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Reply to comment by David E. Parker et al. on "Unresolved issues with the assessment of multidecadal global land surface temperature trends"

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1. Introduction

[1] *Pielke et al.* [2007a] identified a variety of problems affecting the accuracy or appropriate level of confidence of the global historical land surface temperature data set, as applied to estimates of global temperature trends, and called for several measures to be taken to improve this network for this purpose. *Parker et al.* [2009], while acknowledging the importance of making improvements to the network and its data, take issue with two particular aspects of our analysis. We are grateful for the opportunity to engage in further discussion regarding these important issues.

2. Degree of Independence of Land Surface Global Surface Temperature Analyses

[2] Lack of independence and incomplete coverage are two important shortcomings of estimates of global and regional temperature trends. Lack of independence has two related meanings: the extent to which different estimates of temperature trends rely on the same underlying data, and the extent to which homogenization has conflated data from an individual station with data from surrounding stations. This lack of independence, when quantitatively assessed, will increase the uncertainty of estimates of temperature trends. Incomplete coverage particularly affects estimates of regional trends in undersampled areas, with an impact on global and hemispheric trend estimates as well.

[3] *Parker et al.* [2009] claim that effectively independent analyses of land surface global temperature trends have already been carried out. These previous analyses either involve subsampling of data from more comprehensive analyses or are independently performed comprehensive analyses. They also conduct their own new subsampling analysis. As discussed by *Pielke et al.* [2007a, 2007b], however, the raw data from which all of these analyses are drawn are not independent. The typical procedures to "homogenize" climate data may involve any of several steps, as summarized from *Pielke et al.* [2002]: (1) a hand-checked quality assurance of data outliers from the original records; (2) an adjustment for time-of-observation biases [*Karl et al.* 1986]; (3) an adjustment based on known instrumentation changes, such as correcting for the introduction of the maximum-minimum temperature system (MMTS) using the bias value given by *Quayle et al.* [1991]; (4) an adjustment based on station moves, for example, using the procedure described by *Karl and Williams* [1987]; and (5) an adjustment for urban effects, such as described by *Karl et al.* [1988]. Recent papers to evaluate the urban temperature bias include those by *Gallo et al.* [1999] and *Owen et al.* [1998a, 1998b]. The first three steps are essential, and we agree they are needed in order to standardize the data sets. However, explicit treatment of the statistical uncertainty associated with the second and third steps (e.g., in terms of the standard deviation associated with the regression adjustment) has only recently been included in the development of grid point analyses [*Brohan et al.*, 2006].

[4] Even more significant, however, are step 4 and (in those analyses where it is used) step 5. Adjustment for station moves results in an interdependency among nearby stations, as each adjustment compels a trend segment from

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