

Response to Second Review B

We would like to thank the reviewer for the additional time spent reviewing our manuscript. We have found the review comments to be very helpful in clarifying the paper and ensuring that the information is presented in a concise manner. Our responses are below.

{1. Page 6: The NOAA polar orbiters are not the Polar Pathfinder series of satellites. To my understanding, Polar Pathfinder is the name given to derived data sets from AVHRR measurements.}

This has been corrected.

{2. Page 8: Is equation (6) correct? Based on (4) and (5) you seemed to have dropped one A_j . Please clarify.}

Equation (6) is correct. From equation (4), $\mathbf{A}_j \mathbf{x}_j = \mathbf{A}_j \mathbf{V}_{1,1}^T \mathbf{V}_{2,1}^T = \hat{\mathbf{b}}$. From equation (1), this can be equivalently expressed as $\mathbf{A}_j \mathbf{x}_j = \hat{\mathbf{U}}_1 \hat{\mathbf{\Lambda}}_1 \mathbf{V}_{2,1}^T = \hat{\mathbf{b}}$. One can then obtain $\hat{\mathbf{A}} \hat{\mathbf{b}}$ by replacing $\mathbf{V}_{2,1}^T$ with \mathbf{V}_1^T , which yields equation (6).

{3. Page 9: "During 1982-2006, the PCs appear in A (not b) .." This appears to contradict the text on page 7, line 13. In general, the authors should be very careful throughout the text to qualify their use of the term "PCs". In some places they are described as satellite PCs and in many places they are not qualified with satellite when it appears as though they should be.}

The statement on page 7, line 13 describes what S09 claim in their text (footnote 3 on this line explains that this definition by S09 is not accurate). Page 9 describes what actually happens in the algorithm. They are, indeed, different. In the revised text, we have ensured that the term "PC" is only used to describe the satellite PCs.

{4. Page 13, discussion of Fig. 2: West Antarctica= red plus green. I think more careful discussion is needed as to what precisely the reader should see from this figure (and Fig. 7) and which symbol (circles or stars) are "better".}

We agree, and have added additional explanation in the text. The question is not so much which is "better" as which is mathematically correct. Since S09 recover the gridded estimates by multiplying the estimated PCs by the AVHRR eigenvectors (the stars), then the PCs must be estimated using a comparable spatial structure. Failure to do so results in geographic translation of information. Whether the stars are a "better" (i.e., more accurate) representation of the actual spatial structure of near-surface Antarctic temperatures is a separate question.

{5. Page 17: Do A and V mean the same thing as on page 8?}

They do not. On page 8, those symbols are used to describe the eigenvalues and spatial eigenvectors of the ground data. On page 17, they refer to the eigenvalues and spatial eigenvectors of the AVHRR data. This is, indeed, confusing, and we have added subscripts and explanation in the text.

{6. Page 24: Your Peninsula warming is maximized in fall and winter, rather than winter and spring, as stated.}

This has been corrected.

{7. Page 25: The observed trends at South Pole should be stated along with their statistical uncertainty. Probably only the winter value is meaningful as a confirmation of your trend map.}

The statistical uncertainty of the South Pole trend has been added.

{8. Page 33: Is Lathauwer et al. (2000) used in the text?}

It is not (it was a holdover from the Chladni pattern discussion) and it has been removed.

{9. Page 35: Note the repetition of the Trishchenko and Li (2001) reference.}

This has been corrected.

{10. Page 46, Fig. 1: Show geographic boundaries for EA, WA, and AP on this figure. Caption: You mean Fig. 7 rather than 5 as stated?}

This is an excellent suggestion. The incorrect caption has been corrected.

{11. Page 50, Fig. 5: Please give statistical significance for RLS and E-W seasonal trend maps, equivalent to Fig. 4.}

This, also, is an excellent suggestion. The requested figure has been incorporated into the text.

{12. Page 51, Fig. 6: Caption: Correct to Bellingshausen.}

This has been corrected.

{13. For Figs. 2 and 7, it would be valuable to list the stations considered along with their period of record, probably in another table.}

We have incorporated this suggestion into the SI. Given that there are 88 stations in Figure 1, the table would be rather long for the main text.