Ground-truth of a 1-km downscaled NLDAS air temperature product using the York City Community Air Survey

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Downscaled NLDAS-NYCCAS minimum temperature comparisons

Motivation

• The frequency of extreme heat days has risen with the increase of anthropogenic global warming.
• Public health decision making and messaging depend on reliable air temperature data.
• In an urban public health context currently available data lack sufficient spatial resolution.
• Prior ground-truthing has not been done for a downscaled NLDAS (North American Land Data Assimilation System) dataset for air temperature in a highly variable urban landscape such as NYC.

Data sources

The New York City Community Air Survey (NYCCAS): Air temperature records

NYCCAS has the most comprehensive geographic coverage of any urban air monitoring network in the U.S. with 150 monitors in a 790 square kilometer area (Matte et al., 2013).

NLDAS meteorological re-analysis 1x1 km² downscaled temperature data

• Historical NLDAS land-surface model temperature data derived from the National Centers for Environmental Prediction (NCEP) NARR (Al-Hamdàn et al., 2014; Mesinger, 2006; NOAA/ U.S., 2005, Cosgrove et al., 2003).
• 12x12 km² NLDAS dataset (Al-Hamdàn et al., 2014) downscaled to 1x1 km daily maximum/minimum air temperature using 1 km Moderate Resolution Imaging Spectroradiometer (MODIS) Land Surface Temperature (LST) (Crosson and Al-Hamdàn, 2014).
  • LST grids created previous 8-day composite MODIS-LST products
  • Calculated NLDAS air temperature standard deviation for geographic ‘neighborhood’
  • Normalized departure for 3x3 grid cells in Version 1, 5x5 in Version 2
  • Version 2 improved the slope slightly and decreased the error for 2009 and 2010 comparisons.

Summary statistics

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</table>

Table 1. Summary statistics showing correlation coefficients, coefficient of determination, root-mean-square error, mean absolute error, and slope for daily minimum comparisons. All numbers are for the 1 km downscaled model averaged centroids except for those labeled 12 km.

Summary and conclusions

• Strong improvement of the downscaled NLDAS model in capturing the spatial variability of temperature across NYC neighborhoods over the native 12 km resolution.
• Very good overall agreement between downscaled NLDAS modeled minimum temperatures with NYCCAS ground station measurements.
• NYCCAS measured warmer temperatures on average than the downscaled NLDAS temperatures, with the best agreement in cases of lower average minimum temperatures and lower vegetative cover.
• The higher resolution is needed for coastal urban applications.
• Allows for discernment of neighborhood level differences in temperature and areas with heterogeneous land cover.
• The nationwide dataset will be available at the Centers for Disease Control Prevention (CDC) Environmental Public Health Tracking Network.

Acknowledgements and references


NYC Health