A PRELIMINARY INVSTIGATION OF CO_2 AND CH_4 CONCENTRATION VARIATIONS WITH THE LANDUSE IN NORTHERN CHINA BY GOSAT

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1. INTRODUCTION

It has been found that emissions of carbon dioxide (CO_2) due to changes in land use mainly come from the cutting down of forests and instead using the land for agriculture or built-up areas [1]. In China, the land use has been rapidly transformed with the development of economy. So far, we still do not clearly understand the spatial distribution of green house gases concentrations, such as CO_2 and methane (CH_4), and their variations with the landuse changes because there are no large-scale observing data available now. The Greenhouse gases Observing SATellite (GOSAT) is designed to monitor the global distribution of CO_2 and CH_4 from orbit [2], which has been successfully launched in January 2009 [3]. GOSAT is a joint project of Japan Aerospace Exploration Agency (JAXA), the Ministry of Environment (MOE) and the National Institute for Environmental Studies (NIES) in Japan [3]. This paper took an initial investigation for the spatial distribution of CO_2 and CH_4 combined with the characteristics of landuse distribution in Northern China, which try to reveal the spatial variation characteristics of green house gases concentrations and their relationships with landuse changes by GOSAT FTS SWIR L2 products of CO_2 and CH_4 concentrations data.

2. DATA AND STUDYING AREAS

We collected GOSAT L2 products data (Ver.002/Ver.003) including the parameters of CO_2 column, CO_2 dry air mixing ratios (XCO2), CH_4 column, and CH_4 dry air mixing ratios (XCH4) during July-October in 2009 and mainly covers the northern part of China as the research announcements users in the GOSAT project [3]. The landuse data which indicate the percentages of landuse type within 1-km grid were used, which were derived from the landuse map of China in 1:100000 map scale. The landuse map of China was produced in 2005 by using Landsat-TM images in the project of National Landuse Investigation which was implemented since 1995 [4], and the map was updated every 5 years.

Because the GOSAT observation points mainly covered the northern part of China, the study area of this paper selected the northern part of China.

3. METHODOLOGY

In our investigations, we firstly took a statistical analysis for XCO2 and XCH4 data observed by GOSAT within China. And the spatial variations of CO_2 were analyzed with various landuse types such as the farmland, forest (including tree and shrubs), grassland, water cover and built-up areas.

4. RESULTS AND CONCLUSIONS

The statistical results showed that the mean, standard deviation, and range of XCO2 for the entire GOSAT observing points in China is 371ppmv, 5.5 and 335-391ppm, respectively. The mean, standard deviation, and range of XCH4 is 1.72ppmv, 0.027, and 1.60-1.85ppmv. Fig.1 showed the spatial variation of XCO2 and XCH4 for the provinces in the northern part of China where there are more available GOSAT observing point data.

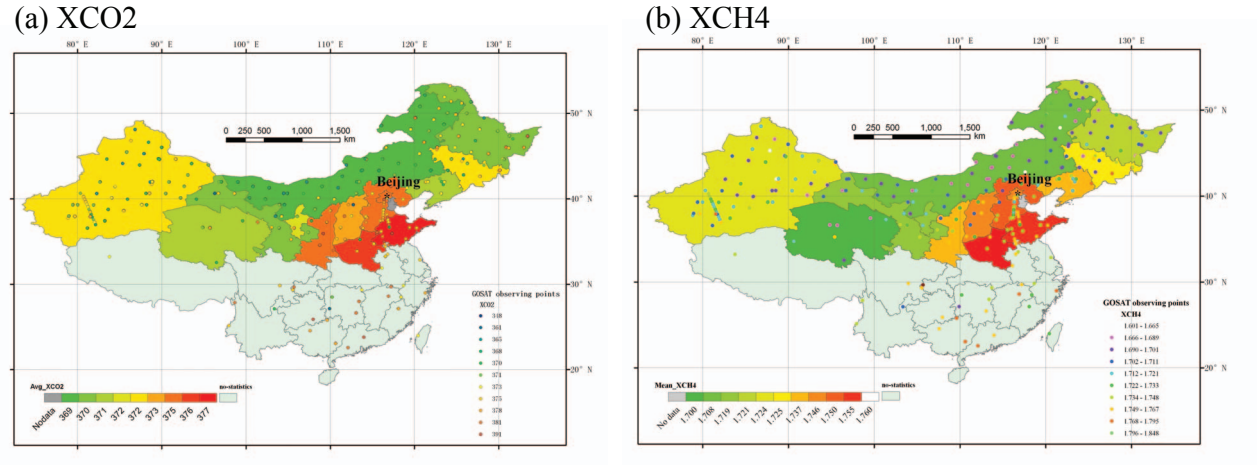

Fig.1 Spatial Variation of XCO2 (a) and XCH4 (b) based on the statistics of the provinces in Northern China.

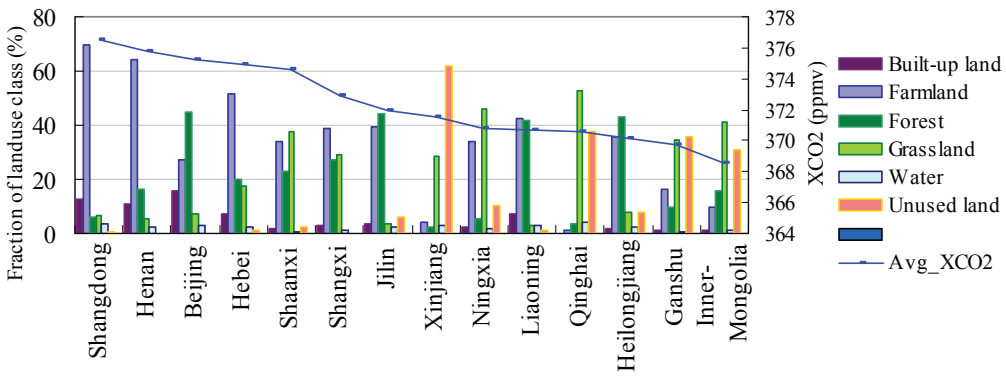

Fig.2 Fractions of various landuse classes in the provinces of northern China and their mean XCO2 (Avg_XCO2).

Comparing the fractions of landuse classes in the province with the XCO2 as shown in Fig.2, it could be found that XCO2 showed higher value over the farmlands except Beijing. There is the large coverage of shrubs in Beijing so that the fraction of forest which includes trees and shrubs showed highest in Beijing (Fig.2). Additionally Xinjian province showed higher CH_4 column amount (Fig.1(b)) where there are not humanistic emission. It has been reported that the atmospheric methane in Yakela field of Xinjian was 45.10×10^{-3} heavier by $112\times10^{-3}\sim210\times10^{-3}$ than the global average observed from a ground on-line method for measurement of the $^{13}C/\ ^{12}C$ ratio of methane by a gas chromatography/high-temperature conversion isotope ratio mass spectrometry (GC/C/MS) technique[5]. Thus this GOSAT CH_4 results may be caused by the seepage and diffusing of methane from Xinjian's condensed gas reservoir.

The spatial variation of XCO2 and XCH4 depends on many factors such as the emission of CO_2 and CH_4 from humanistic activities, the land vegetation and soil, and atmospheric transmissions and so on. Our research presents a preliminary investigation for the variation of XCO2 and XCH4 over the administrative district with the different fractions of landuse classes. Now we are taking the further analysis additionally combining with some data related with the human emissions of CO_2 and CH_4 in the districts, and will give more results and discussion in the full paper.

5. REFERENCES

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