

## Clarification of recharge source and emergence/disappearance mechanism of an oasis in Tottori Sand Dune

SAITO, Tadaomi<sup>1\*</sup>, KASUYA Satoshi<sup>1</sup>, KAWAI Takayuki<sup>2</sup>, INOSAKO Koji<sup>1</sup>, YASUDA Hiroshi<sup>3</sup>, SHIOZAKI Ichiro<sup>4</sup>

<sup>1</sup>Faculty of Agriculture, Tottori University, <sup>2</sup>Regional Industrial Academic Cooperation, Tottori University, <sup>3</sup>Arid Land Research Center, Tottori University, <sup>4</sup>Graduate School of Engineering, Tottori University

### 1. Introduction

The Tottori sand dunes, located in the Sanin Kaigan national park, are the most famous sightseeing sand dunes in Japan. In this sand dune, there is an oasis which repeats emergence and disappearance. There is a perpetual spring near the oasis. It has been considered that the spring is the recharge source of the oasis. The emergence/disappearance mechanism of the oasis and the recharge source of the spring are longtime academic concerns. In addition, because the Tottori sand dunes were registered in the global geoparks network in 2010, clarification of the emergence/disappearance mechanism of the oasis has been strongly expected. Although some local researchers have advocated that the water in the spring comes from the Tanegaike pond which located on the south side of the sand dunes, this hypothesis has not been confirmed due to limitation of investigations in the national park. The objectives of this study were to clarify (i) emergence/disappearance mechanism of the oasis, (ii) the recharge source of the spring and (iii) elapsed time from rainfall events to discharges from the spring, through hydrological observation and water stable isotope ratio analysis.

### 2. Material and Methods

#### 2.1 Water level observation in the oasis

Pressure type water level loggers were buried into the ground at the oasis emergence area. The inside and around area of the oasis were surveyed and three-dimensional shape of the oasis was determined. The shape was used to estimate contribution rate of evaporation to reduction of the oasis volume by combining water level data and pan evaporation data.

#### 2.2 Water stable isotope ratio analysis

Precipitation water for all daily precipitation events was collected from Nov. 2010 - Dec. 2011. Also the oasis and Tanegaike pond water was collected every one-three days. Oxygen ( $\delta^{18}\text{O}$ ) and hydrogen ( $\delta\text{D}$ ) stable isotope ratio of the water samples were analyzed by an isotope ratio mass spectrometry. The d-excess value was calculated using of the  $\delta^{18}\text{O}$  and  $\delta\text{D}$  values for each sample.

### 3. Results and Discussion

The emergences of the oasis were strongly affected by the precipitation within a few hours. The contribution rate of evaporation to reduction of the oasis volume was about 10%, meaning that the most of the oasis water was lost by infiltration to the ground. The values of  $\delta^{18}\text{O}$  of the spring and Tanegaike pond did not cross through the whole year, indicating low probability of water flow from the Tanegaike pond to the spring. The annual variation of the d-excess values in the precipitation and spring water suggested that the source of the spring water was reserved and averaged precipitation for long period. However, after very heavy rainfall events, the rainfall water discharged from the spring within about 10 days.

Keywords: oasis, hydrological observation, water stable isotope ratio analysis, d-excess