Complex Terrain and Ecological Heterogeneity (TERRECO): Evaluating Ecosystem Services in Mountainous Landscapes

Comparison of N_2O, NO_x and CH_4 fluxes as affected by land use systems and climate in the Eger Basin, Fichtelgebirge and in small catchments in Korea

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Introduction

Today it is generally accepted that at least 70% of the global N_2O emissions and 30% of the global CH_4 emissions originate from soils. Unfortunately, our mechanistic understanding about the factors driving the fluxes of these important greenhouse gases is still weak.

The aim of this research is to bring light on how different land use systems in a temporal and seasonal aspect influence N_2O, CH_4 and NO_x fluxes from soils. In order to do this, measurements *via* the "closed chamber"-method will be taken for fluxes of 1. N_2O (with a photoacoustic trace gas analyzer), 2. for CH_4 (*via* GC), and 3. for NO_2- and NO (with chemoluminescence analysis) in different important vegetation types in the Eger Basin (Germany) and in the Haean Basin (South-Korea).

These data will then be related to temperature, soil moisture, precipitation and agricultural management data.

In addition to the trace gas flux measurements, soil gas samples from six different soil depths (10-60 cm) will be taken using single depth diffusion wells. In these soil gas samples the N_2O and CH_4 concentrations will be determined and the isotope signature will be analyzed *via* PreCon-GC-IRMS in order to explain the processes behind the measured N_2O and CH_4 fluxes.

Finally, we aim to draw a balance of trace gas fluxes between soil and atmosphere for the Eger Basin and Haean Basin and to contribute to a better understanding of the factors which are determining the trace gas emission and consumption in soils.

Different land use systems

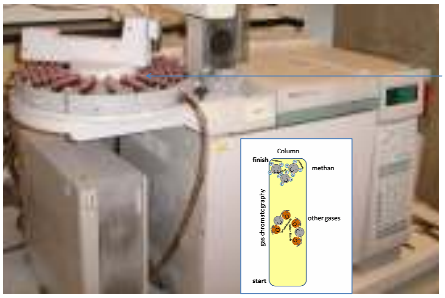
Forest system

Riparian Zone

Rice field

Potato field

Methods



•**Determination of methane concentrations** in the vials

Gas chromatography

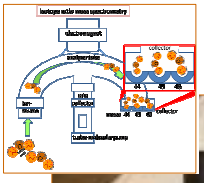
→Calculation of methane fluxes between soil and atmosphere

•Sampling of CH_4 every two minutes and collection of the CH_4 -samples in vials.

•**Identification of N_2O and CH_4 production and consumption areas in the soils**

PreCon-GC-C-IRMS-coupling:

→ Analysis of the soil gas sample's N_2O concentrations and of the isotope signature of N_2O's N and O. (Analysis of CH_4 concentration and CH_4's C isotope signature.)

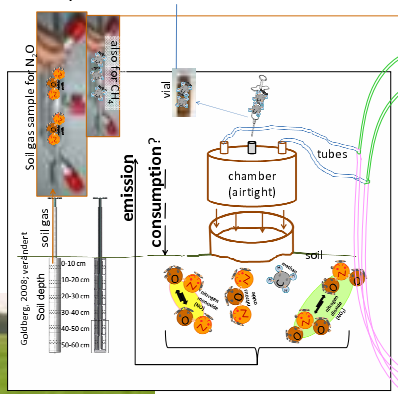


•**„Closed-chamber"-measurements** in different land use systems.

„Closed-Chamber" in conjunction with:

1) Gas chromatography
2) Photoacoustic trace gas analyzer
3) Chemoluminescence analysis

• soil gas sampling from six different soil depths (10 to 60 cm). Collection of soil gas in small glass bottles

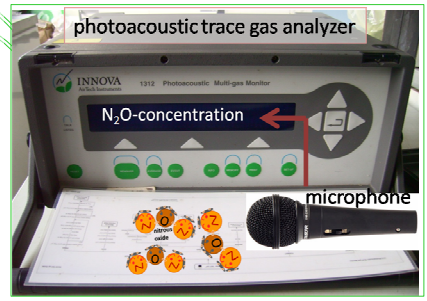


•**Measurements of N_2O concentration** in the „chamber" every two minutes

Photoacoustic trace gas analyzer:

→Analysis of N_2O`s acoustic signal in response to infrared radiation

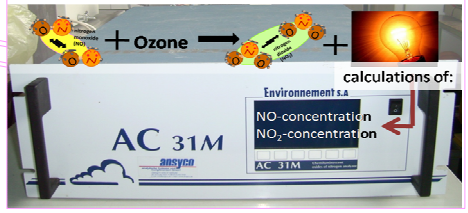
→ Calculation of N_2O fluxes



•**Measurements of NO_2 and NO concentrations** in the chamber

Environment NO - NO_2 - NO_X-Analysator

→ Analysis of the luminiscence intensity of NO_2.



Research questions

•How are trace gas fluxes in representative ecosystem types in the Eger Basin (Fichtelgebirge) and Haean Basin (South Korea) influenced by seasonal changes in temperature, by precipitation events and by agricultural practices?

•Where are sources and sinks for N_2O and CH_4 localised in the soil profile and which biogenic processes are responsible for the production and consumption of the respective trace gases in the various vegetation types?