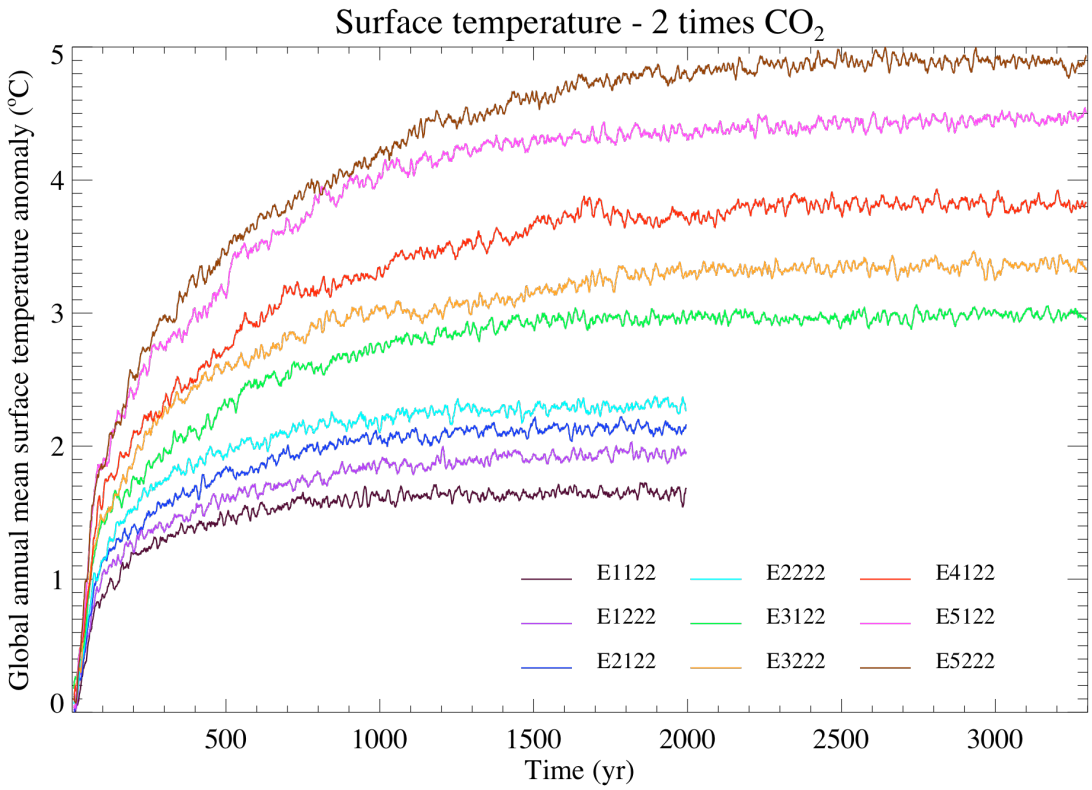
First, we want to thank the referee for her comments. Although she criticizes the organisation of the paper, she also acknowledges its very interesting potential.

The problem is that the paper does not discuss a scientific hypothesis or answer any scientific question. Consequently, it presents no new insight and so does not progress scientific knowledge. The paper should, therefore, either be re-written with a clear scientific result and re-submitted here, or else, if the result is not yet mature, the work may be re-written as a detailed experiment design or model evaluation paper and submitted to GMD.

We feel that the aims and scope of CP fits with our paper better than GMD. Indeed our paper is centred on climate, here the climate of the last millennium with a strong emphasis on the last few decades. In this paper, we are indeed comparing the ability of parameter sets to simulate the past climate. However, our purpose is clearly not to evaluate the components of the climate system. Rather, we aim at presenting the readers how we tried to select a range of parameter sets that simulate a range of climate in agreement with observation and that could be used for estimating a range of future climate change. In other words, we aim at building a scientifically sound assessment of the range of past and future climate changes/variations. Therefore we feel that the readership for our paper is more towards CP than GMD.
We re-organise the paper according to the referees advice.

I have some concerns over the higher sensitivity experiments as they appear to show no sign of starting to equilibrate after 1000 years. I understand that CPU may be limited, but at least the highest sensitivity model should be run for 3000-5000 years to check that it is not unstable.

We agree with the referee that some of the simulations in the two times CO_2 scenario are not yet at equilibrium. However we did not claim to compute the equilibrium climate response to a doubled atmospheric CO_2 concentration. Rather we aim at calculating an index, which reflects the climate change for the specific sensitivity test. In order to answer the reviewer's concern, we extended the simulations. The evolution of the global annual mean surface temperature during this simulation is displayed in the figure below. The temperature increase after 1000 years (CS in the table below) in the two times CO_2 scenario is close to the equilibrium response (Equi in the table) for most of the parameter sets. It is at least closer to the equilibrium than to the transient temperature response (TCR in the table) that is computed as the temperature increase after 70 years in this two times CO_2 scenario simulation. The equilibrium response is computed after 2000 years for the parameter sets 112, 122, 212 and 222, and after 3300 years for the parameter sets 312, 322, 412, 512 and 522.
None of the prolonged two times CO_2 simulations (i.e. the highest sensitive ones) displays unstable behaviour. Additional experiments, not displayed in this paper, were also performed until equilibrium, under slightly different either setup or forcings (e.g. pre-industrial forcing). Simulations with pre-industrial forcings are performed until equilibrium. They do not lead to unstable behaviour. However, we agree with the referee that stability is an important concern that must be kept in mind when running further simulations.



Time evolution of the global annual mean surface temperature response to the atmospheric CO_2 concentration scenario described in the main paper for the nine model parameter sets. Temperature is presented as deviation from the initial value. Carbon parameter set 2 is used here (third digit is 2). The fourth digit (2) is meaningless here.

In order to provide some context for comparison with simulations performed by other climate models (including the fully coupled AOGCMs) it would be helpful to document the equilibrium climate sensitivities, transient climate response (TCR) and ocean heat uptake efficiencies (Gregory y and Mitchell GRL 1997) of the ensemble members. These should all be easy to calculate from the existing outputs with no need for additional runs, e.g. using the method of Gregory et al GRL 2004 over the last 930 years for the equilibrium sensitivity (if TOA radiation balance is unknown, net ocean heat uptake will provide a good estimate).

In addition to the index given in the main paper, we give here the temperature increase after 70 years in the two times CO_2 scenario. We also computed the effective climate sensitivity according to Gregory et al. (2002). The equilibrium climate sensitivity is also provided. The temperature increase after 1000 years in our sensitivity experiment (CS) is already very close to the value of the effective climate sensitivity (Ceff) and the equilibrium climate sensitivity (Equi) for the less sensitive parameter sets (112, 122, 212 and 222).
The quoted " CO_2 *sensitivity" does not seem to be a useful diagnostic as it is unique to this manuscript and seems to be some blend of transient and equilibrium response depending on the parameter values.*

As the referee recognised the CO_2 sensitivity is indeed computed for the purpose of this paper. However the table here above shows that the equilibrium climate sensitivities

exhibit values very close to our index. This additional table will be included in the Supplementary Material of the revised version of the paper.

Parameter set	TCR (°C)	CS (°C)	Ceff (°C)	Equi (*) (°C)
112	0.7	1.6	1.6	1.6
122	0.8	1.8	1.9	2.0
212	0.8	2.0	2.2	2.2
222	0.9	2.1	2.2	2.3
312	0.9	2.5	2.7	2.9
322	1.0	2.9	3.1	3.3
412	1.1	3.2	3.5	3.7
512	1.5	3.9	4.4	4.5
522	1.5	4.1	4.8	4.8

Several indices representing the climate sensitivity of LOVECLIM according the nine climatic parameter sets. TCR and CS are the temperature increase (21-yr mean period centred at year 70) after 70 and 1000 years in the two times CO_2 scenario. Ceff is the effective climate sensitivity according to Gregory et al. (2002).
(*) This temperature anomaly is computed as the average over the last 50 years of the time series plotted in the figure.