Report for Project bk0726 on the Supercomputer Mistral, DKRZ

Period: Nov 2016 – Oct 2017

Project Title: WASCAL – Regional climate simulations for West Africa

Principal investigator: Dr. Dominikus Heinzeller[1,2,3], dom.heinzeller@noaa.gov

Project contributors:

Ms. Diarra Dieng[1,2]

Dr. Gerhard Smiatek[1]

Dr. Cornelia Klein[2,7]

Dr. Joël Arnault[1,2]

Dr. Jan Bliefernicht[2]

Dr. Christiana Olusegun[1]

Dr. Edward Naabil[5]

Dr. Ilse Hamann[4]

Dr. Mouhamadou Bamba Sylla[6]

Prof. Dr. Harald Kunstmann[1,2]

[1] Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Garmisch-Partenkirchen, Germany

[2] University of Augsburg, Institute of Geography, Augsburg, Germany

[3] University Corporation for Atmospheric Research, Research Applications Laboratory, Boulder, CO, USA

[4] German Climate Computing Center (DKRZ), Hamburg, Germany

[5] GRP-WACS, Federal University of Technology, Akure, Nigeria

[6] WASCAL Competence Center, Ouagadougou, Burkina Faso

[7] Centre for Ecology and Hydrology, Wallingford, UK

Contents

1 In brief

In our application for computational resources on Mistral for the period 1/2017 through 12/2017, we proposed to continue with high-resolution regional climate modeling experiments with RCMs CCLM and RegCM. Furthermore, the collection of global seasonal prediction data via download of NCEP's CFS output, compression and archival in HPSS arch was to be continued to facilitate WASCAL's own future seasonal prediction modeling efforts.

2 Progress

2.1 WASCAL RCM WRF output data on the move

Eventually all output from WASCAL climate model experiments shall be stored locally at the WASCAL Competence Center[1] (CoC), but a high capacity storage silo (400 TB) has not yet been procured. Therefore long-term archival and publication of 60 Terabytes of post-processed output data from regional climate simulations with RCM WRF (created in 2016) at the World Data Centre for Climate (WDCC), hosted by DKRZ, was chosen as an interim solution.

First the data were transferred from shared storage media of KIT/IMK-IFU in Garmisch-Partenkirchen to a so-called NetApp, i.e. a type of disk-storage device which owns and controls a filesystem and presents files and directories to hosts over the network, a scheme that is sometimes called Network-Attached Storage (NAS). Then in mid-February 2017 this NetApp was driven to Hamburg, where colleagues Carsten Beyer and Thomas Kaule of the Systems Department of DKRZ mounted the storage on two nodes of DKRZ's Mistral supercomputer, and transferred the data in less than two days to the work space of the WASCAL 726 computing project at DKRZ. Transferring this data volume via the internet from Garmisch-Partenkirchen to the WDCC in Hamburg would actually have taken about 2 months.

2.2 Training future climate modelers and climate service providers

To facilitate the wide use of this treasure of data – projections for values of 88 climate-relevant variables for several decades in the 21st century in up to now unsurpassed high spatial and temporal resolution – Peter Lenzen and Ilse Hamann of DKRZ presented workflows of climate model data management at the *Hydro-Climate and Remote Sensing Training Opportunity for West African Students and Early-Career Scientists in Ouagadougou*[2], Burkina Faso, in March 2017. Specific knowhow on metadata, conventions for Climate and Forecast (CF) metadata, Data Reference Syntax (DRS), the WDCC/CERA database system and Long Term Archiving (LTA), and Quality Assurance procedures (QA) was passed on to the participants of the Workshop.

2.3 Experiments with RCM RegCM4 started

After preparing simulation runs with RegCM4 at the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, Mouhamadou Bamba Sylla of the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) spent one week in April 2017 at DKRZ to get first-hand experience on the HPC platform Mistral at DKRZ intended for the production of WASCAL's remaining last third of the complete set of 9 GCM/RCM combinations. He learned where to get forcing data from historical and RCP runs from various GCMs, which directories to use for different steps/tasks in his model experiments, obtained the list of output variables to save from RegCM runs that should match the one used with WRF and CCLM, and in which format to save those data (CF-compliant).

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[1]   http://www.wascal.org/about-wascal/our-team/competence-center/
[2]   https://www.wascal.org/fileadmin/user_upload/Research/Trainings/HYDRO-CLIMATE_TRAINING_WEST_AFRICA.pdf

He has extensively tested the RCM and freezed a version. The historical MPI-ESM-MR driven run has been initiated while input data for pre-processing of the rcp4.5 MPI-ESM-MR driven simulation is being gathered.

2.4 Long-term archival of WRF and CCLM output at WDCC

WRF: On the basis of the CERA2 Metadata Submission Guide[3] colleagues in the Data Management Department of DKRZ advised the data providers at KIT/IMK-IFU how to formulate the metadata for the data entities to be long-term archived. The WDCC has issued 14 DOIs (Digital Object Identifiers) in August 2017 for high-resolution climate simulation experiments carried out with RCM WRF[4]. The DOIs have been registered with DataCite and are resolvable (Heinzeller et al., 2017). Furthermore 314 datasets with results from these simulations have been long-term archived at WDCC (10 years).

CCLM: After continuing with simulation experiments with RCM CCLM during the first quarter of 2017 Diarra Dieng of the University of Augsburg KIT/IMK-IFU has completed post-processing of previous CCLM runs. She is now following the example of her WRF modeling colleagues and is preparing metadata and having the data quality checked in order to long-term archive and obtain DOIs for her high-resolution climate simulation results with CCLM.

3 Publications

Diarra **Dieng**[1,2], Gerhard Smiatek[1], Jan Bliefernicht[2], Dominikus Heinzeller[1,2], Abdoulaye Sarr[6], Amadou Gaye[7], and Harald Kunstmann[1,2]: Evaluation of the COSMO- CLM high-resolution climate simulations over West Africa, Journal of Geophysical Research: Atmospheres, 122, 1437–1455, https://doi.org/10.1002/2016JD025457, **2017**

Dominikus **Heinzeller**[1], Diarra Dieng[1,2], Gerhard Smiatek[1], Christiana Olusegun[1], Cornelia Klein[3], Ilse Hamann[4], Seyni Salack[5], and Harald Kunstmann[1,2]: The WASCAL high-resolution regional climate simulation ensemble for West Africa: concept, dissemination, assessment. Earth System Science Data (ESSD), Received: 21 Aug 2017 – Accepted for review: 18 Sep 2017 – Discussion started: 22 Sep **2017**. https://www.earth-syst-sci-data-discuss.net/essd-2017-93/

Harald **Kunstmann**[1,2], Dominikus Heinzeller[1,2], Diarra Dieng[1,2], Gerhard Smiatek[1], Jan Bliefernicht[2], Ilse Hamann[4], Seyni Salack[5]: The WASCAL high-resolution climate projection ensemble for West Africa, Geophysical Research Abstracts, Vol. 19, EGU2017-13780, **2017**, EGU General Assembly 2017, http://meetingorganizer.copernicus.org/EGU2017/EGU2017-13780.pdf

[1]Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Garmisch-Partenkirchen, Germany

[2]University of Augsburg, Institute of Geography, Augsburg, Germany

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[3] https://cera-www.dkrz.de/docs/CERA2MetadataSubmissionGuide.pdf
[4] https://cera-www.dkrz.de/WDCC/ui/cerasearch/q?query=wascal%20doi&ref_type_name_s=Citation-DOI&page=0&rows=15

[3]Natural Environment Research Council, Centre for Ecology & Hydrology, Wallingford, United Kingdom

[4]German Climate Computing Center, Hamburg, Germany

[5]WASCAL Competence Center, Ouagadougou, Burkina Faso

[6]l'Agence Nationale de l'Aviation Civile et de la Météorologie (ANACIM), Senegal

[7]Laboratoire de Physique de l'Atmosphère et de l'Océan Siméon Fongang, Cheikh Anta Diop University, Dakar, Senegal

Report written by: Ilse Hamann, 7.11.2017