

Review of “Climatic signals from 76 shallow firn cores in Dronning Maud Land, East Antarctica” by S. Altnau, E. Schlosser, E. Isaksson, and D. Divine

This paper is a valuable analysis of climatic data from Dronning Maud Land. Records of oxygen isotope and surface mass balance variations in firn cores have been collected from many different sources. By stacking groups of these records together, the authors have reduced the signal-to-noise ratio and derived new information from data previously analysed in isolation. The paper is certainly worth publication but could perhaps be improved by some re-balancing of the material. My personal feeling is that the first sections (1-4) are a bit too detailed, while the results and discussion sections (5 and 6) could do with a stronger structure. Since the sources of the data are acknowledged in Table A1 the authors could perhaps do without a separate Section 3; where previous authors have made relevant deductions from their data these could be commented on in the Discussion section. I found it quite hard to recall which ideas presented by the authors had already been proposed by others because of the separation between sections 3 and 6.

I think the number of figures could perhaps be reduced. Figures 5 and 7 do not seem to be essential.

I agree with Referee 1 that the comparison with the SAM index is worthwhile reporting, whatever the result. It is important to remind the non-specialist reader that Antarctic precipitation does not always increase with warming temperatures even if a clear explanation of what is happening in the coastal regions cannot be derived from the data available so far.

The English is generally excellent, although there are inevitably a few places where minor improvements can be made. I have suggested some possible changes in the detailed comments section below. There is a slight problem of wavering tenses which needs to be sorted out. My own preference is for past work to be described in the past tense but for the new work presented in the paper to be described in the present tense. However, it does not matter what convention is used so long as the authors are consistent.

Detailed comments

(Suggestions for minor improvements in English are in italics)

p.5962 1.15 *has exhibited*

1.24 *not only is an increase in sea ice observed but also...*

1.26 move “ and thus increase surface mass balance” to next page

1.26 *observed over the entire..*

p.5963 1.5 How about “This is important because an increase in precipitation, and hence increased surface mass balance (SMB), might mitigate sea level rise.”

1.7 *Close monitoring...*

1.12 *are only available since...*

1.16 *isotope ratio; annual mean SMB...*

1.20 *as part of different national... In particular, the pre-site-survey..*

1.23 *hitherto poorly explored...*

1.25 *have been published*

1.26 *In this study...*

1.27 *At this point I would move into the present tense: “the spatial and temporal variations are investigated. Calculation of stacked records helps considerably to improve...*

p.5964 1.6 *The area of the rectangle shown in Figure 1 is c. 960,000 km² according to the scale shown. So the area of the western part of DML under discussion must be less than this. Would it be more useful to give this area rather than that of the whole of DML?*

1.6 *Our study is focused on...*

1.12 *with an area of 33000 km²*

1.20 *After this DML was only visited sporadically.....Systematic data acquisition...*

1.22 *I cannot see Neumayer Station on the map*

p.5965 1.4 *The statement that the cores are not directly comparable is confusing for the reader at this stage since it is not clear whether you are going to include the data in your comparison or not.*

1.9 *To make this sentence clear you could write “ a positive correlation of the Ritscherflya stable isotope ration with the surface air temperature at Halley” .*

1.10 *This is all a bit confusing for the reader – what exactly is the point being made by this paragraph? Is there a connection between meteorological conditions at a coastal station and in the inland region or not? Bear in mind that the reader does not know until p.5969 1.11 that you do not think Halley is representative of your coastal ice shelves because of the presence of the ice-covered Weddell Sea.*

1.24 *when the SAM is...*

1.27 *as part of*

p.5966 1.5 *The area was found to be...*

1.24 *study by Frezzoti...*

1.27 East Antarctic Plateau

1.28 *but found that almost all sites*

p.5967 1.3 *ice cores obtained during...*

1.11 As a matter of interest what were the chemical species determined by the Continuous Flow Analysis?

1.20 Do you mean “**annual** values of SMB are poorly correlated” ? If so you could write *Annual values of SMB....are poorly correlated even between cores from the same location....*

1.22 *due to the effects of wind..... values. Furthermore,....*

p.5968 1.16 *on Amundsenisen...*

1.27 *the percentage deviation from the mean*

p.5969 1.4 *are available. An automatic weather station (AWS) was installed 1.5 km west of Kohnen Station in 1998 and moved to the Station in 2007. In coastal ...*

1.11 *not representative of the climate*

1.14 “no homogenous time series”?

1.17 *thus the data can be used*

1.24 *a SAM index*

p.5970 1.10 I had to go back to the Johnsen et al (1997) paper to work out what was meant here. I suggest you repeat the wording of that paper which is quite precise:

One way of estimating the signal to noise (S/N) variance ratio is by comparing the variance of a stacked record (VAR_S) based on n overlapping records, with the mean of the variances (VAR_M) for the n individual records. The estimate of a single record S/N variance ratio then becomes.....

1.19 You do not explain here that $F_c = n F_i$ although this seems to be the case from Table 2. I wonder if you mean you are comparing F_c and F_i between areas rather than with each other, which is what you appear to be saying in the text?

1.23 why do higher values of mean accumulation mean higher SNVR? Could you expand a little?

p.5971 1.3 Present tense here? *It turns out that*

1.12 *independent of short-term (interannual) variability. An ANOVA F-test is used to test whether these trends are statistically significant. The period 1950-2000....*

l.21 Have you said the same thing twice here? Is normalisation and detrending the same as converting into anomalies?

p.5972 l.1 “The significance of the correlations.... using the standard t- test” is followed at line 6 by “Significance of the cross-correlations..... using Students t test” . This appears to be a duplication.

l.6 *cannot*

l.12 The font in Figure 2 is rather small and difficult to read without magnifying the figure. Would it be possible to use a larger font for the values?

l.18 *related to geographical factors*

l.19 *The distance to the coast (continentality)...precipitation. Latitude and elevation effects are....*

p.5973 l.6 *In contrast to other studies... because of differences in moisture transport..*

l.14 *cannot be explained physically.*

l.15 But are the values from these cores shown as points on the graph? If so could they be indicated?

l.24 Earlier in the paper you use R^2 rather than write out “coefficient of determination” in full.

p.5974 l.1 *Both Schlosser et al. (2008)and Fujita et al. (2011) note that the main wind direction along ID1 is NE.*

l.7 *lower than on the windward side..... generally lower on the lee side...*

l.12 *however, not as strong ($R^2=0.90$) as between...*

l.17 I am not quite sure how this diagram works. If the whiskers mark the extreme data points how can the “outliers” be outside the whiskers? Are these “outlier” points excluded from the statistical calculation? If so, maybe you could specify that the whiskers indicate the range of points included in the calculation, not the extreme data points.

p.5975 l.4 *to Student’s t test...*

l.9 *agrees well with...*

l.10 The stable isotope ratio is not almost constant year-to-year. The smoothed record (5-year running mean) shows little variation which is, I think, what you mean.

p.5976 l.2 It is not clear here whether the previous work involved only some of the cores or only some sections of all of the cores.

1.24 *on two different ice shelves.*

p.5977 1.3 $r = 0.59$? Previously you have used R^2

1.7 *A positive correlation between..... is expected because of....*

1.13 The notation implies that you are going to compare a ratio with the SAM index. I think you mean both $\delta^{18}\text{O}$ and SMB will be compared with SAM.

1.17 Figure 9 actually shows (a) $\delta^{18}\text{O}$, Neumayer temperature and SAM index and (b) SMB, Neumayer pressure and SAM index as a function of time. This allows a comparison to be made by eye, but is not in itself a comparison.

p.5978 1.14 It is a matter of choice, but if you choose to use the present tense to describe the analysis in the paper then at this stage the analysis is completed. Therefore you would say... *have been analysed.... This has been the first comprehensive study... Thus it has been possible to analyse climatic trends...*

p.5979 1.8 *The origin of precipitation...*

1.11 *In the 200-year records...*

1.12 *However, in this context.... should also be discussed*

1.19 *This suggests that winter accumulation has decreased even more strongly than...*

1.25 Saying “to confirm the hypothesis” is probably better than saying “to prove” it

p.5980 1.19 *for the data set presented here.*

1.25 *As well as firn cores and*

p.5981 1.3 *ice core data from the*

p.5992 *The standard deviation of the slope is also given*

p.5993 Should the 1950-2000 Plateau trend be in bold type?

p.6004 The diagram is a bit difficult to understand. Maybe you could separate plateau and ice shelf data i.e. have 4 panels?

