

Influence of snow on iron release from soil

Mayumi Seto[1], Tasuku Akagi[2]

[1] Faculty of Agri., TUAT, [2] Fac. Agricul., Tokyo Univ. Agricul. & Technol.

<http://www.tuat.ac.jp/~akagilab/index.html>

1. Introduction

Iron is essential to all organisms. Some areas of the oceans showed extremely low concentration of iron and considered to be iron-limited areas where iron limits the biological productivity (Martin, 1992).

In this study, we found that Fe concentrations in waters increased during snow and thaw seasons with the decrease in Eh and pH, then postulated a hypothesis of snow influence on the supply of iron in the oceans.

2. Samples and Measurement

Ground and surface waters were sampled at Nikko and around Ozenuma during December 2001 and January 2003. Measurement of Eh, pH was carried out in situ. The waters were analyzed for Fe, other cations, anions, and TOC in laboratory.

3. Results

pH of the ground water was quite stable during the period. The beginning of thaw season, pH of those surface waters were lower and increased later. At both sites, Eh was lower in the thaw season, increased in summer, and decreased from fall to winter (snow season) again. The Fe concentrations increased in the snow and thaw seasons, being accompanied with decreases of Eh and pH.

4. Discussion

As DO is consumed in water, Eh decreases rapidly. Measured variations of Eh can be resulted from the change of DO. When snow cover or thaw occurs, the diffusion of oxygen in soil is disturbed and oxygen is consumed by respiration of microorganisms and plants.

To explain the above consequence, we have measured the partial pressure of oxygen in soil and the respiration rate of soil and modeled the relationship of oxygen pressure to snow depth assuming a steady-state.

The model showed that the partial pressure oxygen in soil would decrease to 6% with 2 m snow depth. However, it could decrease as low as 0% when the 10 times increase of respiration rate of soil, which was reported to occur during thaw season.

Fe concentrations in water were increased due to the declines of Eh and pH. Therefore, it is considered that the chemical form as well as amount of Fe supplied to the ocean can be changed by snow. It is believed that the principal source of iron is continental aeolian dust (Kumar, 1995). The present study suggests that snow and following melt can be one of the candidates to account for the source. If this is the case, the circulation of iron, thus the whole geo-system, has been affected by the recent greenhouse effect.