

## ABSTRACT

Recent studies show that the anthropogenic forcing due to changes in Land Use and Land Cover (LULC) is contributing significantly to the recent climate change and its contribution varies in regional scale. Hence, it is important to investigate the impact of LULC changes on regional climate. Though a number of studies are conducted to investigate the impact of LULC on climate over other regions, such study over Indian region is not available. This thesis deals with the impact of LULC changes on the climate over Indian region through observational analysis and numerical simulations in multi-decadal scale.

The impact of LULC changes towards the temperature trends over India and its five homogeneous regions during 1981-2006 is investigated through 'Observation minus Reanalysis (OMR)' analysis. The results indicate that India got warmer at a rate of  $0.1^{\circ}\text{C}$  per decade and LULC changes contributed towards overall cooling at a rate of  $0.02^{\circ}\text{C}$  per decade during 1981-2006. The cooling was due to the conversions of shrubs/small vegetation to agricultural/fallow land and open forest to agricultural/fallow land/dense forest.

It is important that such impact of LULC changes is captured by the climate models as these models are used in understanding various aspects of climate and also for future projection. Hence, the impact of LULC changes on multi-decadal simulation of regional climate over Indian region is investigated. For this purpose, the regional climate model RegCM4 is customized through sensitivity studies on cumulus convection and land surface parameterization schemes. The LULC datasets over the Indian region are prepared for the years 1981, 1991 and 2001. The impact of LULC changes during 1981-2010 is estimated through numerical simulations with fixed LULC and changed LULC (updated every decade) using the customized version of the model. It indicates that the model simulated impact of LULC changes on temperature trends over India and its homogeneous regions matches with the one obtained from OMR analysis.

The performance of the modeling system is evaluated through statistical analysis. Overall the temperature over Indian region is reasonably well simulated by the model though the precipitation in the monsoon season is under-predicted.

**Keywords:** Regional Climate, Warming, Cooling, Regional Climate Modeling, Land Use and Land Cover Change, Bias, Standard Error, Correlation, OMR analysis.