



## COMBINE

### Comprehensive Modelling of the Earth System for Better Climate Prediction and Projection

## Quarterly Newsletter 3 – January 2011

The last 2 months of 2010 have been dedicated to writing and synthesizing the 1<sup>st</sup> Period report. We are grateful to everybody for the enjoyable collaboration during the report preparation.

#### *This issue:*

- 1<sup>st</sup> Periodic Report Publishable Summary
- Report on SPARC DynVar Workshop 2 and the COMBINE WP3 side event.

#### *Announcement:*

- To provide for an opportunity to report on the scientific and technical work produced within the project, we have initiated the **COMBINE Technical Report Series**. Possible topics for the series include documentations of scientific and technological development of new model components, analysis tools for evaluation of model outputs, support datasets for running experiments (e.g. land cover changes datasets, specified ozone distribution for the CMIP5 simulations, etc), new observations and analysis datasets for initializing and/or evaluating model performance, and methodologies for model evaluations. Please consider the COMBINE technical report series (<http://www.combine-project.eu/Technical-Reports.1668.0.html>) as an avenue to publish and disseminate your technical oriented work.

#### *Project News:*

- COMBINE Technical Report No. 1: Balmaseda et al. 2010, The NEMOVAR-COMBINE ocean re-analysis. ([http://www.combine-project.eu/fileadmin/user\\_upload/combine/tech\\_report/COMBINE\\_TECH\\_REP\\_n01.pdf](http://www.combine-project.eu/fileadmin/user_upload/combine/tech_report/COMBINE_TECH_REP_n01.pdf)).
- combine-all email list at 154 participants: Many thanks to the project WP leaders for collecting emails during the first reporting period.

#### 1<sup>st</sup> Periodic Report - Publishable Summary

The general goal of the COMBINE project is to advance the capabilities of climate prediction and projection by including critical physical and biogeochemical processes (“new components”) into Earth system models (ESMs) and by using observation based analyses of the ocean and sea ice states, to benefit from the predictability of the climate system.

At the start of the project the consortium had available climate and impact models, as used to contribute to the 4<sup>th</sup> Assessment Report of IPCC. The protocol for the Coupled Model Inter-comparison Project phase 5 (CMIP5) for new climate projections and climate predictions was published, though important data sets needed for CMIP5 were not yet available to the community. Prototypes of component models in some cases were also available to the consortium, although the knowledge and experience in the coupling between the component models and the ESMs were generally not available.

During the reporting period, the COMBINE partners have advanced significantly on two main tasks: develop the scientific and technical foundations for incorporating new components in ESMs; and prepare and test the ESMs to be used for CMIP5.

#### Main results achieved so far:

- Implementation in relevant ESMs and first testing of new processes related to the carbon cycle, such as land use changes, terrestrial and oceanic nitrogen cycles, and wildfire; and processes related to methane emissions from changes in permafrost and wetlands.
- Improvements in the description of sub-grid-scale cloud-radiation and aerosol-cloud interactions, first evaluations of cloud-radiation effects and of aerosol-cloud

relationships; and land use impacts on tropospheric chemistry.

- Significant improvement in the representation of stratospheric variability both in the tropics and in the extra-tropics in the relevant ESMs.
- Extensive evaluation of the processes regulating ice-sheet surface energy and mass balances; and increased realism of the representation of surface snow processes in both ice-sheet and sea-ice models.
- New ocean re-analyses conducted using the most up-to-date quality-controlled ocean observation data sets and forcing fluxes from improved atmospheric re-analyses; significant progress in the area of sea-ice assimilation.
- Provision of initial states for decadal hindcasts and forecasts; preliminary assessment of the impact of different ocean re-analyses and initialization strategies on the simulated ocean variability and predictability.
- Decadal prediction and centennial projection simulations following the CMIP5 protocols have started with the relevant COMBINE modeling systems. Following the project plan, 4 modeling systems are employed for the decadal experiments. These experiments have been initialized using observation based ocean state estimates to benefit from the predictability of the climate system. All the COMBINE modeling systems are involved in the centennial CMIP5 simulations.

Some non-critical delay in the project work is reported. A major reason for this delay is the fact that convergence, within the international climate research community, in delineating and constructing the CMIP5 radiative forcing data was reached only toward the end of 2009 (and in some cases beginning of 2010). This situation has been exploited for further advancing the status of the ESMs, but it has delayed the actual running of the simulations and in some cases also the work on the incorporation of the new components in some ESMs.

Neither the expected results nor the intentions for use and impact of the project results have changed. The COMBINE model-data; the quantifications of impacts and scenarios and the scientific knowledge emerging from the improved ESMs will substantially contribute to

the next IPCC assessment. The project work will strengthen the scientific base for environmental policies of the EU for climate negotiations.

### **Report on SPARC DynVar Workshop 2, 3-5 November 2010, and the COMBINE side event, 2 November 2010.**

*E Manzini (MPI-M, Hamburg, DE)*

The DynVar Workshop 2 was jointly organized by the DynVar Activity of the Stratospheric Processes and their Role in Climate (SPARC), a core project of the World Climate Research Programme (WCRP), the National Oceanic and Atmospheric Administration (NOAA) Earth System Research Laboratory's (ESRL) Physical Sciences Division, the Cooperative Institute for Research in Environmental Sciences (CIRES) at University of Colorado, and the COMBINE WP3 Stratosphere. The Workshop took place on 3-5 November 2010 (2 and ½ days) and was kindly hosted by NOAA's ESRL. The workshop attracted 68 participants from 11 countries. The workshop consisted of 12 invited and 41 contributed presentations, of which 11 orals and 30 posters.

The SPARC DynVar Activity goals are to determine the dependence of the mean climate, climate variability, and climate change on stratospheric dynamics as represented in Climate and Earth system Models. COMBINE funding and coordination allows Europe to take the lead on many aspects of the SPARC DynVar Activity and indeed underpins the European contributions. For further information on SPARC DynVar: (<http://www.sparcdynvar.org/>).

The motivation of the SPARC DynVar Workshop was to provide a forum for presenting works on the development of climate models with a well-resolved stratosphere and their applications to seasonal forecast and climate prediction and projections. The Workshop was timely, given the ongoing international efforts on these topics.

The workshop agenda was organized partly based on time scales: The first day was dedicated to presentations on interannual and shorter time scales, including discussion on the Stratosphere resolving Historical Forecast Project (SHFP), part of WCRP's Working group on Seasonal to Interannual Prediction cross

cutting activity (WGSIP) and Climate Variability and Predictability Project (CLIVAR). The second and third days were dedicated to decadal and centennial time scales and CMIP5 models and experiments. The final session on Friday was dedicated to consolidate future efforts and plans. Topics addressed in the workshop included: Influence of the stratosphere on the tropospheric circulation, on the ocean circulation via air-sea interactions, and on snow and sea ice fields; Role of the stratosphere in the tropospheric circulation response to climate change; Mechanisms for two-way stratosphere and troposphere coupling. Presentation sessions were complemented by discussion sessions dedicated to address how best analyze CMIP5 runs, with the role of the stratosphere in focus. One of the outcomes of the Workshop is that about 10 modeling groups are carrying out a selection of the CMIP5 simulations with coupled global atmosphere ocean sea-ice models, specifically designed to simulate stratospheric dynamics, while interactive atmospheric chemistry was included in three model systems and at least three modeling systems will additionally be run with CO<sub>2</sub> emissions, requiring modules for the land and ocean carbon cycle. Following the Workshop, Research Groups have been established, to foster analysis of the SHFP and CMIP5 archives, with the role of the stratosphere in focus and in view of future opportunities to convene in 2012. The relative large number of participants to the workshop demonstrates a growing interest in the role of stratospheric dynamics and variability on the climate system. For a detailed report see Manzini et al. (SPARC Newsletter 36, 19-22, 2011).

Prior to the Workshop, members of COMBINE WP3 met with international colleagues involved in the running of the CMIP5 experiments for a one-day retreat to discuss issues relevant to WP3 research. The side event was kindly hosted by the National Center for Atmospheric Research (NCAR), and was attended by 16 participants from 7 countries. Topics discussed in the side event included the status of the CMIP5 simulations with high-top models, the details of the forcing and scenarios used, and specifics relevant to their application in high top models, possible additional sensitivity runs, and coordinated analysis of the simulations as well as multi-model studies.

**COMBINE Web Site:**

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**EVENTS of interest:**

28 February – 4 March 2011, **AGU Chapman Conference on Atmospheric Gravity Waves and Their Effects on General Circulation and Climate**, Honolulu, Hawaii, USA

27 March – 1 April 2011, **Arctic Science Summit Week**, Seoul, Korea.

3–8 April 2011, **EGU General Assembly**, Vienna, Austria

16-19 May 2011, **YOTC International Science Symposium and 8th AMY International Workshop**, Beijing, China

24-27 May 2011, **2<sup>nd</sup> COMBINE General Assembly**, Exeter, UK

27 June – 8 July 2011, **IUGG XXV General Assembly: Earth on the Edge: Science for a Sustainable Planet**, Melbourne, Australia

12-15 July 2011, **Past Present and Future Change in the Atlantic Meridional Overturning Circulation, International Science Meeting**, Bristol, UK

18-23 September 2011, **3rd iLEAPS Science Conference**, Garmisch-Partenkirchen, Germany

24-28 October 2011, **WCRP OSC: Climate Research in Service to Society**, Denver CO, USA