

General comments

Dating of climate archives is very important to understand processes in the climate system. The older the climate archive the more problematic it is to obtain an accurate time scale. Orbital frequencies are evident in many climate proxies and it is tempting to use them for dating purposes. It is very important to be aware of the limits of dating by orbital parameters. The manuscript by Landais et al. does an excellent job on showing the limitations on using precessional cycles obvious in O₂/N₂ and δ¹⁸O of O₂ in ice cores. The manuscript is very details which in some places also makes it hard to read.

Specific comments

Page 2219, line 5: Please specify before present (1950, 2000, 2011?)

Page 2219, line 14: “at least 2.5 kyrs” It is unclear if this means better or worse than 2.5 kyrs.

Page 2220, line 29 and later in the manuscript: The tropical water cycle should not have a large effect on the oxygen isotopes. Isotopes in tropical precipitation deviate the least from the ocean water source.

Page 2222, lines 18 and following: The synchronization needs some more explanation. Further the Lemieux-Dudon approach is a study illustrating a method of including dating information from various sources. However, it is a demonstration and not an improvement of the EDC3 time scale. If this time scale is used it has to be explained in what the stated improvement consists.

Page 2225, line 7: This method is generally referred to as “by peak jumping”. The term interfering masses implies a correction of results due to interference in the source which as I understand is not the case here.

Page 2225, last paragraph: As I seem to understand the method used is a melt refreeze method. Therefore whether or not clathrates are present is therefore irrelevant.

Page 2227, first paragraph: Temperature is increasing gradually to bedrock. If this has an influence on the precision of the data also a gradually lower precision with depth would be expected.

Section 3.2: This section is hard to follow. I suggest to first state that the -50°C samples are believed and therefore not corrected. Why distinguish between series 3 and 4 at all? Follow by 1) removing outliers and 2) shifting series.

Equation 3: The motivation for this approach is hard to understand. From figure 1 it looks like series 1 and 2 are offset from series 3 and 4 and nothing else. I cannot see the motivation for this additional correction.

Page 2231, line 9: The peak at 28kyr is unexpected. It could point to a bias in the time scale over a specific period. It would be interesting to localize the origin of this peak.

Page 2233, line 18: Should this be June insolation for GISP2?

Page 2234, first paragraph: The cited model is a concept. This should be stated. There is no proof whatsoever that this approach is correct.

Page 2234, bottom paragraph: This paragraph is a little confusing. How about stating that the dates for the austral summer duration and the austral summer solstice have been fixed, neglecting the small variations arising from the exact astronomical definition.

Technical corrections

page 2219, line 20: “illustrate” should maybe be “quantify”?

Page 2224, line 3: Explain the abbreviation LSCE

Line 11: “manual Nupro valves, and 6 ports”: Is that a Vici valve?

Line 12: propose “batches” instead of “shifts”

Line 13: replace “a turbo” with “the turbo”

Page 2226, line 10 and following: Series 1, 2 ... have not been introduced at this stage. It is not clear that the two series were not measured on the same MS.

Page 2233, line 10: “period” should read “periods”