Geophysical Research Abstracts, Vol. 7, 02951, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02951

Impact of urbanization on climate change in Korea, 1973-2002

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The objective of the study is to separate the long-term trend of surface air temperature of global warming from urbanization and to find the actual temperature increase from urbanization in Korean peninsula. The most important anthropogenic influences on climate are the emission of greenhouse gases and land use such as urbanization. But it has been difficult to separate these two influences because both tend to increase the daily mean surface air temperature. The urban temperature has been compared with observations in cities with those in surrounding rural areas, but results differ significantly depending on what data are used. In general, a numerical model well describes global warming but it is insensitive to surface observations such as the urban climate characteristics come from land cover, population, and vehicles, etc. However long-term surface air temperature increase patterns that have been generated the numerical model simulation could be recognized as evidence of global warming. Here we used the difference between trends in observed surface air temperatures in Korean peninsula and the corresponding trends in a reconstruction of surface temperatures determined from a reanalysis of global weather over the past 50 years. For the data analysis, the daily air temperature observations of the Korea Meteorological Administration (KMA) during the time period from 1973 and 2002 were used at the five rural sites and five cities. The 50-year re-analysis surface air temperatures of National Center for Environmental Prediction (NCEP) were used to compare with the observations in the grid of the Korean climate domain. The results showed that for the 30-years period, there are in good agreements between observations and NCEP reanalysis in the temperature trends at the major cities and rural areas; however, decadal trends show differences between observation and NCEP reanalysis. The analyses reflect the fact that the urban area is experiencing the high rate of temperature increase with 1.39oC of

regression value at the urban area, Seoul, and 0.43oC at the rural site, Chupungnyeong during the period of 30 years. The temperature due to the urbanization only showed the increase in the range between 0.44oC and 0.86oC, and the observed decrease in diurnal temperature range at five of urban areas during the 30 years period. For more understanding the Empirical Orthogonal Function (EOF) analysis was performed to find the dominant modes of temperature variability in the Korean urban area. In the analysis using temperature data averaged for each year in the 30-years period, the first EOF explained with 83.6% of the total variance and is a major temperature variation mode due to the impact of urbanization and global warming. The second EOF, whose horizontal structure showed positive values in the urban area and negative in the other area, explains 4.8% of the total variance. This mode is related to the temperature increase effect. In the analysis using temperature anomalies data, the leading four modes explain 70.4% of the total variance. The first EOF reflects the impact of urbanization on climate change in Korea.