General Note to All Reviewers

Based on a request from one of the reviewers, we have agreed to incorporate our "most likely" reconstructions into the main text. These reconstructions do not infill the ground station data using TTLS; instead, they utilize ridge regression. Verification statistics are mildly improved and solution stability is much improved. The smooth regularization and ability to adapt the regularization parameter to the number of predictors in ridge regression proves to be of significant benefit (which was noted as a possibility in Schneider, 2001). Because of this, the TTLS/TSVD reconstructions now serve only to show that cross-validation testing provides a superior means of determining a truncation parameter than the heuristic tool used by S09, and have been relegated to the SI.

We also decided to make additional simplifications for clarity. As using RegEM in a non-standardized (i.e., covariance) mode results in degraded verification statistics and was far more subject to overfitting than using it in the default standardized (i.e., correlation) mode, we feel it adds little to the paper to include the non-standardized infilling operations. This includes the non-standardized ground station infilling and E-W reconstructions. These have been removed.

In addition, we have removed the correlation RLS reconstructions. Since the vast majority of the AVHRR grid cells have no ground information, the only available scale information for standardization is the AVHRR data. However, the AVHRR data displays lower variance than the ground data, and rescaling using the variance of the AVHRR data results in a decrease in the variance of the estimates and corresponding decrease in reconstruction trends. This decrease is difficult to justify on mathematical grounds.

Using covariance for RLS is not a panacea; it comes with its own difficulties. Since RLS is not scale-invariant, the covariance RLS reconstructions likely suffer some undue bias from high-variance stations – many of which are located in the Peninsula and along the Ross Sea (e.g., Esperanza, Faraday, Marambio, Rothera, Scott Base). However, the problems with covariance RLS present possible future solutions (GLS / WLS), while the problem with correlation RLS does not. We therefore have removed the correlation RLS reconstructions (which showed lower trends than covariance RLS for all regions) from the main text and SI.

These simplifications, we believe, add greater clarity to the text. Rather than presenting 8 different variants in the text and discussing the differences primarily in the SI, we now present the 2 objective "best estimates" of covariance RLS and standardized E-W. Given that these best estimates are no longer the TTLS/TSVD solutions, much of the background information concerning TTLS and TSVD in the SI is of little value, and the SI has been significantly shortened (which was a specific request from one reviewer).