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Biogeochemical studies of today and tomorrow: Roles of the SI method to integrate field observation and modeling

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The ideas such as Earth System Science Partnership (ESSP) and Global Earth Observation System of Systems (GEOSS) are now well established under the global environmental issues. The rapid developments in the field of satellite remote sensing, computer sciences and automatic field observation systems make it possible to promote these kinds of international programs. At present tentative goal of the global environmental studies is to provide clear cut scientific scenarios to solve various kinds of environmental problems. Along this line, integrative studies of the observation, modeling and simulation are highly required.

In this context, we can consider that SI studies provide possible roles to contribute above mentioned integration. Biogenic substances in nature contain significant amounts of less abundant stable isotopes (SI) of light elements such as carbon and nitrogen. Although the SIs of a particular element have rather similar chemical behaviors, their specific thermodynamic properties and rate constant in chemical and biological reactions differ. The SIs of biogenic substances vary depending on the isotopic compositions of the reactants, the pathways and kinetic modes of the reaction dynamics, and the physical, chemical, and biological conditions. Thus, every biogenic material has its own unique isotopic composition, known as the "dynamic stable isotope finger print", which is determined by its function and position in the material flow of an ecosystem or metabolic map.

Because of these characteristics SI methods can be useful for studies of material cycling occurring in natural ecosystems at levels from molecule to ecosystem..

The following topics will be reported and discussed.

i) Roles of the SI method in collaborative studies to create a new paradigm .

ii) Structure of biogeochemical systems and food chains.

Trophic fractionation of C/N isotopes at a level of metabolic maps with emphasis on amino acid metabolisms.

iii) Possible validation of ecosystem models

Keywords: Stable Isotope Ratio, Nitrogen, Carbon, Food Chain