

Earth Surface Temperature Changes above Latitude 45 Degrees North from 1973 to 2008

Wandee Wanishsakpong^{1*}, Kehui Luo² and Phattrawan Tongkumchum¹

¹*Department of Mathematics and Computer Science, Faculty of Science and Technology,*

Prince of Songkla University, Pattani Campus, Pattani 94000, Thailand.

²*Department of Statistics, Macquarie University, NSW 2109, Australia.*

*Corresponding author. E-mail: one_d7@hotmail.com

ABSTRACT

In this study, we examined monthly temperature variation from 1973 to 2008 on grid regions of the earth surface above latitude 45°North, covering the Arctic Ocean, northern areas of the Atlantic and Pacific Oceans, and the Asian and European continent. Linear modelling was used to investigate the trends and patterns of temperature changes and account for auto-correlations of the temperature changes over time. Factor analysis was then used to model filtered residuals, i.e., the residuals after removing time trends and auto-correlation, providing a basis for identifying and classifying regions with similar temperature change. Twelve large regions, each having similar temperature change patterns, were identified. Of the 69 sub-regions considered in the study, 64 sub-regions experienced significant increase in temperature, 2 sub-regions had insufficient data, and only 3 sub-regions remained unchanged. High temperature increases (0.200°C to 0.320°C) occurred in the North Pacific Ocean, Alaska and Eastern Siberia. Moderate temperature increases (0.130°C to 0.199°C) occurred in north Canada, Greenland, Iceland, Norway, Sweden and Finland. The north of Siberia and part of the North Atlantic had low increases (0.090°C to 0.129°C) while northeast Canada and its surrounding seas did not show evidence of warming.

Keywords: Latitude, Climate change, Time series analysis, Correlation, Auto-correlation, Factor analysis.

INTRODUCTION

Earth surface temperature change is one of the most important issues the world faces today. Global surface temperature has changed over the past 150 years, with a slightly higher rate of warming in the 20th century (Jones et al., 1999). This warming is associated with change in sea levels, destruction of ecosystems, shrinkage of mountain glaciers, reduction of ice cover (National Academies Report, 2008) and altered ocean circulation patterns (Houghton et al., 2001).

Increased surface temperature in the Arctic Ocean has been a major topic of international reviews and indigenous observations during the last decade (Krupnik