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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.***

### **Anonymous Referee #2**

Received and published: 6 August 2013

The phase shift in trends between Antarctica and the Arctic is an enigma to sea-ice science, and all efforts to shed more light on the issue are most welcome. Xiao et al provide a proxy method to reconstruct the Antarctic sea ice extent over 3 centuries via MSA data from an ice core. Using the information from ice cores is one way to proceed in understanding the Antarctic sea ice extent. The authors show that over a control period of ca 30 years they get a 0.16% fit ( $r = 0.4$ ) between the MSA data in an ice core from ca 75 deg E and the sea ice extent in this sector of Antarctica. This is a step forward in a reconstruction of sea ice extent around Antarctica. The fit degrades though when the authors extend the proxy for other sectors of Antarctica, showing that the MSA found in the core is a regional signal of the Indian Ocean sector, and should

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not be used as a sea ice proxy for the other sectors. Use confidence limits to delimit in which sectors the correlation are significant (see comment 4 below).

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.

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?

1. 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.

2. Consider to use  $r^2$  instead of  $r$  when making correlation analysis,  $r^2$  is a better parameter to show % in agreement between the datasets.

3. 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.

4. Curran et al 2003 gave confidence limits to their data to the 95 and 99% confidence

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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.

5. 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.

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

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7, C1331–C1333, 2013

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