The inclusion of "GCM" in the title is mis-leading.

with pre-calculated output from
several steady-state simulations with the HadCM3 general circulation model
Inaccurate and misleading. Two simulations is not "several".

The simulated ice-sheets at LGM agree well with the ICE-5G
reconstruction and the more recent DATED-1 reconstruction in terms of
total volume and geographical 20 location of the ice sheets.
Since ICE-5G use DATED-1 precursors for margin constraint and
since the GCM was forced with ICE-5G boundary conditions, this
is a weak result

Both types of studies share the shortcoming of having no clear
physical cause for the prescribed climatological variations,
I would argue that the approach presented herein also has no clear
physical cause given the adhoc choice of weights and ignorance of all
the other feedbacks from ice sheets to climate..

Others used dynamically coupled ice-sheet models to Earth System Models..
Since you've started a list of alternatives, you should make it complete.
IE Should also consider asynchronous and accelerated coupling with GCMS, eg
Gregory et al, 2012, and Herrington and Poulsen, 2012.

on this same note, should also mention the option of using results from a
range of climate models, Eg Tarasov and Peltier, QSR 2004.

Difficulties in bridging the differences in model resolution, as well
as other inconsistencies between model states, are addressed and
solved
This is a vague arguable claim. Be more precise and accurate as to
what you do and do not "solve".

the model, we simulate ice-sheets at LGM that agree very well with
geomorphology- based reconstructions
This is not true for North America.

This ensures the constructed climate history is in agreement with the
observed 15 pCO2 record and the modelled ice-sheet configuration,
thereby capturing the major feedback process between global climate
and the cryosphere, where any change in ice-sheet configuration has an
immediate impact on local climate through changes in albedo and
orographic forcing of precipitation
This statement is not justified, especially with the use of only two
GCM climate snapshots. Atmospheric circulation and therefore climate
will depend non-locally on ice sheet geometry, a dependence that is not captured
by two or even a handful of GCM snapshots.

It combines the shallow ice approximation (SIA) for grounded ice with the shallow
shelf
approximation (SSA) for floating ice shelves to solve the mechanical
how are fluxes at the grounding-line handled?

How are sub-shelf melt and ice calving treated in this model?

Horizontal resolution is 20 km for Greenland and 40 km for the other three regions
For future work, I would recommend 20 km or finer grid resolution for non-
ensemble best
runs

fig 4:
please include present-day continental outlines even under ice using a different
colour than the black/grey contours for ice to aid geolocation

strongly parameterized -> highly parameterized

should reference earlier work, eg EBM climate model coupling to ISMs

eq 1, linear co2 weighting factor
given the near logarithmic depending of radiative forcing on pCO2,
justify why a linear dependence is imposed

eq 5: justify the equal weight contribution for Wco2 and Wice. Given
the large variation in insolation changes from the South to North of
eg the North American ice sheet complex over a glacial cycle, I
don't see how this constant weight mix makes sense.

Gaussian smoothing filter F with
a radius of 200 km, and
Why 200 km?

Since the relative changes in ice-sheet size for Greenland and
Antarctica are much smaller than those for North America and Eurasia,
the changes in absorbed insolation in those regions should have less
impact on local climate. This is reflected in the model by giving more
weight to the pCO2 parameter
So why not use this same weighting for the part of Canada covered
by the same latitudinal range as Greenland, especially given the
proximity of NorthWestern Laurentide/Innuitian ice sheets to Greenland?
Why not rely on the 200 km Gaussian radius to take care of the ice sheet
scale? I highly suspect that the need for this adhoc change is weighting
is due to the lack of accounting for larger scale (eg atmospheric dynamical)
effects of ice sheet on climate.

eq 10
Novel lapse rate approach that addresses a common problem especially
for those modellers who rely on a constant lapse rate value.

eq 10
Need to show equation for T(x,y,t) given T_{ref,GCM(x,y)} and lapse_LGM(x,y)
As I understand, eq A1 is for de Boer et al 2014, not this paper
(since a constant lapse rate is used)

For Greenland and Antarctica, where the changes in ice cover are
relatively small even during glacial cycles, the constant lapse-rate
is still applied.
justify 8K/km choice

and that the drop in precipitation caused by the ice-plateau-desert
effect scales appropriately with ice-sheet size and that the drop in
precipitation caused by the ice-plateau-desert effect scales

appropriately with ice-sheet size
what does "scales appropriately" mean? By what criteria?

Similarly, for North America and Eurasia, precipitation is adjusted
using the Roe and Lindzen parameterization for wind orography- based
correction of precipitation as described in Eq. A3 - A6, but now by
using the GCM-generated precipitation and orography as reference
fields instead of their ERA-40 equivalents
Why are no orography effects imposed on Greenland? Observed PD
fields show such effects

Although the main dome of the ice-sheets is not
as thick as in the ICE-5G reconstruction
this is a good thing

Although the main dome of the ice-sheets is not
as thick as in the ICE-5G reconstruction, it now lies more westward than in the
simulation with the 5 default ANICE model,
which is in better agreement with the reconstruction
Not clear where you main dome is given the 1000 m contour interval

The Antarctic ice-sheet now shows a much stronger increase in ice
volume around LGM, matching the 16 m of eustatic sea-level
contribution postulated by ICE-5G (Peltier, 2004)
Should reference more recent literature. The ICE-5G Antarctic
ice sheet has little constraint.

However, since it was the ICE- 5G reconstruction that was used as
input for the HadCM3 simulation by Singarayer and Valdes (2004), we
aim to maintain 30 consistency and reproduce that particular ice-sheet
with our model rather than the DATED-1 LGM ice sheet.
By what logic? You are assuming that ICE5-G is in conformity with
the GCM climate generated using ICE5-G boundary conditions. That is
a big assumption. The ice mask leaves a strong climate footprint and
so I would expect it not hard to match ICE5-G extent but matching I
see no rational to otherwise match ICE5-G topography

pg 10 comparison to ICE5-G
GCM fields generated with say ICE5-G boundary conditions will have a
strong imprint of the ice sheet margin on the resultant climate. So
recreating ICE5-G ice extent with this interpolated climate forcing
offers little validation as to the utility of the approach. For me,
the challenge is to get a range of climates without the imprint of
assumed ice sheet boundary conditions used by the GCM.

fig 4 and 7
add the ICE5-G ice margin extent as say a red
contour to these plots to aid comparison
also use 500 m ice thickness contours to show more detail (1 km is awfully
coarse)

The southern margin lies a little too far to the north
This is an understatement. Be precise

regarding Greenland surface temperature anomalies when neglecting the

strong negative excursions during Dansgaard-Oeschger events, which are
not present in our model forcing or 10 climate reference runs and are
also not included as feedback mechanisms in our model physics
larger diffs than just missing D/O events in fg 12. Plot 4kyr
running mean and you'll see significant diffs.

Fig 10
Please replace this with a sensitivity parameter range that captures
say 90% confidence intervals for your parameters. Just switching
between PMIP III results from 2 different GCMs will from my
experience give a much larger spread in ice sheet volume

Modelled temperature anomalies over Greenland and
Antarctica agree well with ice-core isotope-based reconstructions. When
not for NGRIP

Local monthly ablation Abl is parameterised as a function of the 2-m
air temperature Tano, albedo a and incoming solar radiation at the top
of the atmosphere QTOA, following the approach by Bintanja et
al. (2002):
...
with c1 = 0.0788, c2 = 0.004 and c3 a tuning parameter different for each
individual ice-sheet.
equations are dimensionally inconsistent and need dimensional coefficients.

These climate states span a two-dimensional climate matrix, with
This is not what most modellers would take as a climate matrix

calculated temperature between the LGM and PI fields over the ice-free area in the
region at LGM.
specify region

When accounting for uncertainty in the applied forcing and model
parameters, the simulated volume of the four major continental
ice-sheets (excluding contributions from smaller ice caps, glaciers,
thermal expansion and ocean area changes) at LGM amounted to 97 ± 6 m
sea-level equivalent.
This shows that uncertainties are not adequately addressed. The uncertainties
in this modelled system (ie compared to "reality") are going to be much larger
than 6 m SLE.

At least 3 of the references to equations in the text have the wrong
equation number.

review comments by PhD Candidate Taimaz Bahadory (in Lev Tarasov's group) to
also address ####

P2-L14
  Still I'm not convinced how "This ensures the constructed climate
  history is in agreement with the observed pCO2 record and the
  modelled ice-sheet configuration". All the climate states other
  than PI and LGM are interpolations based on some weights, so why
  should they be in agreement with the actual climatic history? For
  instance if the jet-stream pattern variation would be a function of

a threshold in ice altitude, how would that be captured by interpolation?

P4-L21
What does "some external forcing" mean?

P4-L28
What is the "existing independent literature"?

P8-Eq. 11
Why don't you use local altitude instead of the ice-thickness? The difference at LGM could reach 1 km and it is surface elevation that physically matters.

P8-L12
Did you do the same calculation for lapse-rate over Greenland and Antarctica to check how small the difference would be?

P8-L16
"Whereas a continental-sized ice-sheet influences temperature mainly through albedo"; is this true? What about changes in atmospheric circulation, runoff and therefore changes in ocean circulation, and the elevation itself, hence the lapse-rate effect?

Fig. 6
The total ice volume evolution, specially during the inception phase, doesn't follow the records; eg the 110 ka max volume.

refs to add:

Terminating the Last Interglacial: The Role of Ice Sheet–Climate Feedbacks in a GCM Asynchronously Coupled to an Ice Sheet Model
ADAM R. HERRINGTON AND CHRISTOPHER J. POULSEN
DOI: 10.1175/JCLI-D-11-00218.1
2012

Modelling large-scale ice-sheet–climate interactions following glacial inception
J. M. Gregory1,2, O. J. H. Browne1, A. J. Payne3, J. K. Ridley2, and I. C. Rutt4
Clim. Past, 8, 1565–1580, 2012
www.clim-past.net/8/1565/2012/
doi:10.5194/cp-8-1565-2012