Future changes of surface air temperature in summer over the Japanese archipelago by d4PDF regional climate simulations.

*Yasuko Okada[1], Masayoshi Ishii[2], Hirokazu Endo[2], Hiroaki Kawase[2], Izuru Takayabu[2], Hidetaka Sasaki[2], Shingo Watanabe[1], Mikiko Fujita[1], Shiori Sugimoto[1], Sho Kawazoe[1]

1. JAMSTEC Japan Agency for Marine-Earth Science and Technology, 2. Meteorological Research Institute

Recent years, the abnormally high temperature is often generated during summer and can also cause serious damage in our life. Developing a better understanding of the features and occurrence frequency of this high temperature is an important element of prevention of drought, heat stroke and more. Various analyses by global warming prediction experiments have been carried out so far, but since the number of ensemble is small. It is not possible to fully evaluate natural fluctuation, that is, uncertainty accompanying abnormal weather such as low-frequency events. Based on such problem consciousness, numerous (up to 100 members) ensemble experiments are conducted using the 60-km-mesh global atmospheric model and the 20-km-mesh regional atmospheric model (Mizuta et al. 2016). This database called database for Policy Decision making for Future climate changes (d4PDF), which is intended to be utilized for the impact assessment studies and adaptation planning to global warming. We investigate using this dataset future changes of the surface air temperature in summer over the Japanese archipelago based on observational locations.

We use output data of the 20-km-mesh regional atmospheric model (RCM) simulations for the historical simulation (1951-2011) and +4K simulation (2051-2111) under the global-mean surface air temperature warming becomes +4K. The simulated +4K climates include the outputs obtained with six different sea surface temperature (SST) patterns. The RCM are conducted for 50 members of the historical simulation and for 90 members of the +4K simulation, and we use all members in this study. We also use the data of meteorological offices at 152 locations nationwide as observation data for each location.

In order to assessment the surface air temperature by location, bias of this model can not be ignored depending on the location. We correct by bias correction (Piani et al. 2010) using least squares method assuming between observed value and locational value of historical simulation as a linear relation. Although this method is a very simple correction method, it is able to sufficiently reduce errors at all locations. For +4K simulation, we use the correction coefficient obtained from the comparison between a locational value of observation and historical simulation.

The frequency of daily average temperature, maximum temperature and minimum temperature in summer improved better at all location with bias correction. On the other hand, hot summer days slightly overestimate depending the location. For example, hot summer days in Tokyo slightly show increase unlike observational value because it is not affected by a sea breeze. However, the difference is not significant. In +4K simulation using the correction coefficient obtained from the comparison between a locational value of observation and historical simulation, the number of hot summer days increases by about 5 times at any location compared to historical simulation. In addition, this value varies depending on the difference in SST patterns and this tendency is largest in summer.

In the Social Implementation Program on Climate Change Adaptation Technology (SI-CAT), we conduct experiment assuming a near future where the surface air temperature is increased by 2K, like +4K experiment. Using current output data, we investigate future changes of surface air temperature in each location. In the near future (+2K simulation), the number of hot summer days in summer is increased by about twice as much as the historical simulation. We confirm that the near future climate is located approximately midway between the historical climate and the future climate.

The authors were supported by the SI-CAT, the Ministry of Education, Culture, Sports, Science, and

Technology (MEXT), Japan.

Keywords: global warming, high temperature

