

Reply to Reviewers

Reviewer-1

This is an interesting study investigating the seasonal predictability of the Russian heat wave during July and August 2010 using an ensemble of 61 members from simulations with the AGCM CAM3. The topic of seasonal forecasting is very important and I believe that their results indicating the weaknesses contribute to the ongoing research in this field. I think that the manuscript deserves publication after taking into consideration a few minor comments.

We would like to thank the reviewer for the useful and constructive comments. The revised manuscript includes reviewer's entire recommendations and corrections. Our reply to the reviewer's comments follows:

Specific Comments:

1. Although the authors provide an adequate number of research articles for the specific heat wave at Eastern Europe and Russia, the introduction is lacking of references on the topic of seasonal predictability which is actually the main focus of this manuscript. There is a number of relevant articles already from the late 90s (e.g. Rowell, Journal of Climate, 1998) to recent ones (e.g. Hurrell et al., BAMS 2009; Lee et al., Clim Dynamics, 2010 and 2011, Chowdary et al., JGR, 2010; Brunet et al., BAMS, 2010; Shapiro et al., BAMS, 2010; DelSole et al., GRL, 2013; and many others) that the authors take into account.

Reply: *The introduction has been revised including also the recommended references.*

2. I think that the authors should discuss their results about the seasonal predictability in the framework of other relevant work more extensively. This is only done for the work of Matsueda et al., 2011.

Reply: *The principal aim of this study is to examine the predictability of the Russian heat wave on a seasonal time scale. In this context, there isn't any paper dealing with this event in a seasonal time scale. Only a few papers studied this event in a medium-range and not in seasonal time scale and they all agreed that the predictability has been lost after a few weeks of simulation. However, the paragraph of discussion has been extended in the revised manuscript including the evidences provided by Dole et al. and Ghelli et al. manuscripts.*

3. Please refer if CAM3 has been used in previous studies for seasonal forecasting and especially if there are previous evaluation studies (articles or official technical reports) for its seasonal predictability.

Reply: *CAM3 is the atmospheric component of the Community Climate System Model (CCSM3), which is a fully coupled global climate model. Thus, it has been primarily designed to support long-term climate simulations and applied as the modeling tool providing the data for the assessment reports of IPCC. However there are a few studies used CAM3 for seasonal-to-annual*

simulations (e.g. Shukla et al., BAMS, 2000; Leung et al., BAMS, 2006; Das et al., J. Earth Syst. Sci., 2013) but in general its use in a such time scale is rather rare because it requires a lot of modifications mainly related with the preprocessing stage and its source code as well.

We implemented CAM3 in this study after extended modifications in the initial conditions and its source code. To this end the model uses GFS or ECMWF gridded data as initial conditions for both atmospheric and soil models instead of the default idealized balanced 3D atmospheric fields in preselected periods. Additional modifications have been also done in the scheme handling the horizontal diffusion and the divergence in order to reduce the model spin up period. Numerous tests have been finally performed in order to match the GFS/ECMWF soil masks with the CLM one and to adjust the timesteps calling the physics and radiation packages in CAM3. However, we think it is not necessary to include this effort in the manuscript due to it may sound as a part of a technical work.

4. The authors conclude that it is of great importance to investigate furthermore the performance of the LAF ensemble forecasting system during other recent extreme weather events although their study shows weak seasonal predictability of the Russian heat wave event. This is rather confusing especially for the non-experts of seasonal forecasting. Could the authors discuss in which sense the investigation of other extreme case studies is an added value, and which are the limitations and possible future developments for improving seasonal predictability.

Reply: *In the last sentence we meant that in order to extract a more definite conclusion regarding the forecast skill and the effectiveness of the seasonal prediction, it is necessary to investigate other case studies using the same methodology (LAF method+CAM3 model) The expected limitations come from the extended period of the numerical simulations where the predictability is mainly dominated by uncertainty and significant decrease of the signal-to-noise ratio. To overcome these limitations, apart of improving the model's own physical parameterization schemes, it is feasible also to ingest better initial conditions in conjunction with downscaling techniques that utilizes the large-scale information provided by CAM3 to force a high resolution regional model. However we revised this last sentence of the manuscript in order to clarify the above mentioned issues.*

Technical comments

1. Page 7, lines 26-29: This is a long sentence that maybe needs rephrasing.
Reply: *Corrected.*
2. Page 9, line 28: It should rather read "compared" instead of "comparing".
Reply: *Corrected.*
3. Figures 1, 2 ,3, 5, 7, 8, 9: Although it easy to figure out, it would be helpful for the reader to specify in the figure caption which parameter is plotted with color shade and which with contour.
Reply: *Corrected.*