Hochschule Karlsruhe (HSKA) – University of Applied Sciences
Master Geomatics (MSc) **Faculty IMM**

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Bachelor/Master/Diploma Thesis (Year: 2015)
A Novel Downscaling Methodology for Refinement of Remotely Sensed Land Surface Temperature Data with respect to Fine-Scale Climatic Phenomena

Referee
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Key Words
Downscaling, Land Surface Temperature, Remote Sensing, Dasymetric Mapping

Summary
The present availability of satellite-retrieved data is limited in both, temporal and spatial resolution. Whereas sen-sors such as Moderate Resolution Imaging Spectroradiometer (MODIS) or Advanced Very High Resolution Radiometer (AVHRR) provide an adequate temporal resolution of daily overpas-ses, the low spatial resolution of approximately 1km is less suitable for investigations at the urban scale. In contrast, sensors such as Landsat 8 provide an appropriate spatial resolution of 30m, how-ever the temporal coverage ensues within a 16 days period.
In order to bridge this gab, the present thesis pursuits the approach of developing a methodology for downscaling MODIS coarse resolution Land Surface Temperature (LST) to UHI reasonable finer spatial resolution using the relationship of various land-use / land-cover (LULC) types and LST. The current study attempts to adopt basic approaches of dasymetric modeling for a synthe-sis with traditional regression-based downscaling methodologies used within remote sensing. The developed downscaling methodology has been applied to the Stuttgart-Ludwigsburg area, Ger-many. This region features heterogeneously spread surface properties. The developed model was tested within three different target LST resolutions, 500m, 250m and 125m. Root mean square error (RMSE) of ≈1K on average for all resolutions could be achieved within the validation with reference LST retrieved from Landsat 8. Despite results for all resolution show appropriate RMSE score, the outcomes tend to be more accurate with increasing resolution. In order to investigate the transferability of the developed model, the model was applied to another study area (Harris County, Texas), which consists of different urban morphology. Results show that the model is also applicable and performable within homogenously distributed LULC types. Accord-ing to RMSE>0.7K achieved from tests on Harris County it can be concluded that the develo-ped model performs well for regions of homogenous surface properties. Further focus of this thesis was on the exploration of including additional miscellaneous variables in the downscaling pro-cess. Therefore different resolution models were applied by means of several surface properties and com-pared to models, which are applied by means of Normalized Differenced Vegetation Index (NDVI). Results show that both models perform reasonable. It can be demonstrated that NDVI can be re-placed by surface indices, however the accuracy for downscaling LST including NDVI show better accuracy.