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Transboundary air polluton effect on the precipitation in Matsue, Japan

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Background and objective
Anthropogenic NOx emission has been increasing world wide. Although total phosphorus concentration is stable, total nitrogen of Hii River in Matsue Prefecture has been increasing, suggesting the possible contribution of atmospheric NO3- deposit from continental origin. This suggests that the spread of atmospheric NO3- deposit may influence not only in the regional scale but in the continental scales as well.
To clarify the effect and mechanism of river water eutrophication by the increase of atmospheric nitrogen compound from continental origin we measured d15N-NO3- and d18O-NO3- of the rain samples at Matsue using denitrifier method. We also measured inorganic ion and nutrient, and used back trajectory analysis to analyze the impact of transport of the air mass to Matsue.

Methods and Study Site
Rain samples were collected at Matsue City using the automatic rainwater collector set on the rooftop at 24m above sea level. The sampling period was about a year from August 2007 to August 2008. d15N-NO3- and d18O-NO3- were analyzed using the denitrifier method (Sigman et al, 2001; Casciotti et al. , 2002).We analyzed total nitrogen, NO3-N, NH4-N and inorganic ion concentrations. Rainfall patterns were classified by surface synoptic weather chart and arriving air mass type by back trajectory (BTJ) analysis.

Results and Discussion
Concentration of NO3-N, NH4-N, SO42- were higher in the cool season (October?March) than those in the warm season (April?September). Air mass transport patterns from the continent were frequent in the cool season whereas air mass from the Pacific Ocean was observed often in the warm season. By principal component analysis, NOx and SOx transportation from continental origin contributes concentration of NO3-N, NH4-N, SO42- in the cool season.
d15N-NO3- ranged from -5.4 to 5.9 per mill. d15N-NO3- values showed characteristic features by seasons. Average was -1.7 per mill during warm season and 0.6 per mill during cool season. Because the anthropogenic NOx has higher d15N -NO3- than a natural origin, higher value of d15 N -NO3- in the cool season should reflect the anthropogenic origin.
d18O-NO3- ranged from 58.1 to 91.7 per mill. The warm season average of 64.5 per mill is significantly lower than the average of cool season (79.5 per mill). We assumed that the higher d1 8O-NO3- during cool season reflected the NOx and O3 interactions in the atmosphere reacted actively in the cool season, because O3 has high d18O. Air mass from continental origin was transported through high elevation, which would also elevate thed18O-NO3- of the cool season value.

Keywords: Nitrate, Oygen and nitrogen stable isotope of nitrate, Rain water quality