

Urbanization in Shanghai

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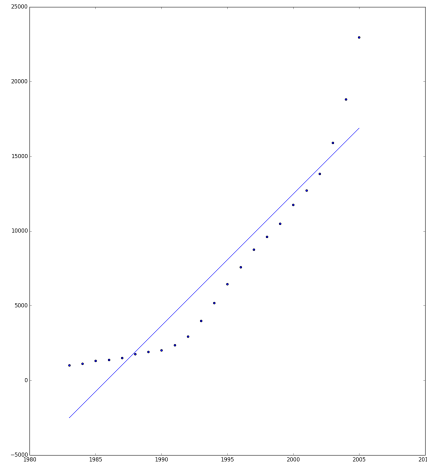
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1 NYC vs Shanghai: Urban Heat Island

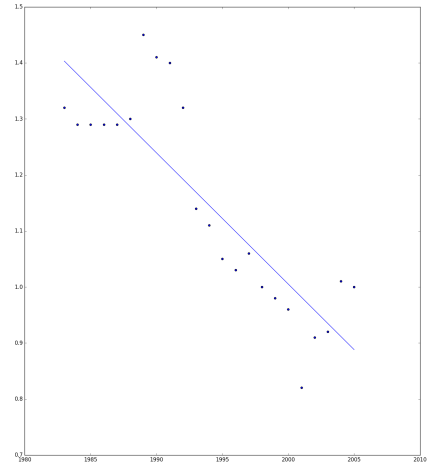
With global warming forecasts set to continue into the near and no-so-near future, heat waves will become more and more likely to occur over time. The Urban Heat Island metric (or UHI for short) is typically defined as the temperature difference between urban, suburban, and exurban areas. For instance, [2] found that over the last 30 years in Shanghai, the average mid-summer temperature in urban districts has been increasing at an average rate of 0.073 K per year, whereas surrounding exurban areas saw no substantial change. That's a combined increase of urban mid-summer temperature by more than 2 K.

Comparing results detailed in [1] and [2], it would appear that the UHI effect in NYC is still much more pronounced than in Shanghai, though Shanghai is quickly catching up. This is a pattern we see again and again. The majority of years between 1975 and 2010 saw a UHI intensity of roughly 2 to 2.5 K in NYC, with a handful of years approaching 3 K. In Shanghai, we see an increase from a UHI of 0.2 K in 1975 to a UHI of 1 K in 2000, with most of the 1990s having a UHI of roughly 0.8 K.

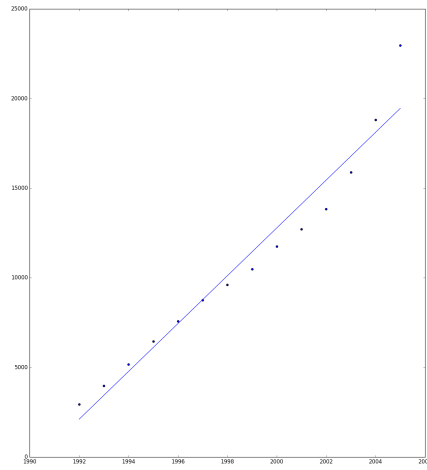
According to [3], we have the following figures. We can see that air quality and GDP growth are negatively correlated.



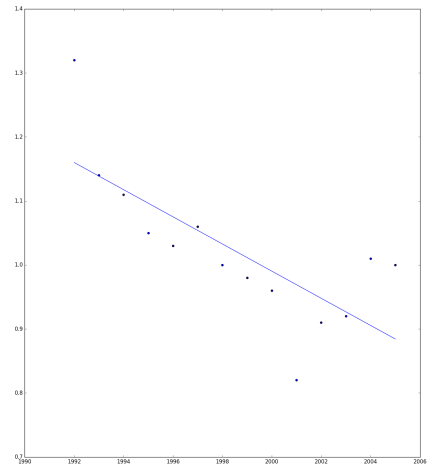
GDP growth over time



Air quality over time



GDP growth since 1991



Air quality since 1991

References

- [1] S. R. Gaffin, C. Rosenzweig, R. Khanbilvardi, L. Parshall, S. Mahani, H. Glickman, R. Goldberg, R. Blake, R. B. Slosberg, and D. Hillel. Variations in new york city's urban heat island strength over time and space. *Theoretical and Applied Climatology*, 94(1):1–11, 2008.

- [2] Jianguo Tan, Youfei Zheng, Xu Tang, Changyi Guo, Liping Li, Guixiang Song, Xinrong Zhen, Dong Yuan, Adam J. Kalkstein, Furong Li, and Heng Chen. The urban heat island and its impact on heat waves and human health in shanghai. *International Journal of Biometeorology*, 54(1):75–84, 2010.
- [3] Ti-Yuan Xia, Jun-ying Wang, Kun Song, and Liang-jun Da. Variations in air quality during rapid urbanization in shanghai, china. *Landscape and Ecological Engineering*, 10(1):181–190, 2014.
- [4] Kaixuan Zhang, Rui Wang, Chenchen Shen, and Liangjun Da. Temporal and spatial characteristics of the urban heat island during rapid urbanization in shanghai, china. *Environmental Monitoring and Assessment*, 169(1):101–112, 2010.