



SIBAE Introductory Course

Stable isotopes in ecosystem research

23-29 Sep 2012
Nancy, France

Stable Isotopes in Biosphere-Atmosphere-Earth System Research

The main goal of this SIBAE Training School is to offer a broad introduction to the use of stable isotopes in ecosystem research.

Lectures will give an overview of the major stable isotopes (carbon, nitrogen, water and metals) used in ecosystem studies, of fractionation processes that affect isotope distribution in ecosystem pools, of their use as tracers using either natural abundance distribution or labelling experiments, and of modelling at ecosystem and global scales.

Questions related to instrumentation, technology and measurement quality will also be addressed.

Practical works and computing exercises will be conducted throughout the week in small groups.

Lectures:

1. Basic knowledge on stable isotope
2. Instrumentation, technology & measurement quality
3. Carbon isotope fractionation
4. Soil carbon turnover & cycling
5. Fate of nitrogen in ecosystems
6. Stable isotopes in plant & soil waters
7. Labelling with stable isotopes
8. Stable metal isotopes
9. Modelling at ecosystem & global scale

Computing exercises:

- Mixing ratio & source partitioning
- Biological nitrogen fixation
- Water-use efficiency & tree rings
- Craig correction of IRMS data

Practical works:

- Fractionation by soil microorganisms
- Photosynthetic & post-photosynthetic fractionation
- Leaf water oxygen isotope
- Uptake of inorganic nitrogen from soil
- Tracing Ca with Sr isotopes in plant, soil & water

- ✓ Venue: Nancy INRA research centre, Champenoux
- ✓ Application deadline: 22th April 2012
- ✓ Registration confirmation: May 2012
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Practical work 1: Determination of the fractionation factor of glucose mineralisation by soil microorganisms (TDL and EA-IRMS monitoring)

This practical work consists in the determination of the fractionation factor of glucose mineralisation by soil microorganisms. We will continuously record the isotopic composition of the CO₂ emitted from the soil incubated with glucose in controlled conditions and test the effects of nitrogen availability on microbial activity.

Practical work 2: Photosynthetic and post-photosynthetic fractionation processes

This practical work consists of measurements of diurnal variation in carbon isotope signatures of leafdark-respired CO₂ and water soluble and non-soluble organic matter fractions of several plant functional types.

Practical work 3: Leaf water oxygen isotope composition and its relation to stomatal conductance

This practical work consists in sampling different plant organs (stem, leaves) as well as soil water and atmospheric humidity. Water will be extracted from the plant samples and all water samples measured for their oxygen isotope composition. Concurrent measurements of stomatal conductance will allow the exploration of the Farquhar model of leaf water enrichment.

Practical work 4: Uptake of inorganic nitrogen from soil by tree seedlings

This practical work consists in sampling different plant organs (root, stem, leaves) at several times after addition of ¹⁵N labelled nitrate or ammonium in soil to compare the uptake rate of both nitrogen forms by two contrasted tree species.

Practical work 5: Tracing Sr, as an analogue of Ca, in plant and soil

The objectives of the practical work are (1) to illustrate an isotopic approach to trace Sr and Ca transfers between soils, plants and-water and (2) apply this method to study the effect of a lime treatment on a forested catchment. Samples of soils, solution and vegetation from an amended and a non amended catchment will be prepared and Sr isotopes will be analyzed. Results will permit to discuss about acidic forested ecosystems functioning, nutrient cycling, acidification processes and amendment used to help soils and water quality restoration