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Reply to comment by Jason E. Smerdon et al. on "Robustness of proxy-based climate field reconstruction methods"

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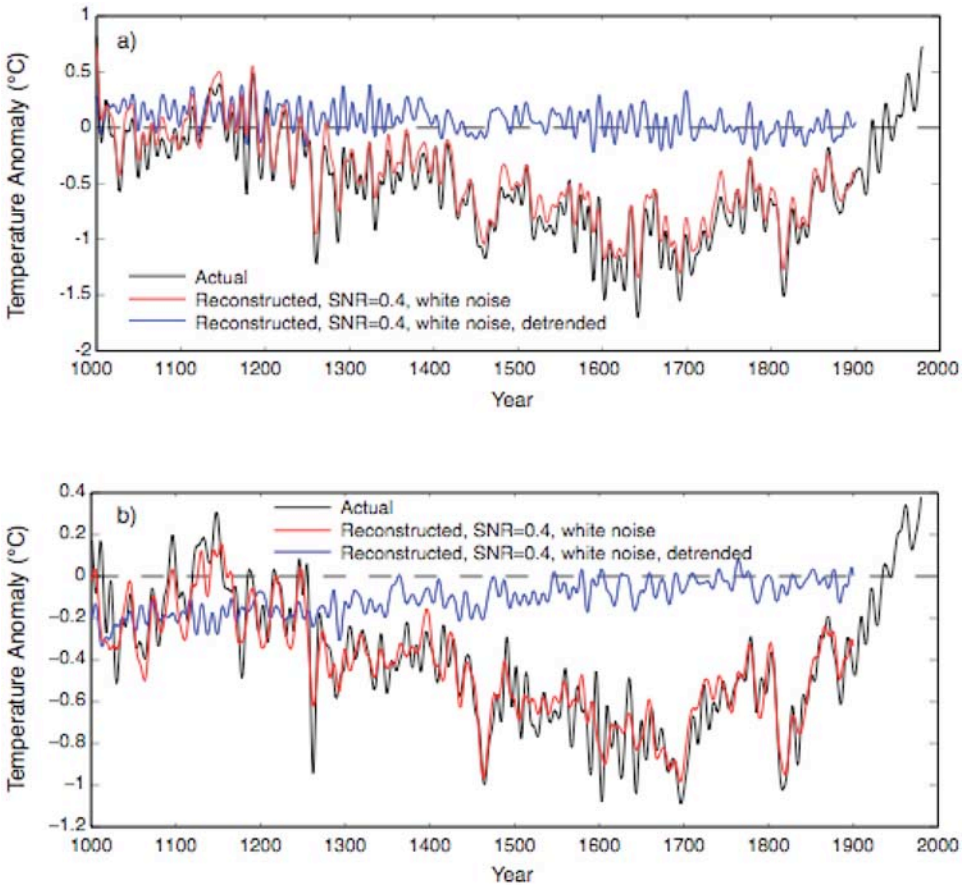

Figure 1. Results of experiments "y" (red line) and "z" (blue line) (a) from M07 and (b) using the regridding method described here. The use of the alternative regridding method does not change the results and conclusion of M07.

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[1] *Smerdon et al.* [2008] correctly conclude that the initial regridding method used by *Mann et al.* [2007] (hereafter M07) to map ECHO-g output to the resolution of surface observation data resulted in enhanced variability of the Northern Hemisphere (NH) mean series compared to the original model output (Figure 1a of *Smerdon et al.* [2008]). They also correctly conclude that the gridding method has no effect whatsoever on the conclusions of M07 because those conclusions were primarily based on results using the CSM model, and because the ECHO-g

Table 1. Long-Term Verification Scores for the Six ECHO-g Experiments Shown in Table 1 of *Mann et al.* [2007][a]

Experiment	Network	SNR	Rho	Calibration	NH RE	NH CE	NH rsq	Mult RE	Mult CE	Mult rsq
t-old	**A**	**1.0**	**0.32**	**1856–1980**	**0.99**	**0.97**	**0.98**	**0.75**	**0.57**	**0.64**
t-new	A	1.0	0.32	1856–1980	0.96	0.88	0.90	0.39	0.11	0.27
u-old	**A**	**1.0**	**0.32**	**1900–1980**	**0.97**	**0.92**	**0.96**	**0.65**	**0.41**	**0.54**
u-new	A	1.0	0.32	1900–1980	0.97	0.90	0.92	0.41	0.13	0.27
v-old	**A**	**0.4**	**0.32**	**1856–1980**	**0.97**	**0.91**	**0.93**	**0.69**	**0.48**	**0.57**
v-new	A	0.4	0.32	1856–1980	0.95	0.83	0.84	0.36	0.06	0.21
w-old	**A**	**0.4**	**0.32**	**1900–1980**	**0.96**	**0.90**	**0.91**	**0.62**	**0.36**	**0.46**
w-new	A	0.4	0.32	1900–1980	0.94	0.80	0.85	0.30	−0.02	0.20
y-old	**A**	**0.4**	**0**	**1900–1980**	**0.94**	**0.93**	**0.95**	**0.68**	**0.46**	**0.57**
y-new	A	0.4	0	1900–1980	0.97	0.91	0.92	0.30	0.03	0.22
z-old	**A**	**0.4**	**0**	**1900–1980**[d]	**−0.08**	**−1.79**	**0.37**	**−0.03**	**−0.75**	**0.27**
z-new	A	0.4	0	1900–1980[d]	*0.18*	−1.60	0.31	0.09	−0.33	0.05

[a]Rows in bold show the scores reported by M07, and nonbold rows show the scores that result from the new regridding scheme. Notations are as in Table 1 of M07. Abbreviations: NH RE, Northern Hemisphere mean reduction of error; NH CE, Northern Hemisphere mean coefficient of error; NH rsq, Northern Hemisphere mean r^2; Mult RE, multivariate field reduction of error; Mult CE, multivariate field coefficient of error; and Mult rsq, multivariate field r^2.

verification scores were consistent within the context of the regridded data. We also point out that *Mann et al.* [2007] was not an attempt to compare the CSM and ECHO-g models and demonstrate here that detrending the predictand prior to calibration still produces a reconstruction that fails to capture any of the low-frequency variability of the true ECHO-g Northern Hemisphere mean.

[2] To prepare the climate model data for the reconstruction experiments, original model output was mapped to the available 5° × 5° observational grid. M07 used the ''surface'' function in ''The Generic Mapping Tools'' (GMT) [*Wessel and Smith*, 1991] package to regrid the ECHO-g output after first averaging all values within a 5° × 5° grid box. We agree with *Smerdon et al.* [2008] that regridding using bilinear or bicubic interpolation (the ''grdsample'' function in GMT) does preserve a Northern Hemisphere mean at the degraded resolution that is closer to the full-resolution model mean. In M07, the CSM output was regridded to a 5° × 5° resolution using spherical harmonics, which produces a result very similar to that produced by bilinear interpolation, thus the experiments reported in M07 that used the CSM model are unaffected.

[3] New ECHO-g reconstruction experiments based on bilinearly regridded model output lead to the same conclusions as M07 (e.g., Figure 1). Long-term NH mean and multivariate verification scores for the six ECHO-g experiments using the two different gridding schemes are shown in Table 1. The most significant change is that the multivariate scores for the ECHO-g experiments are generally lower than in M07 and more consistent with those scores achieved using the CSM model for the same experiments (i.e., same calibration period, noise level and noise spectrum). This may be because regridding using the ''surface'' function produces a smoother field that is easier to reconstruct compared to the temperatures based on bilinear/bicubic interpolation. It is important to note that the statistical significance interpretations of the multivariate scores remain identical to those of M07, using likewise reevaluated significance levels in the alternate regridded situation. The NH-mean verification scores are essentially unchanged with the only exception being that the Reduction of Error (RE) score for experiment ''z'' (detrended predictand), which was significant below the 90th percentile, is now significant just at the 90th percentile, while the CE score remains statistically insignificant so the reconstruction would still be rejected (Figure 1). In addition, the reconstruction does not capture any of the low-frequency variability present in the true NH-mean time series.

[4] A direct comparison of ECHO-g and CSM model output was never intended by M07 as evidenced by the 20 CSM experiments conducted compared to only 6 for ECHO-g. Using the ECHO-g model in addition to CSM was merely an attempt to show that the RegEM results are not unique to the CSM model fields and hemispheric means.

[5] In summary, we acknowledge that the ECHO-g NH mean shown in M07 exhibits greater variability than does the true model NH mean. However, the technical issue raised by *Smerdon et al.* [2008] has no impact on the conclusions of M07. Furthermore, we suggest that bilinear interpolation be used to degrade the spatial resolution of model output for subsequent pseudoproxy experiments.

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