The effect of different land use types on ^{137}Cs contaminated soil of northern Japan

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Radioactive cesium, especially ^{137}Cs is deemed to the most important contributor to environmental contamination because of its long half- life period released by the explosion of Fukushima Dai-ichi Nuclear Power Plant (FDNPP) in 2011.

The Radiocaesium Interception Potential(RIP) has been researched in past works. It has been well established that cesium is tightly bound by the clay minerals of the soil, The RIP is an intrinsic soil parameter which can be used to categorize soils or minerals in terms of their capacity to selectively adsorb radiocesium, and for analyzing the content of clay minerals, the elements was determined by Particle-induced X-ray emission (PIXE) because of the quantity of samples and the high sensibility of PIXE.

The soil samples were from different provinces around the FDNPP and were taken 0.5cm of surface. The relevance of RIP and elements under different land use types will be showed in this report.

1 Introduction

In the earthquake of Mar. 11st 2011, the explosion of Fukushima Dai-ichi NPP made the rounding environment contaminated, ^{137}Cs is deemed to the most important contributor to environmental contamination because of its long half- life period. It has been well established that cesium is so tightly bound by the clay minerals of the soil, the radioceasium ion can exchange with the clay minerals[1]. In previous work the immobilization of Cs and the Radiocaesium Interception Potential(RIP) have been researched. The RIP is an intrinsic soil parameter which can be used to categorize soils or minerals in terms of their capacity to selectively adsorb radiocaesium[2], Cs keeps the selection of Siloxane Ditrigonal Cavity on the clay particle and Frayed Edge site[3]. The content of elements(Si, Al) were determined by Particle-induced X-ray emission (PIXE),

The objective of this work is to show the relevance of RIP and Si & Al in different land use type soils, and the relationship between RIP and content of C&N.

2 Method and Materials

2.1 Sampling sites and material

The samples were from the fukushima radiation monitoring of water soil and entrainment team, and were taken from top 0~0.5cm.

2.2 Methods

2.2.1 For RIP:

The solution of the container with the dialysis bag was changed 10 times during 7 days. During equilibration, the containers were agitated for 2 h more than each 12 h. Each dialysis bag was then transferred in a new container filled with 94 mL of the KCl-$CaCl_2$ equilibration solution labeled with carrier-free ^{137}CsCl. These bags were again agitated for 2 h each 12 h. After 5 days, aliquots of 10 ml were taken and ^{137}Cs activity of the equilibrium solution was measured by gamma-counting [4,5].

2.2.2 For PIXE:

Fill about 1g soil sample to the bottles which weighted and fill in about 5ml water and standing. Take the supernatant and weight, and take about 0.95 suspended solid and 0.05ml In standard to make a 50ppm mixture. Take 7ul mixture to the holder and dry and elemental analysis.

3 Results

In different region, RIP values of samples from Fukushima are 241.705~2142.136mmol/ kg; RIP of samples from Miyagi are 225.418~1104.083 mmol/ kg; RIP of samples from Ibaraki are 213.464~778.265 mmol/ kg; RIP of samples from Tochigi are 172.489~694.824 mmol/ kg, and then the results were showed in different land type uses (Figure 3.2), and there are no obvious relationship between Si and RIP or Al and RIP in residence sites or farmland (Figure 3.3.1, Figure 3.3.2). The content of C are 0.20%~15.80%, content of N are 0.02%~1.2%. From histogram of RIP (Figure 3.4), 3 high groups were chosen for comparing the relationship between RIP and C&N, they are all showed positive trend (Figure 3.5.1, Figure 3.5.2).

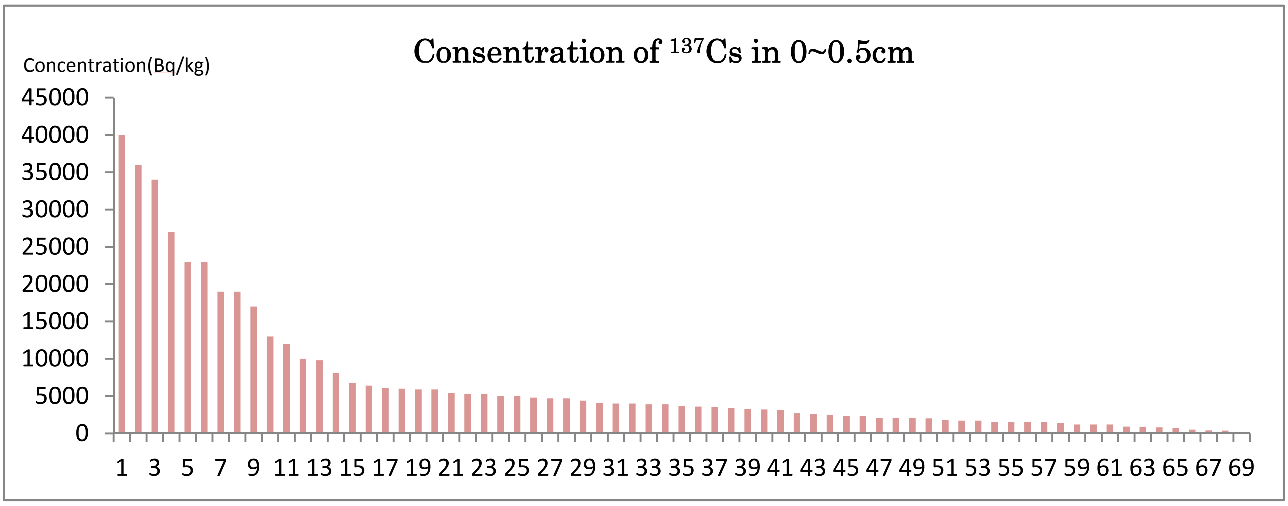


Figure 3.1 consentration of ^{137}Cs in 0~0.5cm

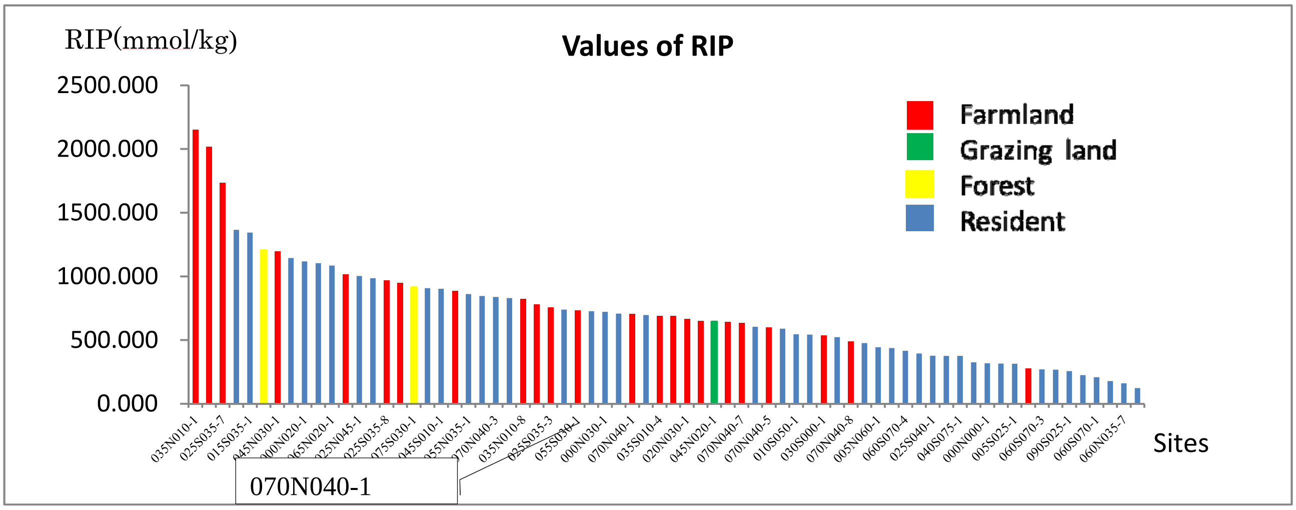


Figure 3.2 RIP values of soil samples in different sites

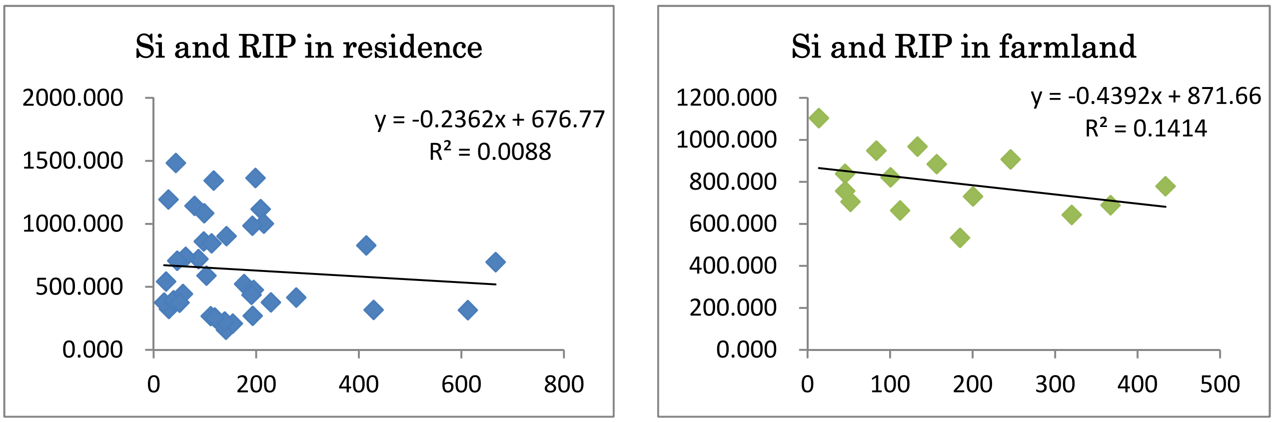


Figure 3.3.1 Relationship between Si and RIP in residence and farmland

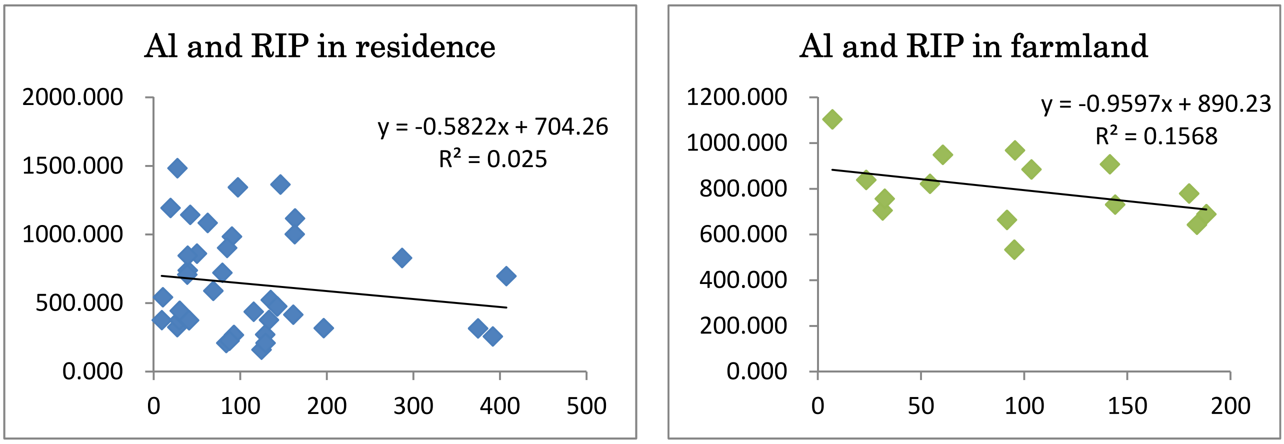


Figure 3.3.2 Relationship between Al and RIP in residence and farmland

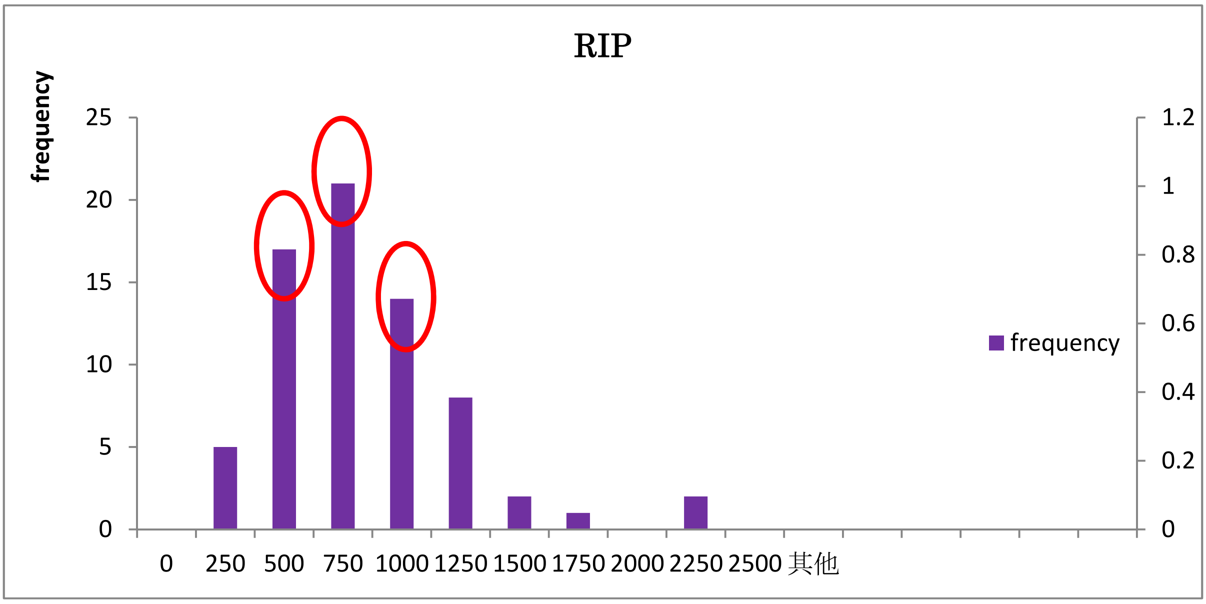
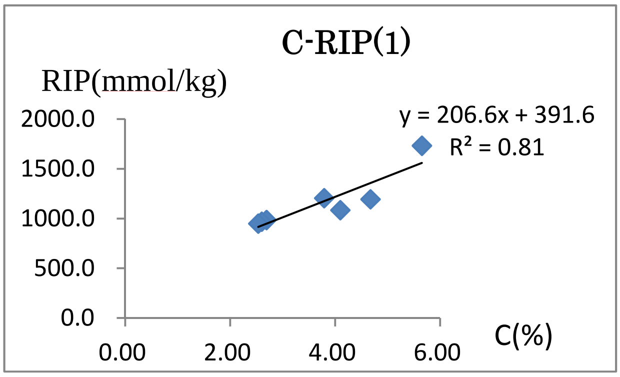
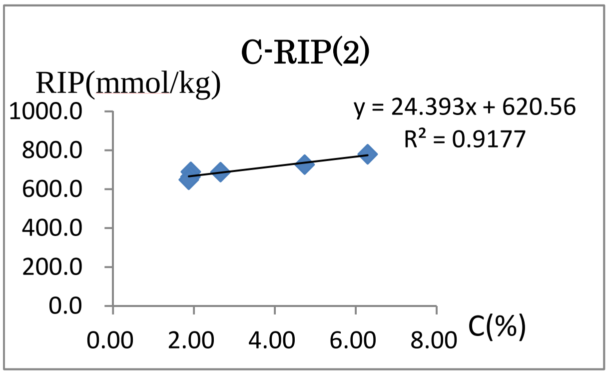


Figure 3.4 Histogram of values of RIP





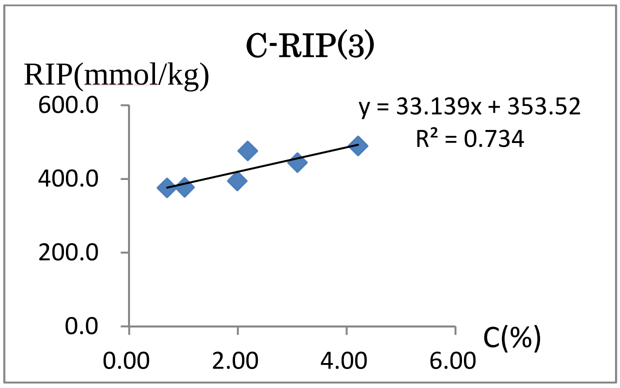
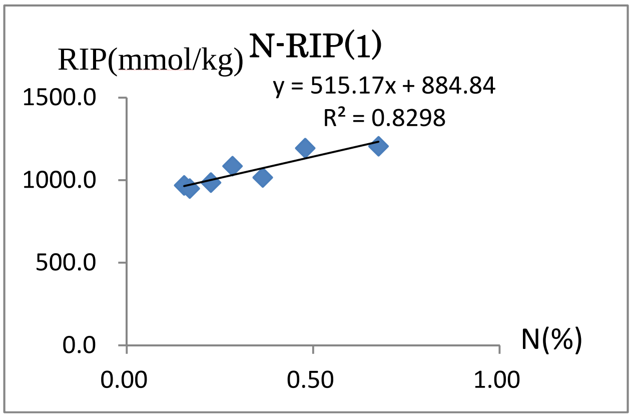
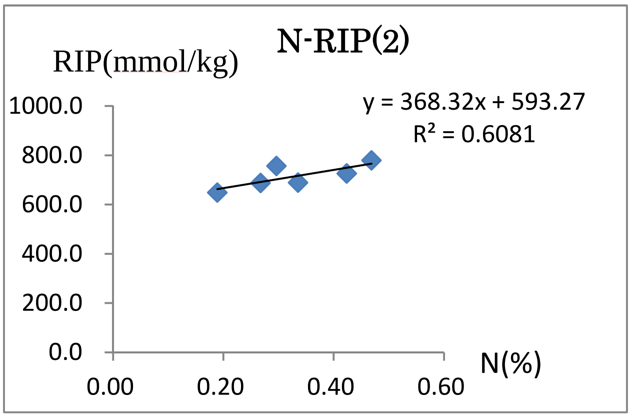


Figure 3.5.1 Relationship between C and RIP





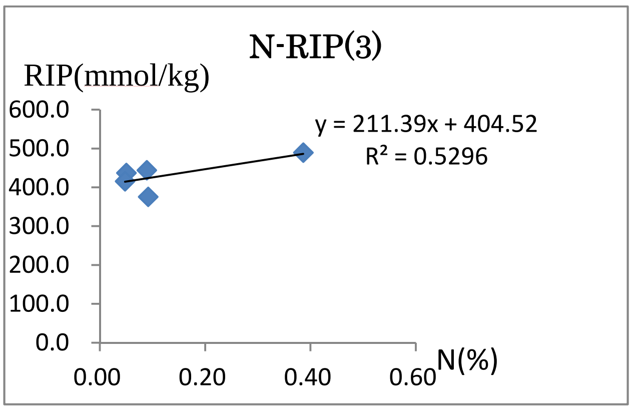


Figure 3.5.2 Relationship between N and RIP

4 conclusion

In land use types, the RIP of farmland, forest, grazing land are higher than RIP of resident region, there is no obvious relationship between Si and RIP，Al and RIP, and there are positive relationships between C and RIP，N and RIP in 3 chosen groups, the clarification of influnces of different clay minerals will be considered in future work.

Reference

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