
- Formally provide first periodical report (D6.1)
- Complete ENES portal updates (M6.1)
- Appoint service reviewer (M6.2)

Next steps and issues to be addressed during RP2 (July 2020 - December 2021)

- Provide OASIS dedicate support to 3 other laboratories and summarise the support
  action in the final report
- Continued KPI collection
- Next periodical reports
- First external review of services for models and tools
- Report on new OASIS coupled models/interfaces

INFRASTRUCTURE FOR THE EUROPEAN NETWORK FOR EARTH SYSTEM MODELLING

WP8/JRA1 – Models, Tools and HPC

Sophie Valcke, Italo Epicoco

IS-ENES3 1st General Assembly
25-27th March 2020
Toulouse, France

Work progress - Main achievements

T1 - Improving Nemo computational performance
(CMCC 11 pm, BSC 20 pm, MetO 5 pm - I. Epicoco, M. Acosta)

- Introduction of MPI3 neighbor collective calls and comparison with standard MPI2 point-to-point communications, tested on FCT advection scheme (CMCC)
  - GYRE_PISCES configuration: **communication time reduction of 18%-32%**

- Halo management support introduced in NEMO to allow developers to specify different halo sizes for different NEMO Kernels (CMCC)

- Basic profiling deployed on MN4 and identification of main bottlenecks (BSC)

- Reduced-precision NEMO version presented by Oriol T. at Mercator Ocean, Met Office, NOC, ECMWF. Discussion going on with IPSL, NEMO HPC group and ECMWF to merge changes in NEMO master branch (BSC).

- Scalability tests of NEMO4-SI3 on Met Office Cray XC40 system (MetO)

Impact of precision on sea-surface temperature in NEMO4: difference between GYRE1/9º simulations using different precisions and a GYRE1/27º double precision reference (not shown)

Sophie Valcke, Italo Epicoco
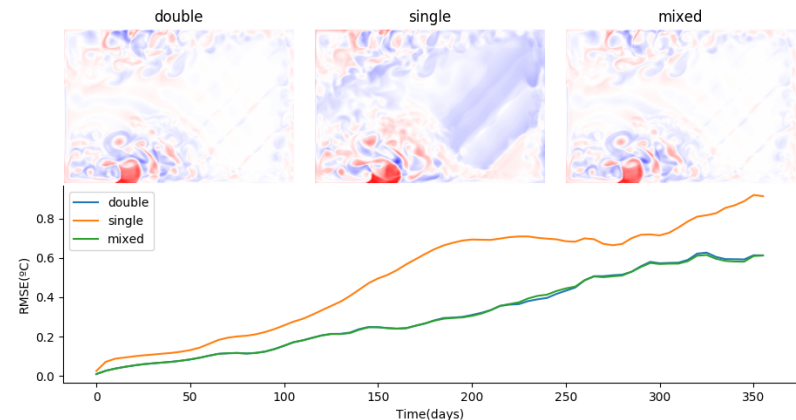
Work progress - Main achievements

T2 - Extending NEMO to include a unified European platform for sea ice modelling
(MetO 4 pm, CNRS-IPSL 4 pm, CMCC 1 pm, MF-CNRM 1 pm, UREAD-NCAS 2 pm – E. Blockley - M. Vancoppenolle)

- 1st version of SI3 released with NEMO 4.0; fixes and HPC optimisations in NEMO 4.0.1 release (MetO, CNRS-IPSL)

- Optimisation of SI3 communication **: from 1.7 to 2.1 SYPD** on 271 Broadwell nodes (36 cores/node) (MetO)

- Use of SI3 into MetO climate model in place of CICE (MetO)

- Demonstrator of **ORCA12 NEMO - OASIS3-MCT - SI3**, **outperforming the single executable at >300 nodes** (MetO + OASIS Dedicated Support from Cerfacs)

Sophie Valcke, Italo Epicoco

Work progress - Main achievements

Significant results and activities for each task, including deviations from Description of Activities:

T3 - OASIS3-MCT development
(CERFACS 23 pm, STFC 6 pm – S. Valcke, R. Ford)

- Deep analysis of SCRIP quality (Cerfacs technical reports: Jonville & Valcke 2019, Valcke & Piacentini 2019)

- Diverse developments and bug fixes: distance calculation in GAUSWGT interpolation, systematic test of NetCDF returned error code, additional nearest-neighbour option in SCRIP CONSERV/DESTAREA and possibility to desactivate it in BILINEAR, BICUBIC, DISTWGT

T4 – XIOS development
(CNRS-IPSL 27 pm), CERFACS 3 pm – Y.Meurdesoif, MP Moine)

- Tool producing a graphical view of xios workflow of a finished simulation

- Automated test set suite to ensure contiguous integration of developments

- *M8.1 : A set of unit tests for XIOS - completed 12/2019*

T5- Cylc/Rose development
MetO (24 PM) - D. Matthews

- Work on Cylc 8 (+ compatible Rose release) : porting to Python 3 and developing a new architecture to support a web based GUI

- *M8.2 : Cylc/Rose development priorities agreed – completed 12/2019*

Next steps with focus on key issues to be addressed

Next steps and issues to be addressed by the end of RP1 (mo18 – June 2020)

- T1 NEMO
  - Complete profiling analysis of NEMO to identify potential MPI improvements (BSC)
  - Technical and scientific validation of the reduced precision approach (BSC);
  - Use of the collective neighbors MPI3 calls with graph topology (CMCC)
  - Validation of the extra halo management development (CMCC)
- T2 SI3 - Document SI3 in coordination with other projects like EU-IMMERSE (CMCC, MF-CNRM, UREAD-NCAS)
- T3 OASIS - Analyse ESMF remapping quality (CERFACS)
- T4 XIOS – Work on XIOS restartability and new workflow infrastructure (CNRS-IPSL)
- T5 Cylc – Work on first formal release of Cylc for end 2020 or shortly afterwards (MetO)

Next steps and issues to be addressed during RP2 (July 2020 - December 2021)

- M8.3 (12/2020): Final list of developments for OASIS3-MCT_5.0 (CERFACS)
- M8.4 (12/2020): Definition of NEMO optimization strategy (CMCC).
- D8.1 (12/2020): NEMO sea ice model code
- M8.5 (06/2021): Documentation of the NEMO sea ice model
- D8.2 (12/2021): OASIS3-MCT_5.0 release