Impact of desertification on Greenhouse Gases Concentration using Remote Sensing Technique

[Summary of the thesis]
Desertification and climate change remain inextricably linked because of feedbacks between desertification and precipitation. Climate change exacerbates desertification through the alteration of spatial and temporal patterns in temperature, rainfall, solar insolation and winds. Conversely, desertification aggravates climate change through the release of Carbon Dioxide (CO2) from cleared and dead vegetation and through the reduction of carbon sequestration potential of desertified land.

The main objective of this research is to examine the relationships between desertification and greenhouse gas (GHG) concentrations through studies of desertification process, GHG concentrations change and the relationships between them. To achieve this aim, three main tasks have been undertaken: (1) identifying desertification progress in Asia. I also selected Kerqin Sandy Land as a study case. In this part, I used Landsat MSS, TM and ETM+ as the main data source to monitor the desertification in Kerqin Sandy Land from 1977 to 2009; then I used GIMMS and MODIS NDVI data to monitor the desertification process in Asia by employed linear regression model and Mann-Kendall (MK) trend test. (2) analyzing the relationships between desertification and GHG concentrations. In this part, I first analyzed the relationships between land cover change and GHG concentrations; then I select Mongolia and northern China as study area to explore the spatial distribution of GHG concentrations in arid and semi-arid regions and to identify how desertification affects GHG concentrations; at last, I analyzed if sand dust storms (SDS, as a result of desertification) affect GHG concentrations or not; and (3) modeling CO2 concentrations based on MODIS products. In this part, I used temperature data (Land surface temperature, LST), vegetation index (Normalized Difference Vegetation Index, NDVI and Enhanced Vegetation index, EVI) and productivities data (Gross Primary Productivity, GPP and Net Primary Productivity, NPP) to build a CO2 concentration model for each continent (Africa, Australia, Eurasia, South America and North America).

My thesis proposed a new method for desertification monitoring and also a model to derive CO2 concentration from MODIS data. It provides knowledge about the relationships between land cover type and GHG concentrations, especially the relationships between desertification and GHG concentrations. There are several areas in which further analysis can be pursued by extending or applying similar concepts and methods used in this thesis.

[Related Publication]