Projections of the duration of low-precipitation season in the Chao Phraya river basin based on the output from CMIP5 GCMs

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The duration of low-precipitation season under climate change was projected in the Chao Phraya river basin based on the output from all 31 CMIP5 GCMs which is available for both historical (1951-1981) and RCP8.5 (2070-2100) emission scenario. We estimated the length of the continuous days in each year that total precipitation during preceding 30days below a threshold which defines low-precipitation season, 15, 30, 45, and 60 mm/30days in this study (the annual average is 82.4 mm/30days). The result indicates that the top 10 percentile of long duration becomes much longer under climate change while the average duration slightly decrease. This tendency is valid for each thresholds. In the case of 15 mm/30days threshold, the occurrence of 10^{th} longest duration in historical period (1951-80 in this study), which corresponds almost 0.1% (ones in ten years), becomes 3.79 times as frequent under climate change from the estimation using 31 GCMs. The range of changing ratio estimated without highest and lowest 2 GCMs, which corresponds almost 90% confidence level, is 1.00 to 6.33. The fact suggests that the severe low-precipitation will happen more often under climate change.
The result of projection is significantly different between with and without applying bias correction method. For the average duration, an increase trend calculated without bias correction changes to a decrease trend after bias correction. It is well known that precipitation simulated by GCMs generally have considerable bias, thus it is common to correct bias before the application. This is true for the projections of the duration of low-precipitation season. To the best of our knowledge, there is no specific correction method for this purpose. Hence, we developed a method that correct the duration of low-precipitation season directly by changing threshold of precipitation for GCMs so that a duration of GCM low-precipitation season calculated by corrected threshold is agree to that of observation by original threshold in historical period. The developed method is different from common bias correction method in terms of the characteristic that not a precipitation itself but a threshold is corrected. This approach used in the correction of low-precipitation amount, which correct low-precipitation below a threshold as 0 considering the characteristic of GCM that there are significantly larger number of low-precipitation than observation.
It is important to understand the change of the duration of low-precipitation season because not only it has some impact on hydrology but also it affects the accuracy of bias correction for the amount of precipitation especially for pre- and post-monsoon season because many of bias correction methods adopt the approach that low-precipitation and others are separately corrected. Due to this reason, it is known that the error of bias correction generally large in these seasons. The results of this study can contribute to the improvement of bias correction as well as understanding the characteristics of the projections of precipitation among GCMs in monsoon regions.

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