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2nd European School on Earth System and Climate Modelling

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01	2014-09-16	Reinhard Budich	Initial release
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Abstract

The Second European Scholl on Earth System and Climate Modeling took place at the Barcelona Supercomputing Centre in Barcelona, Spain, from June 10 – 20 2014, organized jointly by the MPI for Meteorology, Hamburg, Germany, the National Centre for Atmospheric Research, Reading, UK, and the Barcelona Supercomputing Centre, Barcelona, Spain under the auspices of the European Network for Earth System Modeling as part of the IS-ENES2 WP 1.

30 students, of which 15 were male and 7 were not from the EU, participated. 3 Models were set-up, run, and compared, 18 Lectures were given, and about 500 person-hours were spent on tutorship. Participants were very satisfied by the school providing insightful recommendations for the next school, too.

There was a slight deviation from the work plan, illuminated in the text. The next school is planned by NCAS for 2016, to be held at FMI, Helsinki, Finland.

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Dissemination Level		
PU	Public	
PP	Restricted to other programme participants including the Commission Services	
RE	Restricted to a group specified by the partners of the **IS-ENES2** project	
CO	Confidential, only for partners of the **IS-ENES2** project	

CAPACITIES

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Executive Summary

The objectives of the school were:

- To help in the scientific education of early career scientists
- To compactly introduce early career scientists and programmers to Earth System Modelling
- To provide insight into how models work, and how they are used to experiment
- To familiarize participants with model inter-comparison

Major Results can be summarized as follows: The Second European Earth System and Climate Modeling School 2nd E2SCMS took place in Barcelona, Spain at the Barcelona Supercomputing Centre from June 10 -20 2014. 30 students, of which 15 were male and 7 were not from the EU, participated. 3 Models were set-up, run, and compared, 18 Lectures were given, and about 500 person-hours were spent on tutorship. 5 presentations were given be the students groups. The evaluation of the survey after the school showed largely positive reactions of the students, with some exceptions which will help to improve the quality of the next schools.

It is planned to run the next summerschool with the same models in Summer 2016 probably at the FMI/CSC in Helsinki, Finland; the school will be organized with NCAS as a leader. It is planned to advertise for the school more in advance this time (6 months before the end of the application phase). Furthermore, two new experiments should be added for a total number of 6, so that 36 participants could be accommodated. Furthermore, a common environment and support and training for debugging and optimization should be added.

1. Objectives

The Earth‘s climate is a complex natural system, models of the Earth’s Climate System (ESMs) are complex pieces of software. Young scientists working in this field are mostly educated in fields like meteorology or oceanography - or physics or economy, fields even farther away from Earth System Sciences – so they are introduced to ESMs superficially, at best. A focused, coordinated teaching approach to Earth System modelling is missing in many countries throughout Europe, especially where large ESM institutions are not available. Many early career scientists have to acquaint themselves to the ESM of their - or their advisors - choice by „training on the job“, i.e. applying a model not very well known to them to a specific scientific question. Literature studies and knowledge exchange with colleagues and superiors on the job and/or during workshops and conferences accompany this occupation.

The larger ESM institutions have seen the problem of „Teaching Earth System Modelling“ already for a longer time, and established systems like the International Max Planck Research School on Earth System Modelling at Max-Planck-Institute for Meteorology (MPI-M) in Hamburg (http://www.earthsystemschool.mpg.de/) or summer schools like the National Centre for Atmospheric Sciences (NCAS) Climate modelling schools (an example can be found under http://www.ncas.ac.uk/index.php/en/climate-modelling-summer-school#).

Such summer schools share a typical structure: A series of lectures on the realms coupled in ESMs (Atmosphere, Ocean, Land, Ice, etc.), the matter cycles (Water, Carbon etc.), the complete model, but possibly also on numerical aspects, software engineering or hardware and other IT aspects, as well as more general aspects of the Earth system (political, societal etc.) is combined with hands-on tutorials on the model: Sitting in a computer lab, participants are introduced to the software structure, scripts to run and control the model, tools to analyse, interpret and compare their output, and are then guided to parameterise and initiate a model run in a way enabling them to work on assignments answering typical questions in Earth System modelling (see examples below).

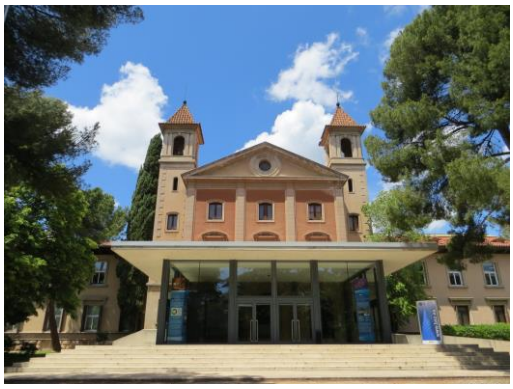
But these summer schools so far were mainly addressed to students of a single institution, and not so much to the larger European community - despite the fact that they were mainly depending on the ESM in question, and not the institution organising it.

Another observation is crucial in this context: ESM scientists and also those colleagues studying impacts of climate change, independent of their career status, today need to compare ESMs and their results, as it is obvious from the numerous Model Inter-comparison Projects, which are a unique feature and crucial part of this field of science, as can be seen not only from the CMIP5/IPCC process.

So within the IS-ENES context the idea came up to transfer the concept of successful ESM summer schools as described above, held and organised by single institutions on a single model, to a larger audience, namely early career ESM scientists throughout Europe, especially from smaller countries, in a series of summer schools, employing not only one specific, but rather a few ESMs, and compare these models during the schools.

Within the IS-ENES consortium the institutions working on this idea first were MPI-M and Academy of Athens (AA).
NCAS joint later, and the three institutions successfully carried out together the 1st prototype of an IS-ENES summer school series in summer 2012 on the island of Kos/Greece. For IS-ENES2, AA was no longer partner in the project, but BSC, representing the EC-Earth consortium, jumped in.

Both NCAS and MPI-M had quite some experience running single institution/model schools already (see e.g. the NCAS reference above or http://issmes.enes.org), whereas BSC was not only volunteering to provide suitable facilities to host the second school, but also afforded a summer school version of the EC-Earth model as 3rd model for the school.



NCAS and MPI-M benefitted from their activities in the 1st school in that they were able to re-use versions of their models and environments installed on the High Performance Computing system of the German Climate Computing Centre DKRZ for the 2nd school. BSC was able to use their own facility for the experiments with the EC-Earth-model, and transfer the output data to be analysed to DKRZ on the fly during the school, for easier comparison with the other two models.

This deliverable describes the 2ndE2SCMS in more detail.

1.1 The School

The 2nd E2SCMS took place June 10 – 20 2014 on the BSC Campus in Barcelona, Spain. Preparation of the school started about 1 year in advance, with frequent video and phone conferences. New assignments were discussed and tested with the three models in advance. The application and admission process and the travel arrangements were conducted and carried out at MPI-M[1]. A committee with participation by the three institutes involved, and the project coordination selected admissions to the school. All final assignments were pre-computed, and the data stored both at DKRZ and BSC, just in case. As an addition to the projects budget, PrACE sponsored the school with 1500,- € which were spent on catering, see agenda. The school was held at the same time as the 1st IS-ENES2 General Assembly, so that there was sufficient room for exchange between the students and more senior staff from the host project.

1.2 Lectures

The lectures, as it is kind of best practice in this type of summerschool, covered the complete Earth System, it's compartments, the models describing these compartments, and their combination/coupling. These readings were accompanied by more specialised lectures on the one hand, introductions to the assignments and methods to be applied, and, on the other hand, more generic evening lectures for the broader academic education and information. For the first time, a lecture on entrepreneurship was added in collaboration with Climate KIC (Milestone M6.3). It was an opportunity to both demonstrate the needs of the climate information job market in the private sector and show possible career opportunities for students.

Much to the advantage of the students it was possible to attract quite a few internationally well reputed teachers for the lectures, as can be seen from the lecturers list in the amendements.

1.3 Tutorship

From each institution involved, at least three tutors were delegated to the school, enabling a very good tutor-student ratio and, such, a good and fast coverage of the questions of the students. BSC also had additional staff on-site for the more technical questions and problems, which was very much appreciated.

1.4 The Agenda

Such schools need to have teaching and training phases, see the agenda below. For the

E2SCMS2: European Earth System and Climate Modelling School
June 9 - 20 2014, Barcelona, Spain

Agenda

Time	Mo June 9	Tuesday June 10	Wednesday June 11	Thursday June12	Friday June 13	Saturday June 14	Sunday June 15	Monday June 16	Tuesday June 17	Wednesday June 18	Thursday June 19	Friday June 20
	Arrival (individual arrangement)	Earth System Processes			HadGEM2, EC-Earth and MPI-ESM components		at free dispositon	HadGEM2, EC-Earth and MPI-ESM components	Simulation analysis and interpretation			Departure (individual arrangement)
09:00-10:00		Checkin: No later than 10 am please!	Energy and Water Cycles: Pier Luigi Vidale NCAS	Ocean physics and Cryosphere: Neven Fuckar IC3	Oceanic composition & processes: Katja Lohmann MPI-M	Radiation and convection: Paul Field Met Office		Ocean - salinity, nutrients, carbon: Tatiana Ilyna MPI-M	Analysis of simulation results			
10:00 - 10:30		Welcome, introduction to facilities, overview Summer School										
10:30-11:00		Coffee Break						Coffee Break				
11:00-12:30		Earth System Science and Coupled Models: Sylvie Joussaume IPSL/CNRS	Land physics and biology: Axel Kleidon MPI BGC	Ocean Biogeochemistry Inga Hense Uni HH	Atmospheric composition and processes: Nicolas Bellouin NCAS	Land - energy, water and carbon: Christian Reick MPI-M		Glaciers, Ice sheets, sea ice: Martin Vancoppenolle IPSL	Analysis of simulation results			
12:30-14:00		Lunch						Lunch				
14:00-15:30		Atmospheric Physics: Pier Luigi Vidale NCAS	Starting simulation experiments	Checking simulation experiments	*Finalizing hypotheses*	Analysis of simulation results		Analysis of simulation results				
				Hypotheses cont.	Checking simulation experiments							
15:30-16:00		Coffee Break						Coffee Break				
16:00-17:00		Ocean Physics: Daniela Matei MPI-M	*Hypotheses contd.*	Visit to MareNostrum	Tutorial: From data to graphics	Analysis of simulation results		Analysis of simulation results	*Open Discussion: Students give a first overview on simulation results to discuss them with all course members (students + teachers). Only pencil and chalk allowed!*	Analysis of simulation results	*Final student presentations*	
17:00-17:30												
17:30-18:00		*Students start formulating hypotheses*		at free dispositon	Analysis of simulation results							
18:00-20.00		Icebreaker and Poster session	*Dinner + Talk* Harilaos Loukos CLIMPACT		*Dinner + Talk* PRACE Sergi Girona BSC	at free disposition		*Dinner + Talk* Tatiana Ilyina MPI-M	at free disposition	*Dinner + Talk* Francisco Reyes IC3	at free disposition	
20.00 - On		at free disposition	at free disposition	Joint Dinner with IS-ENES General Assembly	at free disposition			at free disposition		at free disposition	Dinner and farewell ceremony	

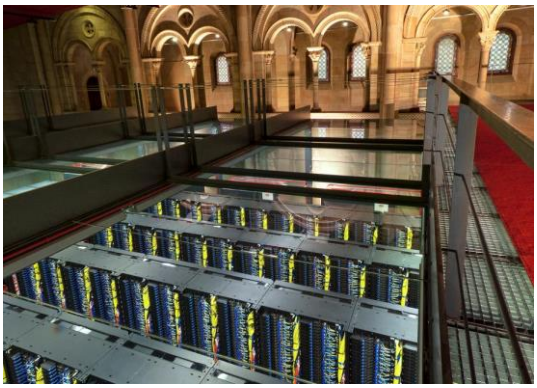
training, the following consideration is important: Due to their numerical properties and performance, the models in question need to run on HPC facilities. Since the assignments for the school need to cover topics relevant in climate sciences, the data

sets produced should cover at least a few decades of model time, preferably more than 100 model years. The models provided have a performance of about 30 - 50 years per real time day, so they need to run for two to three days in order to produce enough data for an analysis interesting for the participants. Given the length of the typical summer school (1 - 2 weeks) and the time needed to interpret the results (including to understand the assignment, find out the relevant parameters, build a hypothesis, understand and employ the analysis tools, check data against the hypothesis, prepare presentation of results, which also sums up to 1 - 2 weeks) it is obvious that the training has to be organised in a way that enables the participants to send off their job script on the HPC facility on day 1 of the school. This implies also quite a large number of tutors to help participants to come up to speed, and provide knowledge and hints to tackle the assignments. The assignments for a multi-model summer school pose a special challenge: In order to compare the models in a meaningful way, the assignments have to be set-up in a way that all models can tackle them. The list of assignments is also attached.

Experiences from schools before led the team to the decision to provide the teaching as early as possible in order to give the students the possibility to apply their newly acquired knowledge to the science problems posed to them, also see below. Another very important element of the school was the hypothesis building process including ample time for discussions about them. Evening talks “looking over the rim” completed the agenda.

1.5 Facilities

The location to be found for such a school has to fulfil some technical requirements: A lecture hall for about 60 people, a separate computer class room with about 16, better 32 terminals, and some separate smaller rooms for discussions of working groups are necessary. Furthermore, a fast network link to the HPC installation - and to the internet at large for research and for the daily needs of the participants - are prerequisite, as are presentation and printing facilities. Board and lodging needs also have to be fulfilled. Given the experiences from the 1st, prototypical, school it was decided to look for a place for the school not only technically apt for the job, but also culturally interesting. Barcelona was decided to be the place of choice.



The computing times, storage facilities, support services and other resources were provided by BSC and DKRZ. BSC made a lecture hall as well as two computing labs available, as well as on-site facilities for lunches and dinners. The computing labs were equipped with 8 PCs each, local as well as on-line support was provided by BSC. Apart from the Spanish keyboards, which some participants needed to get used to first, the technicalities worked extremely well.

1.6 Assignments

The list of assignments is shown on the right. The answers of the students in form of their presentations can be found on our website[2].

1.7 Deviations from the DoW

NCAS and MPI-M swapped the order of execution of the schools from what was planned originally in the DoW, because it seemed appropriate to start with the institute more experienced with international schools. NCAS will plan and carry out the 3rd school.

Experiments at 2ndE2SCMS

Soil respiration

In this experiment the consequences of an abrupt increase of slowly decomposable leaf litter is analyzed. One can think of this as if the litter had been somehow poisoned so that only extremely specialized bacteria or fungi are able to consume the litter.

Ocean Mixing

In this experiment the effect of an increased vertical mixing in the ocean mixing in the ocean is examined.

Ocean albedo

In this experiment the effect of an increased sea water albedo is examined

Flat Earth

This experiment tests the effect of mountains, high plateaus etc., i.e. of surface elevations on the climate. Surface elevations are represented by the surface geopotential, which is seen by the resolved flow, and by surface parameters describing the sub grid-scale surface features. In this experiment the geopotential and the parameters describing the unresolved topography are set to zero, resulting in a "flat Earth" (though the surface roughness remains unchanged).

Increase of GHG concentration

This experiment explores the effects of an increase of CO2 concentration in the atmosphere, following a rate of 1% annually from pre-industrial levels.

2. Results

2.1 Announcement, Applications and Selection Process

The first announcement of the summer school was made in December 2014 via the CLIMLIST mailing list, which is read around the world in the community. Furthermore, announcements were made via the is-enes and other well-known mailing lists as well as in the participating institutions. The deadline for the application was set to end of February 2012.

A complete set of application documents had to consist of:

I. A Letter of Motivation presenting the scientific motivation for the application, including information concerning the applicants' research interests and modelling skills.

II. A Curriculum Vitae (CV / Resume) including current occupation and contact information (e-mail and postal).

III. A description of the applicants modelling experience: The applicant was asked to list computing knowledge (e.g. UNIX, use of supercomputers), experience with mathematical models, and statistical and data analysis tools.

[2] https://verc.enes.org/community/schools/2nd-e2scms-1/lectures-and-suggested-reading/presentations

IV. A reference letter: The referee was asked to e-mail the reference letter as pdf file directly to office.imprs@zmaw.de.

The selection process was executed jointly by BSC, NCAS and MPI-M staff, in cooperation with the ENES-Board, the handling was done by the IMPRS office in Hamburg. The applications were evaluated based upon the 4 criteria mentioned above by the staff of NCAS and MPI-M, and recommendation lists were produced. They were discussed in a joint telco, and then merged into a single list which was forwarded to the ENES-Board for approval. Based on this approval, admissions were issued.

2.2 Participants

Some 40 applications from around the world were received for the 30 places offered for the school. 30 students, of which 15 were female, were selected, from 13 EU and 7 non-EU countries. More information can be found in the table above. Admissions were announced end of March.

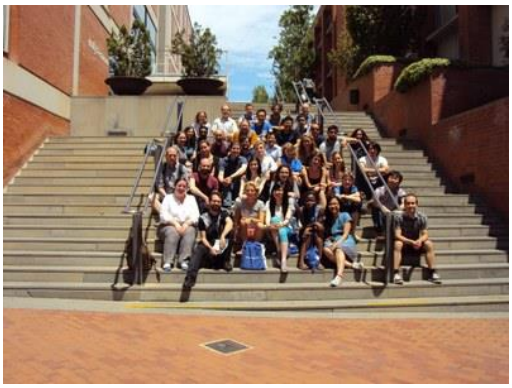
2.3 Evaluation

A survey server was set up for the participants. Evaluation of the answers showed a very content opinion about the school at large, with some statements interesting for the further planning:

Number of Applicants					**Number of participants**		
total	Competitive applications		from .... countries		from	from ... Institutions	
	female	male	EU	Non-EU	EU	Non-EU	Organising
37	20	17	23	14	28	9	9

- Some participants felt that the scope of the school and the expected expertise of the students need clearer statements in the announcement.
- The lecture hall was considered to be sub-optimal
- Not all participants were convinced that the number of models was low enough
- The evening lectures seem to have been a case of overkill, for many

3. Perspectives



3.1 Basic Setup of the school

Given the high satisfaction rate of the participants, lecturers and tutors, the basic concept of the school seems to be very OK, with the remark, that we need to make clearer whom we would like to address as an audience, and ensure that the level of the lectures fits this audience. Everything else seems to be in good shape.

3.2 Number of Models

The number of models should not be raised, but different combinations are naturally feasible in later editions of the school.

3.3 Number of Participants

This needs to fit the number of models and the number of assignments, so 30 seems like a natural number.

3.4 Location

The location was almost perfect, centres with HPC and teaching facilities as well as nice host cities seem a better fit than large hotel resorts. Next venues considered are Helsinki/FMI/CSC or Salento/INGV/CMCC.

Addendum:

The Students:

Name	Institute
Borodina, Aleksandra	ETH Zuerich, Zuerich, Switzerland
Chamberlain, Jill	University of Reading, Reading, United Kingdom
Chen, Ruidan	Max Planck Institute for Meteorology, Hamburg, Germany
Davini, Paolo	ISAC-CNR, Torino, Italy
de Wet, Pierre	University of Bergen, Bergen, Norway
Demissie, Teferi	Norwegian University of Science and Technology, Bergen, Norway
Deppenmeier, Anna-Lena	University of Wageningen & KNMI, The Netherlands
Drews, Annika	GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany
Filipi, Luca	Politechnico de Torino & ISAC-CNR, Turin, Italy
Gamez Nieto, Pedro	University of Barcelona, Barcelona, Spain
Groner, Vivienne	Max Planck Institute for Meteorology, Hamburg, Germany
Guo, Chunchang	University of Bergen & Bjerkness Centre for Climate Research, Bergen, Norway
Hedemann, Christopher	Max Planck Institute for Meteorology, Hamburg, Germany
Klockmann, Marlene	Max Planck Institute for Meteorology, Hamburg, Germany
Laakso, Anton	Atmospheric Research Centre for Eastern Finland & FMI, Kuopio, Finland
Martynova, Yulyia	FSBI 'SibNIGMI", Novosibirsk, Russia
Matsikaris, Anastasios	University of Birmingham, Birmingham, United Kingdom
Nabel, Julia	Max Planck Institute for Meteorology, Hamburg, Germany
Nyawira, Sylvia	Max Planck Institute for Meteorology, Hamburg, Germany
Octaviani, Mega	Max Planck Institute for Chemistry, Mainz, Germany
Paulsen, Hanna	Max Planck Institute for Meteorology, Hamburg, Germany
Rea, Gloria	Parthenope University of Napoli & ISAC-CNR, Rome, Italy
Reith, Fabian	Helmholtz Centre for Ocean Research, Kiel, Germany
Thum, Tea	Finnish Meteorological Institute, Helsinki, Finnland
von der Linden, Eveline	Wageningen University & KNMI, De Bilt, The Netherlands
Winckler, Johannes	Max Planck Institute for Meteorology, Hamburg, Germany
Wu, Lichuan	Uppsala University, Uppsala, Sweden
Wu, Minchao	Lund University, Lund, Sweden
Yiu, Scott	University of Cambridge, Cambridge, United Kingdom
Zhang, Wenxin	Lund University and SMHI, Lund, Sweden

The Staff

Name	Role	Institute
Baldasano, Jose	Organization	BSC
Bellouin, Nicolas	Lecturer	URead
Budich, Reinhard	Organization	MPI-M
Doblas-Reyes, Francisco	Evening speaker	BSC
Evaldsson, Martin	Tutor	SMHI
Field, Paul	Lecturer	MetOffice
Fuckar, Neven	Lecturer	BSC
Gayler, Veronika	Tutor	MPI-M
Girona Turell, Sergio	Evening speaker	BSC
Goncalves Ageitos, Maria	Organization/Tutor	BSC
Haak, Helmuth	Tutor	MPI-M
Hense, Inga	Lecturer	Uni-HH
Ilyna, Tatiana	Lecturer	MPI-M
Joussaume, Sylvie	Lecturer	IPSL
Kleidon, Axel	Lecturer	MPI-BGC
Klingaman, Nicholas	Tutor	URead
Lohmann, Katja	Lecturer	MPI-M
Loukos, Harilos	Evening speaker	Climpact
Matei, Daniela	Lecturer	MPI-M
Pineda, Oriol	Organization	BSC
Reick, Christian	Lecturer	MPI-M
Schiemann, Reinhard	Tutor	URead
Serradell, Kim	Tutor	BSC
Stefanescu,Simona	Tutor	ECMWF
Vancoppenolle, Martin	Lecturer	CNRS
Vidale, Pier Luigi	Lecturer	URead
Weitz, Antje	Organization	MPI-M