QUANTIFYING URBAN LAND COVER TRENDS WITH NLCD IMPERVIOUSNESS AT US HISTORICAL CLIMATOLOGY NETWORK CLIMATE STATIONS BETWEEN 2001 AND 2011

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KEY WORDS: urban land cover, impervious surface, NLCD, climate station, temperature

ABSTRACT:

Urban land cover change modifies land surface conditions by replacing nonurban land with an impervious surface in many urban areas. Since the surface temperature incorporates the effects of surface radiative and thermodynamic properties, the result of this land cover change can further intensify the near-surface air temperature difference between urban and surrounding rural areas. Our previous research suggests that the observed differences in urban and rural temperature increased as the impervious surface area used to define an urban grid cell was increased (Gallo and Xian, 2014). This result, however, was also dependent on the size of the sample area included in the analysis. As the spatial extent of the sample area increased and included a greater number of rural defined grid cells, the observed urban and rural differences in temperature also increased. A cursory comparison of the spatially gridded meteorological observations with observations from climate stations suggest that the number and location of stations included in an urban heat island analysis requires consideration to assure representative samples of each environment are included in the analysis. This research examines the predominant land cover types and associated impervious surface area (ISA) at the climate stations that are included in the US Historical Climatology Network (USHCN). The USHCN is a network of climate stations that are often used in regional and national analyses of temperature trends within the conterminous USA (CONUS). Any change in the local and surface environment that may influence changes in temperatures observed at these stations requires monitoring and documentation. An evaluation of environmental changes at the stations included assessment of the predominant land cover and ISA within 100 and 1000 m grid cell buffers derived from the 2001 and 2011 National Land Cover Database (NLCD) centered on the station locations. The NLCD ISA change products were obtained from updating new impervious surface growth and intensification between periods of 2001 and 2006 and 2006 and 2011 (Xian and Homer, 2010; Xian et al., 2011; Xian et al., 2012). For example, for the change between 2006 and 2011, the method employs the NLCD 2006 impervious surface product as the baseline information and Landsat imagery pairs in 2006 and 2011 as the primary data source. The night-time stable-light satellite imagery from the NOAA Defense Meteorological Satellite Program (DMSP) and ancillary data including slope and elevation were also used to form regression models for estimating percent impervious surface in large areas. The predominant land cover and ISA for 2001 were examined for each station and changes in the ISA values from 2001 and 2011 were evaluated and quantified. Results that identify the stations with the largest proportional ISA changes within these buffer areas will be presented for CONUS.

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