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Interactive comment on "A record of Antarctic sea ice extent in the Southern Indian Ocean for the past 300 yr and its relationship with global mean temperature" *by* C. Xiao et al.

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(1) I am not convinced the NH temperature data is the best to use as comparison as done in Figure 3. Make a correlation matrix between all 5 parameters used in Figure 3b to examine their mutual relation. To the bare eye they seem to be inversely related, meaning larger sea ice extent during colder episodes (at NH, and perhaps globally). Are there water isotopic data from this ice core available, or any other core from the same region that can be added to strengthen as a climate proxy for the region? The Northern European temperature data may not be the best way to describe temperature changes in the Southern seas. Reply: We have answered a similar question of

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reviewer-1, Antarctica-averaged temperature from the PAGES 2k Consortium is added to Figure 5b and discussed. However, it is not possible to make a correlation matrix because of different time resolutions of the data sets. For example, the NH temperature data is not evenly distributed before 20th century. Water isotopes were not measured for the LGB69 ice core, but we have the data from an adjacent site, LGB 65 ice core, 140 km away. We find there is very low correlation between LGB69 MSA and LGB65 ïĄď18O. This is understandable because ïĄď18O most reflects coastal (Prydz Bay) rather than large scale temperature changes (see Xiao Cunde, et al.,. Meteorological and glaciological evidences for different climatic variations on the eastern and western sides of Lambert Glacier basin, Antarctica. Annals of Glaciology, 2004, 39: 188-194.)

(2) An extension of this work would be to combine MSA and water isotopic data from ice cores taken from various sectors to build a network of data proxies of sea ice index around the perimeter of Antarctica, but this is perhaps the scope for a forthcoming study? Reply: I agree we should go in this direction. However, this is very challenging and needs collaborative efforts from many scientists, maybe an international working group like ITASE. It is beyond the scope of the present paper.

(3) P3614, li 1-3. I do not understand how the work by Qin et al 2004 and Ding et al 2011 proves the ice core captures climatic signals. The two data sets referred are important data of monitoring weather parameters, specifically accumulation of snow in the area. But from this state the core captures climate signals is a large step forward. Please explain how the referred data was used to prove the ice core data show a climatic signal over the region. Reply: The papers by Qin et al., and Ding et al., are referred here only to confirm that high accumulation at LGB69. Since our discussion is based on annual context, the reliability of dating of ice core is extremely important. High accumulation rate at LGB69 guarantees precise dating. The text has been changed to make this clearer.

(4) Consider to use r2 instead of r when making correlation analysis, r2 is a better parameter to show % in agreement between the datasets. Reply: Accepted, and we

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now use r2 in the revised manuscript.

(5) As I understand this analysis is done in a similar way as the study by Curran et al, 2003, but on a sector counterclockwise from the area Curran et al made their study. This shall be mentioned earlier in the text, probably already in the introduction. Reply: Yes, Curran's work was an important milestone in this field. The Introduction has been revised to indicate this.

(6) Curran et al 2003 gave confidence limits to their data to the 95 and 99% confidence limits. This shall be done here in the same fashion, which show in which sectors the MSA signal from the ice core is relevant as a sea ice extent proxy. It seem like Curran et al used the 95% limit to delimit their proxy to the sector 80-140 E. Reply: We plot the confidence limits in Figure 3b. However, because we now use a different satellite sea ice data set, as suggested by Reviewer-4, the sector 62E-92E has the highest correlation.

(7) Figure 4. As suggested as in Figure 3b, make a correlation matrix between the 3 parameters here to test the statistical relevance between the data shown. Reply: Accepted and we have done this. The correlations matrix and figure are shown.

These results are discussed in the revised paper (although we do not include the matrix or Figure in the revised manuscript)

Interactive comment on The Cryosphere Discuss., 7, 3611, 2013.

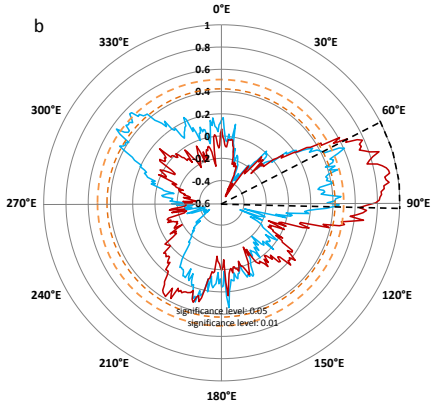

Figure3b. Correlation of LGB69 MS- with the seasonal maximum SIE over the circum-Antarctic (blue). The autocorrelation of SIE at the highest correlation sector with that at each longitude over the circum-Antarctic is also shown (red). Dashed circles are significance level of 0.05 and 0.01 respectively.

Fig. 1.

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Table (has not been included in the revised manuscript): The correlations matrix

	MS¯	SIE	SAM
MS¯	1	0. 495	0. 535
SIE	0. 495	1	0. 58
SAM	0. 535	0. 58	1

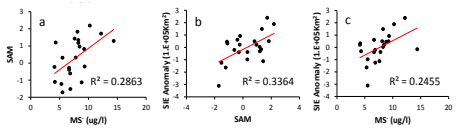

Figure (has not been included in the revised manuscript): Linear correlations between SAM and MS- (a), SIE and SAM (b), SIE and MS (c) for the period 1979-2000.

Fig. 2.

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