Corrigendum: “Attribution of the June-July 2013 Heat Wave in the Southwestern United States”

Hideo Shiogama\(^1\), Masahiro Watanabe\(^2\), Yukiko Imada\(^3\), Masato Mori\(^4\), Youichi Kamae\(^5\), Masayoshi Ishii\(^3\), and Masahide Kimoto\(^2\)

\(^1\)Center for Global Environmental Research, National Institute for Environmental Studies, Tsukuba, Japan
\(^2\)Atmosphere and Ocean Research Institute, the University of Tokyo, Kashiwa, Japan
\(^3\)Meteorological Research Institute, Tsukuba, Japan
\(^4\)Research Center for Advanced Science and Technology, the University of Tokyo, Tokyo, Japan
\(^5\)Faculty of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Japan

We have found the following mistakes in Shiogama et al. (2014, S14):

1. The runs 1–50 and 51–100 of the ALL forcing experiments have the GHGs concentrations of the year 1850 for the 2006–2013 and 2012–2013 periods, respectively. The ALL-long runs also have the GHGs concentrations of the year 1850 for the 2012–2013 period. We have redone these experiments with the correct GHGs concentrations.

2. Although S14 wrote that analyzed period was the June-July 2013, but we used the June-August 2013 data for ALL, NAT1 and NAT2. We have redone the analyses using the June-July 2013 data.

3. There was an error in a program to plot Fig. 6b. Corrections of these errors did not change the main conclusions of S14 qualitatively. S14 underestimated the anthropogenic warming signals. The probability of a hot summer as severe as that of 2013 was 14% for ALL (Fig. 1b, the corrected version of the original Fig. 3b), but that was 2% in S14. Although S14 wrote “the observed value lays in the tail of the histogram for the ALL runs (the first paragraph of the right column of page 124)” and “Although the observed SAT anomalies in 2013 lay in the tail of the histogram for the ALL runs (the second paragraph of summary)”, the observed value is not rare (14%) in Fig. 1.

The other major changes due to the error corrections were found in Fig. 2 (the corrected version of the original Fig. 6). In the second paragraph of the right column of page 124, S14 wrote “Although the histograms of M1 indices for the 2013 runs are positively offset compared to the histogram of the ALL-Long runs, the other members of ALL-Long from 1980-2013 (green curves, with black dotted line representing the ensemble average). The histogram is calculated as a normalized histogram of samples within half-overlapped bins of 0.5°C-width. (b) Histograms of June-July-mean 2013 temperature anomalies for the 100 members of ALL (red), NAT1 (blue) and NAT2 (light blue). The vertical line is the 2013 value of ERAI. These histograms were calculated from 34 samples for (a) and 100 samples for (b).

Corresponding author: Hideo Shiogama, Center for Global Environmental Research, National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan. E-mail: shiogama.hideo@nies.go.jp. ©2016, the Meteorological Society of Japan.
there are no large differences in histograms between ALL, NAT1 and NAT2." However there are no clear offset in ALL, NAT1 and NAT2 in Fig. 2a. In Fig. 2b, the histograms of ALL, NAT1 and NAT2 are not offset compared to the ALL-long as S14. These results suggest that neither the natural variability of SST-SIC nor human activity influenced phases of M1 and M2. Although S14 stated "It was suggested that both the anthropogenic warming and an atmospheric circulation regime related to the natural variability of SST and SIC made the heat wave event more likely (Abstract)", "both anthropogenic warming (Fig. 3b) and the natural variability of SST and SIC increased the probability of such an event (Fig. 6a) (the first paragraph of Summary)" and "nevertheless, the natural variability in SST and SIC increased the probability of atmospheric circulation regimes (Fig. 6a) that are favorable for occurrences of heat waves in the southwestern US (the first paragraph of Summary)", we withdraw these statements.

In summary, we suggest that anthropogenic warming increased the probability of heatwave exceeding that observed in 2013, but we do not found any clear evidence of the influence of natural variability of SST-SIC nor human influence on the atmospheric regimes.

The other corrected figures are shown in the supplement:
(i) Due to changes in the GHG concentrations, the anthropogenic warming in the land area is larger than that in S14 (Fig. S4, the corrected version of the original Fig. 7), causing greater and more zonally uniform warming in the ensemble mean of ALL (Fig. S1b, the corrected version of the original Fig. 1b).
(ii) Although the resemblance of temperature and circulation patterns of the hottest member of ALL (Figs. S1c and S2c) to those in ERAI (Fig. S1a and S2a) is slightly lower than that in S14 (Figs. 1 and 2 of S14), it is suggested that stochastic behavior of atmospheric circulation can cause the pattern of more and less warming in the southwestern and southeastern US like that in ERAI as S14.
(iii) Fig. 4 of S14 does not change (thus it is not shown in the supplement).
(iv) There are little changes in the patterns of M1 and M2 (Fig. S3, the corrected version of the original Fig. 5).

Acknowledgments

We thank Oliver Angélil who found the errors in the GHGs concentrations. This work was supported by the Program for Risk Information on Climate Change (SOUSEI program), Grant-in-Aid Change 26281013 and Grant-in-Aid 26247079 from the Ministry of Education, Culture, Sports, Science and Technology of Japan and the Environment Research and Technology Development Fund (S-10) of the Ministry of the Environment of Japan. The Earth Simulator and NEC SX (NIES) were utilised for the simulations.

Edited by: T. Takemi

Supplement

Fig. S1. Corrected version of the original Fig. 1. Shading indicate surface air temperature anomalies in June-July 2013 (°C) relative to the 1980−2013 average for the contiguous United States for (a) ERAI reanalysis, (b) the ensemble mean of ALL and (c) the member of ALL with the hottest temperature anomalies in the southwestern United States (green box). Contours are geopotential height anomalies at 500-hPa (m). Contour intervals are 10 m for (a) and (c) and 5 m for (b).

Fig. S2. Corrected version of the original Fig. 2. Geopotential height anomalies at 500-hPa in June-July 2013 (m) north of 20°N for (a) ERAI, (b) the ensemble mean of ALL and (c) the member of ALL with the hottest temperature anomalies in the southwestern United States.

Fig. S3. Corrected version of the original Fig. 5. Principal components of 500-hPa geopotential height anomalies (m) during 1980−2013. (a) M1 and (b) M2 for ERAI. (c) M1 and (d) M2 for the ALL-Long runs. The fractions of explained variances are also shown.

Fig. S4. Corrected version of the original Fig. 7. Ensemble averaged surface air temperature differences (°C) during June-July 2013 for (a) "ALL minus NAT1" and (b) "ALL minus NAT2".

References

Shiogama, H., M. Watanabe, Y. Imada, M. Mori, Y. Kamae, M. Ishii, and M. Kimoto, 2014: Attribution of the June–July 2013 heat wave in the southwestern United States. SOLA, 10, 122–126, doi:10.2151/sola.2014-025.

Manuscript received 8 September 2016, accepted 16 November 2016
SOLA: https://www.jstage.jst.go.jp/browse/sola/