Comments on "Global and Regional Comparison of Daily 2-m and 1000-hPa Maximum and Minimum Temperatures in Three Global Reanalyses"

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ABSTRACT

Pitman and Perkins claimed that instantaneous 2-m air temperatures from different reanalysis products largely disagree over widespread regions of the globe and that, due to much smaller differences, temperatures at 1000-hPa should be preferably used. In this comment we show that this claim is based on erroneous results.

1. Motivation of the Comment

Pitman and Perkins (2009), hereafter referred to as 'PP', compared air temperatures at 2-m (T2m) and 1000-hPa (T1000hPa) from three different reanalysis products against each other. As one of the main conclusions, they claimed that due to major differences found in T2m, "commonly exceeding ±5°C and regionally exceeding ±10°C", the use of this variable should generally be discouraged in favor of T1000hPa. Since T2m is a widely used variable in many subdisciplines of the earth sciences, like e.g. hydrological modeling (Weedon et al. 2011), validation of Global and Regional Climate Models (Lorenz and Jacob 2010), statistical downscaling (Hanssen-Bauer et al. 2005; Benestad 2011) and the evaluation of reanalysis products against in-situ observations (Mao et al. 2010), this claim should be guaranteed to be scientifically sound.

In this comment, we repeat the methods applied in Pitman and Perkins (2009) for T2m and T1000hPa from the European Center of Weather Forecasts ERA-40 reanalysis data (Uppala et al. 2005) and the Japanese 25-year Reanalysis Project (JRA-25, Onogi et al. 2007). It will be shown that the mean difference (bias) for T2m is much weaker than stated by PP, that it is comparable or smaller than for T1000hPa and that the above mentioned claim is consequently wrong. Moreover, we show what we believe to be the probable error committed by PP.

2. Data and Methods

The ERA-40 data were obtained from ECMWF's MARS server (`http://www.ecmwf.int/services/archive/`) and come on a horizontal resolution of 1.125°. The JRA-25 data were downloaded at `http://dss.ucar.edu/dsszone/ds625.0/` at a resolution of 1.25°. Due to the different grid types, both datasets were regridded to a common regular grid of 2.5° by using the nearest-neighbor method. In contrast to PP, T2m was not corrected for differences in reanalysis orography, and, thus, differences are expected to be greater than in PP. As

was the case in PP, daily maximum temperatures where defined for T2m and T1000hPa as the daily maximum of the 6-hourly instantaneous time series from 1981-2000 and the mean difference (bias) was applied as validation measure. Since similar results were obtained for for minimum temperatures (defined as the daily minimum of the 6-hourly instantaneous time series), they are not shown for the reason of simplicity.

3. Results and Comparison

Figure 1(a) shows the bias between T2m from JRA-25 and T2m from ERA-40 and is directly comparable to Figure 1(d) in PP. For a large fraction of the globe the bias is below ± 2°C, with maximum values below ± 5°C in any region except the Antarctic. This magnitude is far smaller than was stated by PP and similar to that reported by PP for the comparison of JRA-25 and NCEP-2 (see Fig. 1g in PP). Therefore, we are afraid that something could be wrong with what PP labeled as T2m from ERA-40.

As one possible error-source, the bias between T2m from JRA-25 and T1000hPa from ERA-40 is presented in Figure 1(b). As the difference patterns of this erroneous comparison closely match those of PPs' Figures 1(a) and 1(d), we suspect that PP might have validated T1000 from ERA-40 against T2m from JRA-25 and NCEP-2, and that the large error magnitude they found might arise from comparing the wrong variables.

Moreover, our results for T2m (shown in Figure 1a) are comparable or even smaller than those obtained for T1000hPa (see Fig. 2d in PP). Therefore, the strong claim that "either the 2-m air temperatures should not be used or all three [reanalysis] products should be used independently in any application and the differences highlighted" (stated in the abstract of PP) does not hold any longer.

Finally, we would like to comment that our findings are supported by 1) the official ERA-40 (`http://www.ecmwf.int/research/era/ERA-40/ERA-40_Atlas/docs/section_B/charts/B03_LL_YEA.html`) and JRA-25 (`http://ds.data.jma.go.jp/gmd/jra/atlas/eng/indexe_`

surface11.htm) web portals and 2) the results obtained by Mao et al. (2010) for China. Both independent sources show a close agreement between the T2m fields from ERA-40 and JRA-25.

4. Conclusions

With a mean difference below ±2°C for a large fraction of the globe, this study has shown that instantaneous 2-m air temperatures from the JRA-25 and ERA-40 reanalysis products are in much closer agreement than was stated in Pitman and Perkins (2009), who possibly compared the wrong variables. Consequently, we cannot confirm their conclusion that temperatures at 1000-hPa should be used preferably, since their mean difference is comparable or even higher than for 2m temperatures.

Acknowledgments.

S.B. would like to thank the 'Consejo Superior de Investigaciones Científicas' (CSIC) predoctorcal program 'JAE-PREDOC' for funding. The authors appreciate the free distribution of the JRA-25 and ERA-40 datasets.

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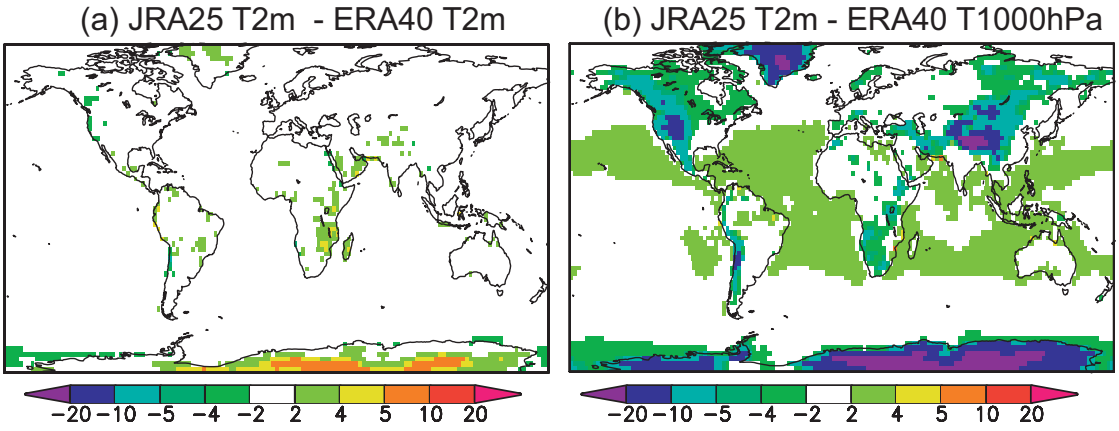

FIG. 1. (a) Mean difference (bias) between Tmax at 2m from JRA-25 and Tmax at 2m from ERA-40; (b) Mean difference between Tmax at 2-m from JRA-25 and Tmax at 1000-hPa from ERA-40; daily instantaneous values from 1981 to 2000