Snow accumulation rates at Concordia Station, Antarctica, observed by stake farms

Stefanini et al., 2025

Editor: Lei Geng

5   General comments

This manuscript presents scientific data on snow accumulation at Concordia Station, Antarctica, collected by stake farms from 2004 to 2024. They reveal the SMB at the site, which is new data. Therefore, this manuscript is worthy of publication. However, I found several issues in this manuscript.

Thanks to devote time to the review of our manuscript and for the helpful suggestions.

10   Specific comments

1. Snow density for SMB calculations, Lines 53−56 and Line 178

Two densities are introduced to calculate the SMB from stake data in previous studies: upper 2 m by Takahashi et al. (1994) and surface to the bottom of the annual snow layer by Kameda et al. (1997) and Satow et al. (1999) in Lines 53–55. As briefly described in Line 178, Takahashi and Kameda (2007) first propose that the appropriate snow density for SMB from stake data
15   is the mean snow density at the stake base during the snow stake measurement period, which is the snow density for SMB considering snow compaction. Kameda et al. (2008) used the density for SMB calculations at Dome Fuji. Thus, it is better to add Takahashi and Kameda (2007) and Kameda et al. (2008) at Line 54, immediately preceding Ekaykin et al. (2020).

The specification has been added as suggested.

2. Lines 156–157

20   The first paper to consider snow density in relation to snow compaction during stake measurements is Takahashi and Kameda (2007). Thus, after line 157, it would be better to add this paper for reference.

The reference has been added to the text.

3. Line 163

I think "hundreds of meters" from the surface is ice, not snow. I think the deepest snow (permeable material) at Dome C is
25   around 100 m, not "hundreds of meters".

Correct, "ice" was added to the text to include the deeper layers.

4. Line 178

Takahashi et al (2007) -> Takahashi and Kameda (2007)

Corrected.

30   5. SMB (cm) in Fig. 4, 5, 7a, 7b, 8

The y-axes of these figures are SMB (cm). Is it a water equivalent value or a snow equivalent value? To eliminate misunderstandings, the term "surface mass balance (SMB)" is often used in previous papers. The unit of SMB is kg m-2 a-1. If you use the unit in the y-axis in these figures, it is clear that the value is the same as mm in water equivalent.

The values show simply the snow buildup as measured at the stakes, the labels and the captions of the figures have been modified accordingly.

6. Line 260

What is +26.6 %%? I think a "%" should be omitted.

Corrected.

7. Line 240.

Is the p-value of 0.40 correct?

Yes, it is correct, it indicates that the two datasets, FRA and FRAb, are compatible. Otherwise, the t-test would have provided a p-value < 0.05.

8. Line 378

I think "erosion" is a more appropriate term than "ablation", because there is no water at Dome C even in the summer season.

All the occurrences of "ablation" have been replaced with "erosion" throughout the text.

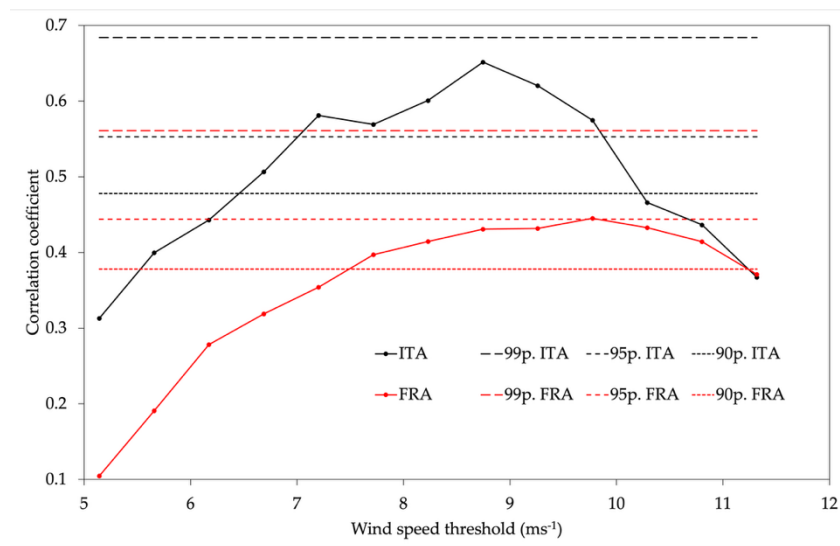
9. Line 379

Kameda et al. (2008) used "the negative and zero SMB" for expressing the condition. Please consider using this term to express the same phenomenon.

The suggested term has been used.

10. Lines 384–387

It is better to add figures to express the relation described in the text.

A figure has been added, after line 387, showing the linear correlation coefficients between the yearly fraction of stakes with negative and zero SMB and the frequency of wind speed values at the AWS above certain thresholds:

"Figure 10. Linear correlation coefficients between the yearly fraction of stakes with negative and zero SB and the frequency of wind speed values at the AWS above certain thresholds. 99%, 95%, and 90% confidence levels for each stake farm are shown."

11. Line 399

Fujii and Kusunoki (1982) and Takahashi et al (1992) will be good references for sublimation at the snow surface at the Antarctic ice sheet.

Please consider to add these papers for reference.

Fujii, Y., and K. Kusunoki (1982), The role of sublimation and condensation in the formation of ice sheet surface at Mizuho Station, Antarctica, J. Geophys. Res., 87(C6), 4293–4300, doi:10.1029/JC087iC06p04293.

Takahashi, S. Endoh, T., Azuma, N. and Meshida, S (1992): Bare ice fields developed in the inland part of the Antarctica. Proc. NIPR Symp. Polar Meteorology and Glaciology, 5, 128-139.

References have been added to the text.