



Spatiotemporal variations of freezing and thawing index in northern Northeast China

Yadong Huang (1) and Huijun Jin (2)

(1) Northwest Institute of Eco-Environment and Resources, CAS, Lanzhou, China, Lanzhou, China (1312866272@qq.com),

(2) University of Chinese Academy of Sciences, Beijing, China

Northern Northeast (NNE) China is the second largest permafrost region in China, only second to Qinghai-Tibet Plateau. The permafrost in NNE China presents high temperature and thin thickness, and the degradation is being accelerated due to climate warming and anthropogenic activities. The mean annual air temperature (MAAT), mean annual ground surface temperature (MAGST), annual air freezing index (AFI), annual ground surface freezing index (GFI), annual air thawing index (ATI) and annual ground surface thawing index (GTI) in NNE China were calculated based on ground surface and air temperatures of 27 selected stations. The results indicated that the MAAT and MAGST were higher compared to decades ago, averaged 1.74° and 0.43° , with an increasing rate of 0.568 and $0.643^{\circ}/10a$, respectively. The AFI, GFI, ATI and GTI ranges were $1757\sim 3619^{\circ}\cdot d$, $1685\sim 3925^{\circ}\cdot d$, $1896\sim 3288^{\circ}\cdot d$ and $2426\sim 3869^{\circ}\cdot d$, respectively, and the multiyear average were $2502^{\circ}\cdot d$, $2602^{\circ}\cdot d$, $2662^{\circ}\cdot d$ and $3238^{\circ}\cdot d$, respectively. AFI and GFI exhibited decreasing trend and the rate were $117.6^{\circ}\cdot d/10a$ and $111^{\circ}\cdot d/10a$. However, thawing index exhibited increasing trend and the liner tendency of ATI/GTI were $89.5^{\circ}\cdot d/10a$ and $111^{\circ}\cdot d/10a$. The strong liner relationship between MAAT and freezing and thawing index were also observed. The results will help us better comprehend the temporal and spatial variation of NNE permafrost and provide scientific basis for permafrost forecast.