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Climate of the Past Discussions

CPD
4, S427–S433, 2008

Interactive Comment

Interactive comment on “Western Europe is warming much faster than expected” *by* G. J. van Oldenborgh et al.

G. J. van Oldenborgh et al.

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Dear Rasmus,

thank you for your comments, which we have addressed as follows.

1. *To make the analysis more robust, it should be repeated with the trend analysis of Scherrer et al. (2005).*

   The method of Scherrer et al (2005) entails the use of running 30-yr means. To detect a trend the end point of the running means are compared. As we mention in the text, this has a smaller signal/noise ratio than the method employed here, as some of the signal (the trend within the 30-yr window) is interpreted as noise. Also, it is not clear which interval to use; after all, the traditional 30 years to define a climatology is a compromise between the optimum lengths for temperature

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Interactive Discussion
Discussion Paper

(about 10 years, see Huang et al., 1996; Livezey et al., 2007) and precipitation (much longer).

We verified that temperature trends are very similar between the three methods. To enable a quick comparison, we divided the local temperature trend obtained by the first and last running mean or linear trend methods by the corresponding trend in the global mean temperature to get an estimate of the A of the article. The error estimate ΔA only includes the variability of the local temperature in all cases. Although the central values are similar, the error estimates are indeed on average somewhat larger when the unphysical running mean or linear trend methods are used, resulting in somewhat lower z-values for the discrepancy between observations and models.

This is illustrated in Table 1 with numbers for the homogenised De Bilt series used for Fig. 1 in the article and a grid point in southern Europe in the CRUTEM3 dataset, 40°–45°N, 0°–5°E (around Barcelona). The starting date of 1950 is not very critical either, from 1920 onwards one obtains very similar results (not shown). Unfortunately, the CP discussion does not yet have the possibility to add maps, but these are available on request.

The larger spread has been demonstrated by a Monte Carlo method. Assuming a trend that is proportional to the global mean temperature, with regression coefficient, and amplitude and lag-1 autocorrelation of the noise deduced from the De Bilt observations, we generated 10^6 time series and computed the trends with the three methods. The results are shown in Fig. 1. The regression against global mean temperature has the smallest residuals (by definition in this case, but in practice as well), and hence has the smallest uncertainty.

More importantly for computing the z-values is the fact that the error estimates are also better, as is shown in Fig. 2. The error estimates for a running mean have a larger spread: quite often the error estimate is erroneously low (a few examples can also be seen in Tab. 1). Fitting a linear trend gives error estimates that are

CPD

4, S427–S433, 2008

Season	Regression	Running mean 1950-2007			Linear trend -2007	
	1950-2007	10-yr	20-yr	30-yr	1950	1970
De Bilt (homogenised)						
Annual	2.5±0.4	2.4±0.2	2.8±0.3	2.3±0.4	2.2±0.4	2.5±0.5
DJF	2.5±1.0	3.0±1.2	3.7±1.9	2.4±2.2	2.8±1.1	2.6±1.4
MAM	3.0±0.5	2.6±0.6	2.9±0.5	2.7±0.6	2.4±0.6	3.8±0.7
JJA	2.2±0.6	1.9±0.6	2.6±0.5	2.2±0.7	2.1±0.7	2.2±0.8
SON	2.0±0.6	1.9±1.0	1.5±0.8	1.8±0.7	1.4±0.7	2.3±0.8
CRUTEM3 40°–45°N, 0°–5°E (around Barcelona)						
Annual	2.2±0.3	1.9±0.2	2.1±0.2	2.0±0.2	2.0±0.3	2.6±0.4
DJF	1.7±0.6	1.7±0.6	2.4±0.7	1.7±0.7	2.1±0.6	1.2±0.8
MAM	2.1±0.4	1.8±0.4	1.5±0.3	1.5±0.4	1.6±0.5	3.8±0.5
JJA	3.1±0.5	2.8±0.8	3.0±0.5	2.9±0.7	2.9±0.6	3.4±0.7
SON	2.0±0.4	1.5±0.4	1.6±0.5	2.2±0.4	1.8±0.5	2.3±0.7

Table 1. Comparison of the trend in the De Bilt homogenized temperature and a CRUTEM3 grid box with the global mean temperature trend using a regression over 1960-2007 (as used in the article), N-year running means over 1950-2007 and linear trends 1950-2007 and 1970-2007.

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Interactive Discussion

Discussion Paper

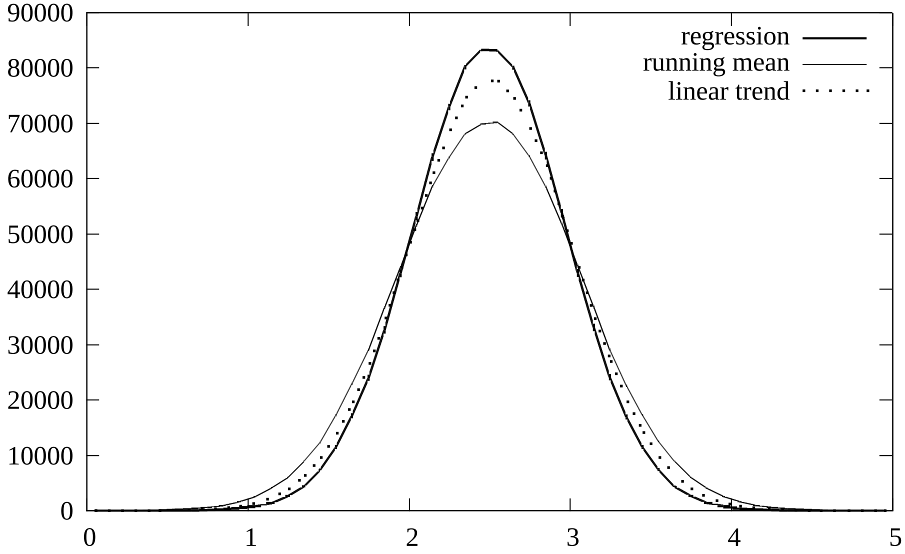

Fig. 1. Distribution of trend parameters of 10^6 artificial time series constructed with the same regression against global mean temperature, standard deviation and lag-1 autocorrelation as the observed series, using the three methods discussed in the text.

systematically higher than the ones from the regression against the global mean temperature, as part of the signal is included in the noise.

We added a sentence that the results are similar, but with lower significances, when running mean or linear trends are considered.

2. *I'm not entirely convinced that Eq. 3 correct — but I may be mistaken. Perhaps more information is needed, explaining the terms in more detail. The reason why I am a bit puzzled is the denominator : dividing the* ΔA *by*

CPD

4, S427–S433, 2008

Interactive Comment

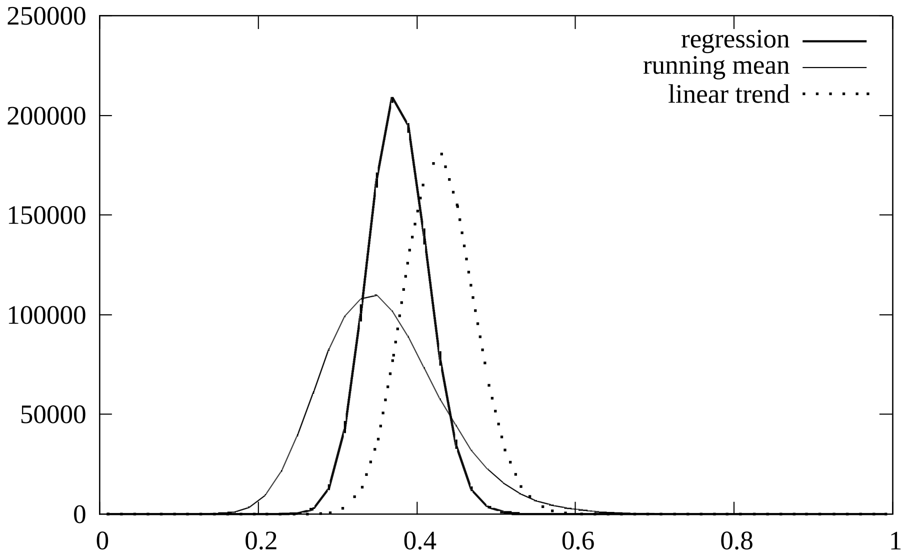

Fig. 2. As Fig. 1, but for the error estimate of the trend parameters.

CPD

4, S427–S433, 2008

Interactive Comment

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Interactive Discussion

Discussion Paper

N is valid as long as the estimate for A really is the same for all models. See about this for a case where such treatment of errors is not appropriate on: http://www.realclimate.org/index.php/archives/2007/12/tropical-troposphere-trends/

We only use Eq. 3 for the Essence ensemble, in which all members are taken from the same model, and hence A is the same. The $1/N$ only reduces the uncertainty due to natural variability, not model uncertainty. For the five CMIP3 models with the most realistic circulation over Europe and the UKMO perturbed physics ensemble we only claim that the observed rate is well above all individual runs, without computing z-values based on the ΔA of the models. The contours of z-values in our Fig. 3 are based on $N = 17$ for ECHAM5/MPI-OM, and $N = 1$ for all other models.

We have attempted to clarify this issue in the text.

3. *I find the results somewhat surprising, as comparisons between results from empirical-statistical downscaling of 20C GCM runs over Norway and obser vations seem to exhibit good agreement (Benestad, 2005 - auxiliary material; Benestad 2008). Thus, these results are inconsistent with other studies, and this fact should be discussed (e.g. why?).*

   As can be seen in our Fig. 2 we also show good agreement between the observed and modelled temperature trends in Norway. The discrepancies appear to the south of Norway. Similar plots to the ones in the Figure 3 of your report but for the Netherlands (1 region only, Fig. 9-3 in van den Hurk et al., 2006) show a large discrepancy between the historical and projected trends and were in fact the reason to start the investigation that resulted in this paper.

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CPD

4, S427–S433, 2008

Interactive Comment