Climate Changes and Trends in Agricultural Meteorology in Hokkaido, Japan 1941–2004

Ai KIMURA and Shunji OHTA
Department of Human Behavior and Environment Science,
Faculty of Human Science, Waseda University, 2-579-15 Mikajima, Tokorozawa,
Saitama 359-1192, Japan

In the last century, the annual mean air temperature in the northern hemisphere has increased. In particular, it was found that the air temperature tended to increase in high-latitude regions. Climate changes such as global warming induce increases in the air temperature and in evaporation rates. These, in turn, lead to changes in agroclimatological resources. This study aims to clarify trends in climate change, and to elucidate the effects of climate change on the agricultural environment in the Hokkaido region, located in the northernmost part of Japan, over the past half century. Climate data observed at 22 stations by the Japan Meteorological Agency were used to analyze climate factors, estimate the potential evaporation and daily mean water temperature, and calculate the index of agroclimatological resources.

1. It was found that the annual mean air temperature tended to increase across the entire Hokkaido region in the last half century. The air temperature increased significantly by a rate of as much as 0.3 °C/decade after the 1980s.

2. In spring, the difference between the water temperature and air temperature increased by 0.5 °C/decade. This trend indicates the change in the energy balance of the water surface.

3. Due to these climate changes, the accumulated air temperature above 10°C (AAT10) increased in the Hokkaido region.

4. In addition, the AAT10 was found to have increased significantly in the Abashiri, Sapporo, Iwamizawa, and Hakodate regions. In these regions, the AAT10 increased by more than 100 °C days from 1941–1970 to 1971–2000.

5. The annual potential evaporation, however, increased by approximately 100 mm at all stations, an annual precipitation of approximately 1140 mm/year had been sufficient for agricultural purposes in the Hokkaido region over the last 60 years.

For ensuring sustained crop production, further studies are required to estimate the impacts of an increasingly warmer climate on the yearly variations of agroclimatological resources.