Answers to the reviewers comments as incorporated into the revised manuscript:

Changes due to review of F. Parrenin

1. Second-order scheme: Added section 3.1.2 and a paragraph in the conclusions. Also added Figure 13 and Figures in the supplement. References Staniforth and Pudykiewicz(1985) was added. In addition we added a paragraph in 2.4.3 after the first one.

2. Vostok ice core: Added last sentence in 3.2.1 and the reference Parrenin et al. 2004

The technical corrections have been made accordingly.

Changes due to review of G. K. C. Clarke

1.Second-order scheme: Added section 3.1.2 and a paragraph in the conclusions. Also added Figure 13 and Figures in the supplement. References Staniforth and Pudykiewicz(1985) was added. In addition we added a paragraph in 2.4.3 after the first one.

2. Polythermal: We changed the last sentence in the Abstract and deleted the sentence “The post-processing tool SICOSTRAT is capable of reconstructing the three-dimensional \chem{\delta^{18}O} concentration of an polythermal ice sheet.”

We clarified the first two sentences and added a paragraph about particles crossing the CTS in the Model description (section 2).

Changes due to review of O. Rybak

1. Tarasov and Peltier: Added the Tarasov and Peltier (2003) reference and added a sentence in the introduction and a paragraph in section 2.2

2. Second-order scheme: Added section 3.1.2 and a paragraph in the conclusions. Also added Figure 13 and Figures in the supplement. References Staniforth and Pudykiewicz(1985) was added. In addition we added a paragraph in 2.4.3 after the first one.

3. Rybak: “*The fact, that the SICOPOLIS model is polythermal and models employed in previous similar studies are not, does not bring any new experience. Or, at least, this new experience is not discussed.” =>* Changes last sentence in Abstract. Deleted sentences “The post-processing tool SICOSTRAT is capable of reconstructing the three-dimensional \chem{\delta^{18}O} concentration of an polythermal ice sheet.” in the introduction
Clarified the first 2 sentences and added a paragraph about particles crossing the CTS in the Model description (section 2).

4. *“The aim of the paper is to “. . . to simulate the δ 18O distribution in ice sheets . . .” (p. 1139, lines 27-28). In my view, the authors fail to demonstrate feasibility and advantages of their new method. At least, it does not follow from the examples demonstrated in the paper. For instance, mismatch between curves in fig. 14b can be attributed either to SICOPOLIS’ errors in dating or to the wrong performance of the tracking algorithm or to any other reason. Nevertheless, the authors mention “The comparison between the simulated cores and observational data shows in general a good agreement of the isotope records.” (p. 1152, lines 24-25). This is just a qualitative evaluation, which is not supported by any quantitative consideration.*”

No changes in the manuscript. We only wrote a comment in the interactive discussion: http://editor.copernicus.org/index.php?_mdl=msover_md&_jrl=365&_lcm=oc108lcm109w&_acm=get_comm_sup_file&_ms=23529&c=72692&salt=1455708068744436551

5. *Comparisons of simulated and observed δ18O curves in the papers by Clarke et al. (2005) and in Tarasov and Peltier (2003)look more convincing. Experiments with the schematic EISMINT-type model (Section 3.1.1) seem to me totally uninformative.*

No changes in the manuscript. We only wrote a comment in the interactive discussion: http://editor.copernicus.org/index.php?_mdl=msover_md&_jrl=365&_lcm=oc108lcm109w&_acm=get_comm_sup_file&_ms=23529&c=72692&salt=1455708068744436551

6. added Lhomme et al. (2005b) reference to the introduction.

Particular notes from O. Rybak

1. spelling of Côté corrected
2. *Figures 7 and 9 are totally non-informative:* we clarified the purpose in the interactive discussion and made no changes to the manuscript
3. *Wiggling of isolines in figures of 8 and 10 probably witness about the problems with the numerics*: We changed the last sentence in 3.1.1 and added another one at the end of the section
4. *Antarctica in fig. 13b looks strange. :* Added the information in the caption that SICOPOLIS 2.9 does not include ice shelves
5. *I do not think that the reference to Gornitz (2008) is a proper one for isotopic thermometry and related issues:* We added some references to the first sentence in the introduction: ”Oxygen isotopes are an important proxy for the reconstruction of temperatures of the past. Air temperature is related to stable isotopic composition of precipitation as indicated by observations (e.g. Daansgard, 1964; Gat, 1996; Jouzel et al., 1997; Gornitz, 200*9)”*

Other changes

\authors with lower case, otherwise latex does not work, and with it the last names are on the very top of the page and not where they should be.
Added \usepackage[dvipdfm]{hyperref} , otherwise latex does not work

References:
Gornitz => change to correct year 2009

Added the last sentence in the Acknowledgements to acknowledge the reviewers.