

Land Surface Temperature analysis report

Introduction

The selected study area is Los Angeles, California, USA at latitude 36.778259 N and longitude 119.417931 W. Los Angeles is a heavily-urbanized city, with a high concentration of heat-absorbing concrete and asphalt infrastructures replacing the natural vegetation that would otherwise support evapotranspiration to naturally cool the area. As a result, Los Angeles is known to be an urban heat island where temperatures are significantly higher than surrounding natural or rural areas. The objective of this research is to visualize and interpret land surface temperature trends in order to better understand the distribution of heat across the Los Angeles, California, region.

Methods

MODIS LST (MOD11A2) provides global surface temperature at 1km spatial resolution at a daily to 8-day temporal resolution (categorized by day vs night) using thermal bands 31 and 32. Landsat LST provides local land surface temperature at 100m spatial resolution per 16-day revisit temporal resolution using band 10 and requires emissivity correction based on NDVI. For visualizing day and night LST by season in 2023, MODIS LST was used with the original scaled integer value converted to Kelvin using scale factor 0.02 then subtracted 273.15 to convert from Kelvin to Celsius. For visualizing July 2023 LST of Los Angeles and nearby regions, Landsat LST and Sentinel-2 were used with emissivity correction based on NDVI value and temperature also converted to Celsius using the same method as previous analysis. Finally, Urban Heat Island (UHI) map is calculated by subtracting rural LST from urban LST values.

Results

The MODIS LST seasonal analysis results from Los Angeles, California in 2023 reveals several thermal patterns. Day LST reaches peak values of 42.5°C at the beginning of August and then again at the beginning of September while in the winter (mid-January) the lowest LST drops to 7.5°C. The night LST follows a similar trajectory but at a significantly lower temperature with the highest LST in the summer around 22.5°C and lowest LST being around 7°C. The diurnal temperature amplitude is mostly consistent with a high 15-20°C in differences during summer and winter months (summer differences being slightly higher than winter). In July 2023, across Los Angeles and nearby regions, temperatures remained high throughout with lower LST in only mountainous regions. From Sentinel-2 data, the mean temperature was around 40.0°C,

and in urban areas around 41.68°C . The UHI Intensity calculated was 18.99°C , which is considered a high value.

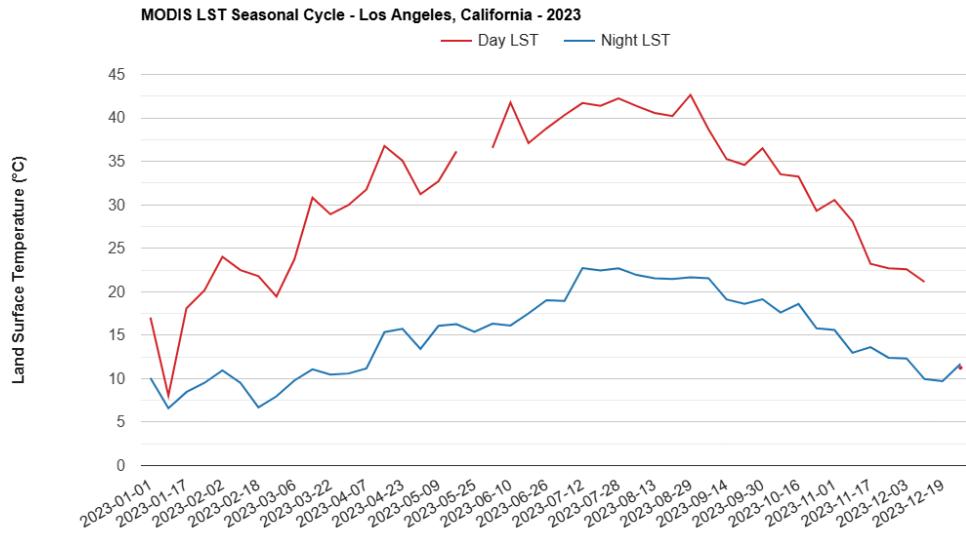


Fig. 1. Seasonal day and night LST patterns in Los Angeles, CA for 2023 derived from MOD11A2

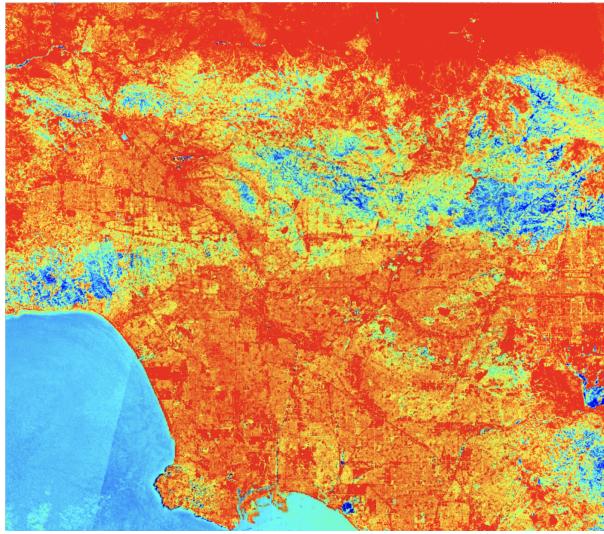


Fig. 2. LST thermal analysis of Los Angeles and nearby regions for July 2023 from Sentinel-2

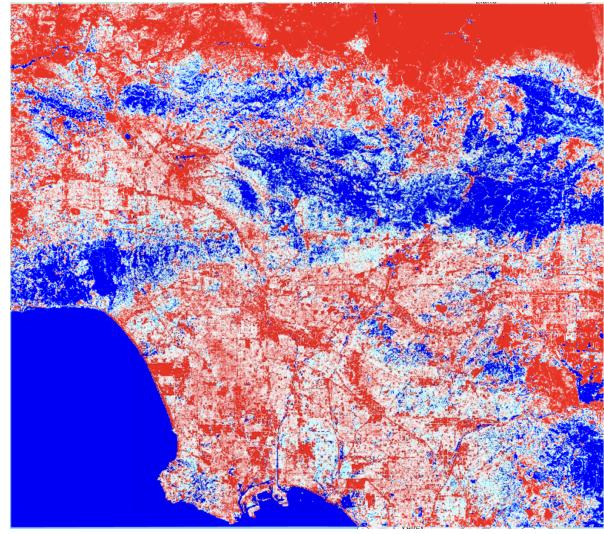


Fig. 3. UHI comparison map for July 2023 from Sentinel-2

Discussion and Conclusion

The LST thermal analysis and UHI comparison map reveal intensely high land surface temperatures and UHI values in central Los Angeles, California. Observing the satellite imagery shows that these areas also correspond to some of the most densely urbanized subregions. This strongly indicates that the lack of vegetation for evapotranspiration, combined with the heat-absorbing characteristics of built-up infrastructure, contributes to elevated land surface temperatures in Los Angeles.