

SPECIAL PROJECT PROGRESS REPORT

Progress Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

Reporting year 2013

Project Title: Land use change in the 21st century

Computer Project Account: SPNLGLAC

Principal Investigator(s): Bart van den Hurk

Affiliation: KNMI

Name of ECMWF scientist(s) collaborating to the project (if applicable) Gianpaolo Balsamo

Start date of the project: 1 Jan 2012

Expected end date: end 2014

Computer resources allocated/used for the current year and the previous one (if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)			500000	130000
Data storage capacity	(Gbytes)			1000	?

Summary of project objectives

(10 lines max)

Via this study, a new set of dedicated climate model integrations will be carried out in parallel to the IPCC historic and future scenario runs. The experiments will be carried out with the EC-Earth climate model, built on the ECMWF IFS. The experimental set-up is designed to analyse (a) the specific contribution of land use change to global mean and regional climate change in the past and the future, (b) the amplification or damping feedback mechanisms that control these land use change impacts, and (c) the degree to which local land use change impacts affect climate variability in remote areas.

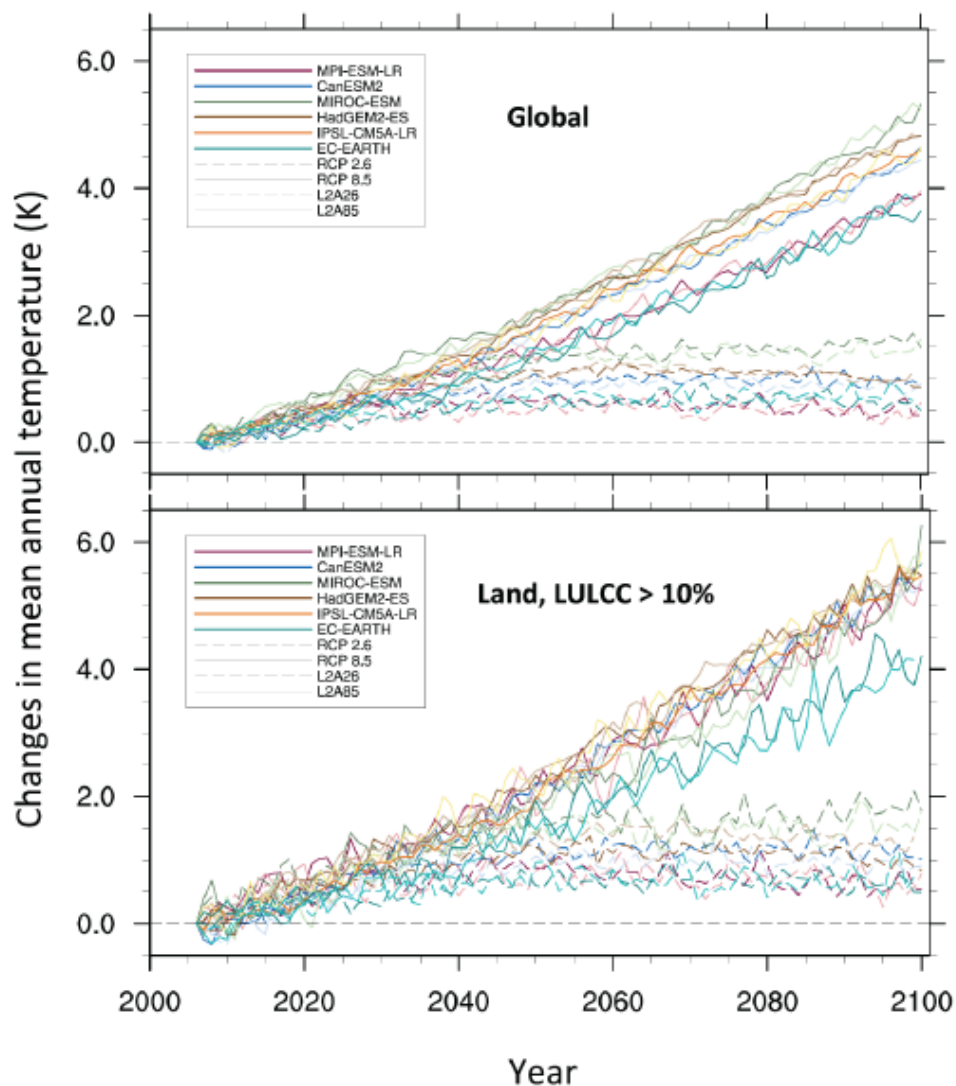
Summary of problems encountered (if any)

(20 lines max)

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The modelling system works fine, and first generation of model runs have been completed. An extension of simulations is now planned in order to incorporate the degree of seasonal and decadal predictability that can be associated to land use and vegetation dynamics.
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Summary of results of the current year (from July of previous year to June of current year)

Model simulations for 2 RCPs (2.6, 8.5) submitted to Prof V Brovkin (MPI) have been inserted in a publication, that recently is accepted for publication by J. Climate. In the ensemble experiments land use was fixed at 2006 conditions, allowing analysis of (ensemble mean) differences in climate and land-atmosphere fluxes between simulations with- and without land-use changes by the end of 21st century. Due to different interpretations of land-use classes, areas of crops and pastures were specific for each ESM. On a global scale, simulated biogeophysical effects of land-use changes projected in the CMIP5 experiments with prescribed CO₂ concentrations were not significant. EC-Earth results added later to this sample did not alter the results significantly. However, these effects were significant for regions with substantial land-use changes (exceeding 10%) (see figure).



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10-yr moving average of changes relative to year 2006 in annual near-surface air temperature, K, averaged for ensemble simulations globally (top) or for land grid cells where LULCC exceeded 10% of cell area (bottom). Bold and dashed lines are for RCP2.6 and RCP8.5 scenarios, dark and light colors are for RCP and L2 experiments, respectively; EC-Earth results now included.

New EC-Earth simulations with the RCP4.5 scenario have been completed after the finalization of this paper. This RCP shows larger land use changes than the ones analysed before. However, a detailed analysis of the results is still underway.

List of publications/reports from the project with complete references

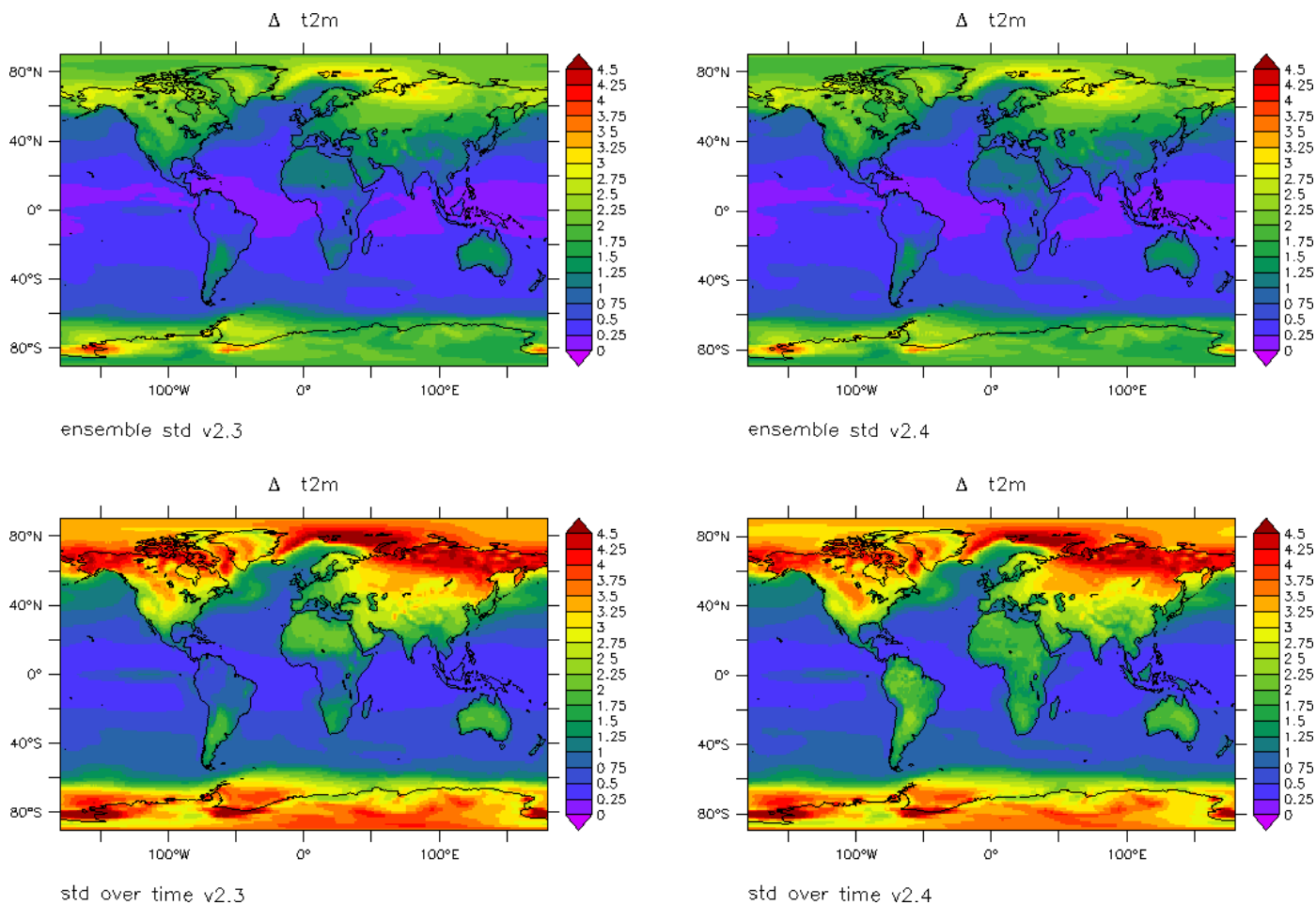
- Brovkin, V., L. Boysen, V. Arora, J.P. Boissier, P. Cadule, L. Chini, M. Claussen, P. Friedlingstein, V. Gailer, B. van den Hurk, C. Hurtt, C. Jones, C. Kato, N. de Noblet-Ducoudre, F. Pacifico, J. Pongratz, M. Weiss, Effect of anthropogenic land cover changes on climate and land carbon storage in CMIP5 projections for 21st century; in press J. Climate, 2012.
- Weiß, M.; van den Hurk, B. (2012) The role of land cover variability on modelled land-atmosphere coupling; EGU2012-12166, European Geosciences Union General Assembly 2012, Vienna, Austria, 22-27 April 2012

Summary of plans for the continuation of the project

July 2013

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http://www.ecmwf.int/about/computer_access_registration/forms/

Apart from the finalization of the RCP4.5 analysis, new simulations are planned in which the contribution of vegetation and land use dynamics to the (potential) predictability is analysed. First results (see figure below) show that around the tropics the variance of 2m temperature over time significantly increases when land use and vegetation dynamics are allowed to covary in interaction with the atmosphere, relative to a model formulation that uses a fixed climatological vegetation description. Exploration of this first result is subject of further simulations and analyses in 2013 and 2014. This work will be done in collaboration with Gianpaolo Balsamo (ECMWF) and other partners.



Variance of 2m temperature across a model ensemble (top panels) and across a number of years (bottom panel) for a fixed vegetation description (left) and an interactive vegetation model (right).

The following activities are planned:

- further analysis and publication of RCP4.5, a scenario with a larger land use change compared to the others
- exploration of (potential) predictability associated with land use and vegetation dynamics

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