“International Conference on current knowledge of Climate Change Impacts on Agriculture and Forestry in Europe“, 3-6 May 2011, Topoľčianky, Slovakia

Assessment of greenhouse gas fluxes in north-western agricultural region of Russia: measurements and modeling

Eugene BALASHOV, Natalya BUCHKINA, Elena RIZHIYA

Agrophysical Research Institute RAAS, 14 Grazhdansky Prospekt, St. Petersburg, 195220 Russia

E-mail: Eugene_Balashov@yahoo.co.uk

INTRODUCTION

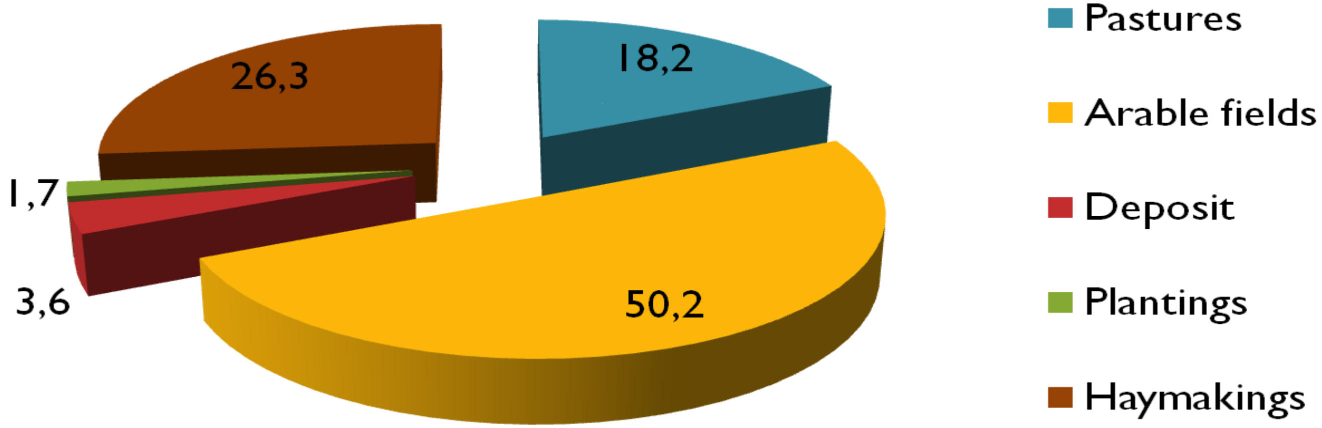
N_2O

Russian agriculture accounts 7,3% of the total greenhouse gas fluxes from all anthropogenic sources.

N_2O emissions are about 69% of the total emissions of greenhouse gases from the Russian agriculture (4th National Communication, Russia, 2006).

INTRODUCTION

Structure of agricultural lands in NW Russia



Federal service of state registration, cadastre and cartography, NW REGION OF RUSSIAN FEDERATION, 2008

OBJECTIVES

(1) to quantify the differences in N_2O concentrations in a profile of a loamy sand Spodosol differing in fertility

(2) to predict the N_2O and CO_2 fluxes from the loamy sand Spodosol differing in fertility

CROP ROTATIONS ON LOAMY SAND SPODOSOL AT THE MENKOVO EXPERIMENTAL STATION (59º34'N, 30º08'E)

1	2
Potato	*Winter rye*
Cabbage	*Spring barley*
Carrot	*Red clover*
Beetroot	*Oat/legume mixture*

SCHEME OF FIELD EXPERIMENT: each plot – 25 x 60 m

SOIL FERTILITY AND NITROGEN RATES (kg N ha^{-1})

LOW			MEDIUM			HIGH		
N 0	N (30) P (0) K (30)	N (70)	N 0	N (70)	N (90)	N (40) K (0) P (0)	N (90)	N (110)

SOIL FERTILITY BEFORE APPLICATION OF FERTILIZERS

	LOW	HIGH
SOC, g C kg^{-1} soil	23,0	25,0
MBC, mg C kg^{-1} soil	325,7	553,5
pH (H_2O)	5,5	6,5
NO_3^-, mg N-NO_3^- kg^{-1} soil	8,4	7,9
NH_4^+, mg N-NH_4^+ kg^{-1} soil	9,3	7,8
FIELD CAPACITY, %	21,2	26,8

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METHODS

Silicone tube method for collection of air samples for measurements of N_2O and CO_2 concentrations in soil profile (10-15, 25-30 and 45-50 cm)

METHODS

Closed chamber method for collection of air samples for measurements of direct N_2O and CO_2 emission from soils

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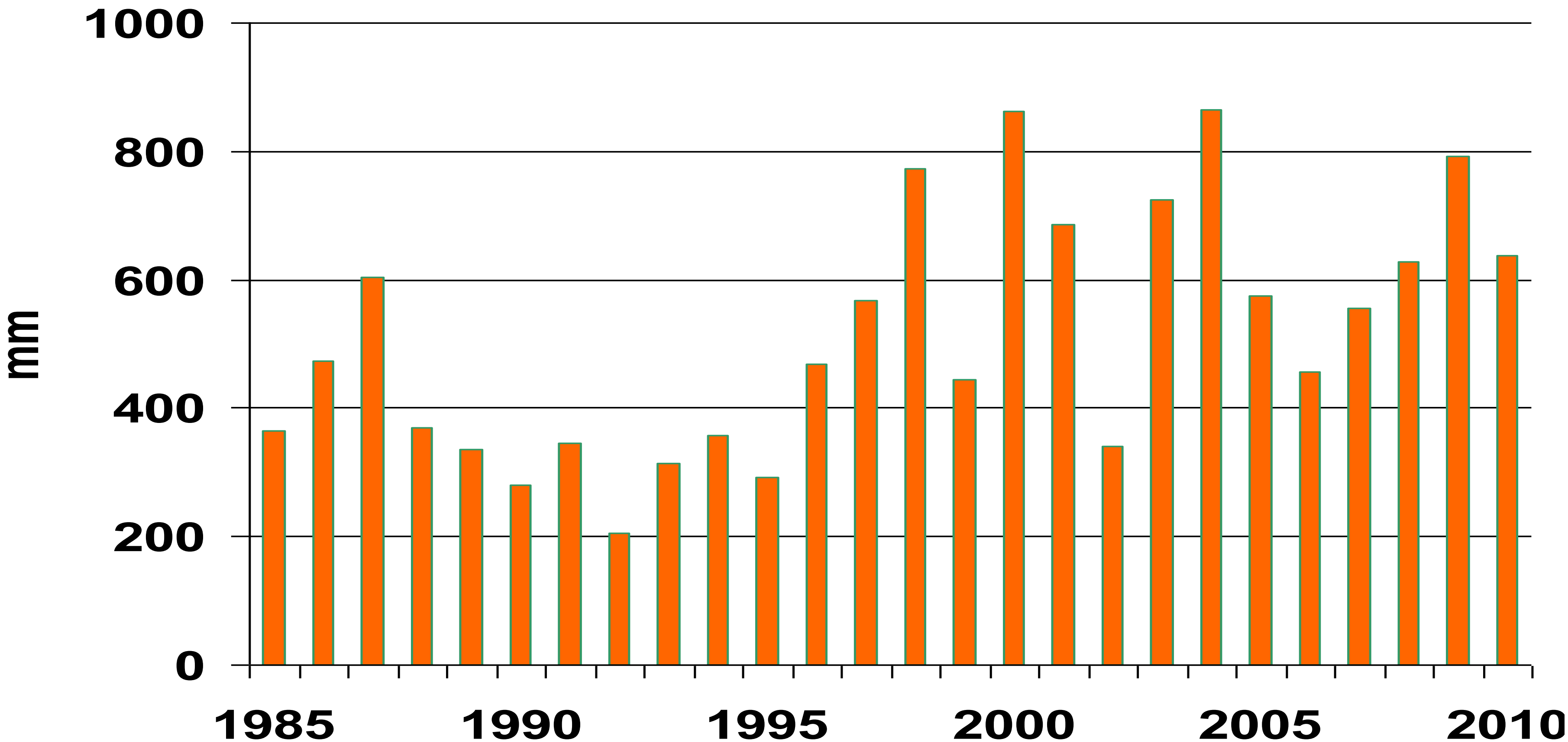
PREDICTION OF N_2O AND CO_2 FLUXES FROM SOILS BY Process-based Denitrification-Decomposition (DNDC) model (Li et al., 1992): www.dndc.sr.unh.edu

RESULTS

DYNAMICS OF TOTAL AMOUNT OF PRECIPITATION FOR MAY – SEPTEMBER IN 1985-2010



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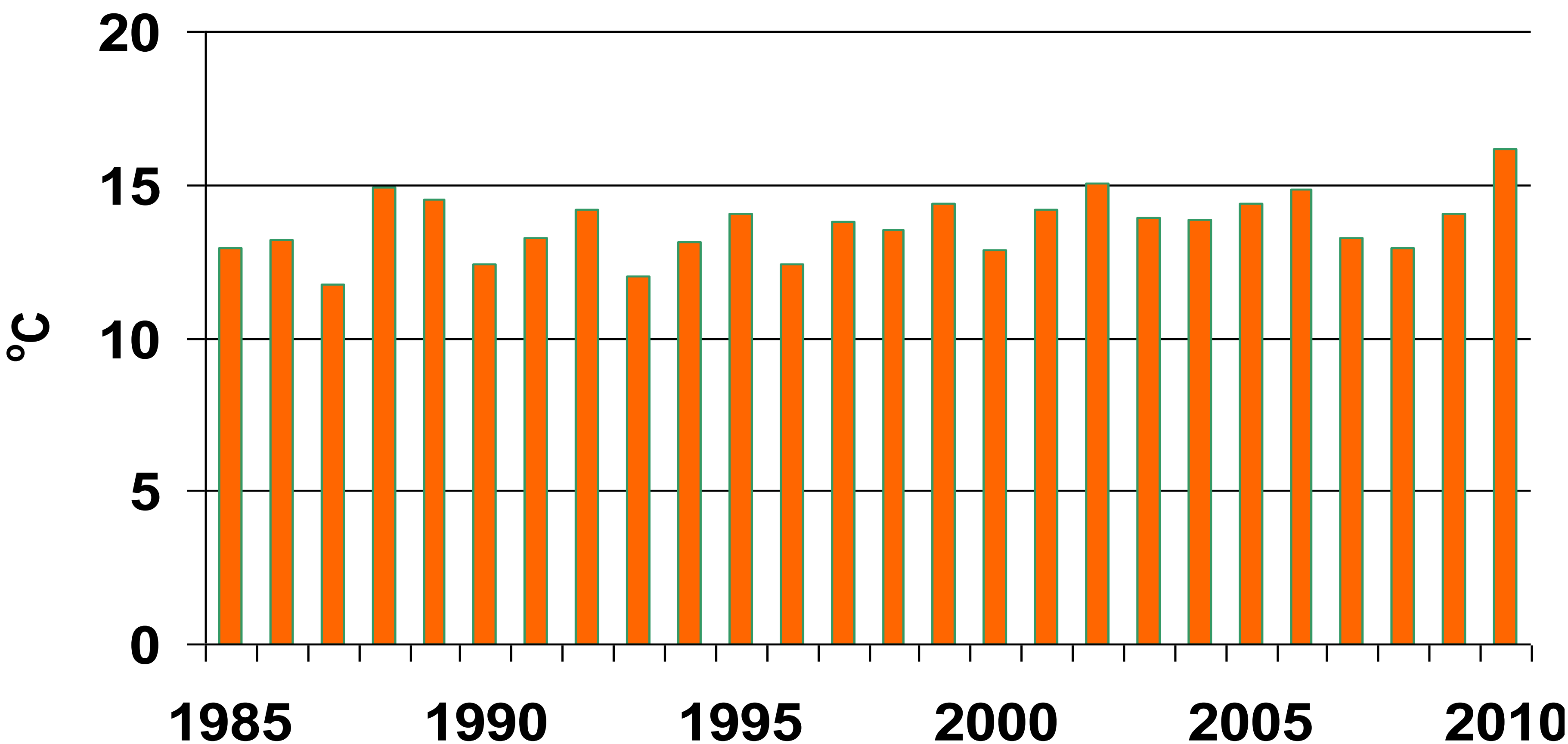
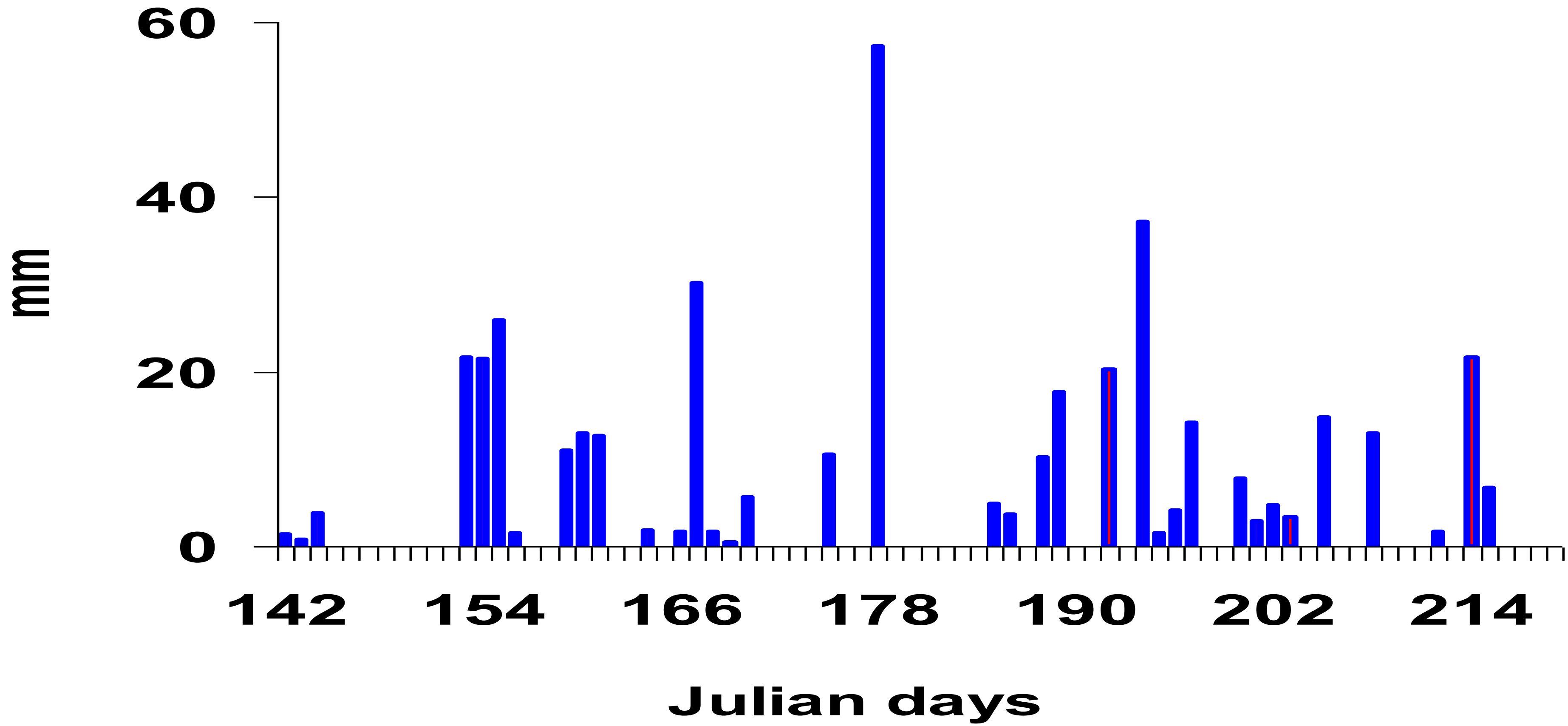
RESULTS

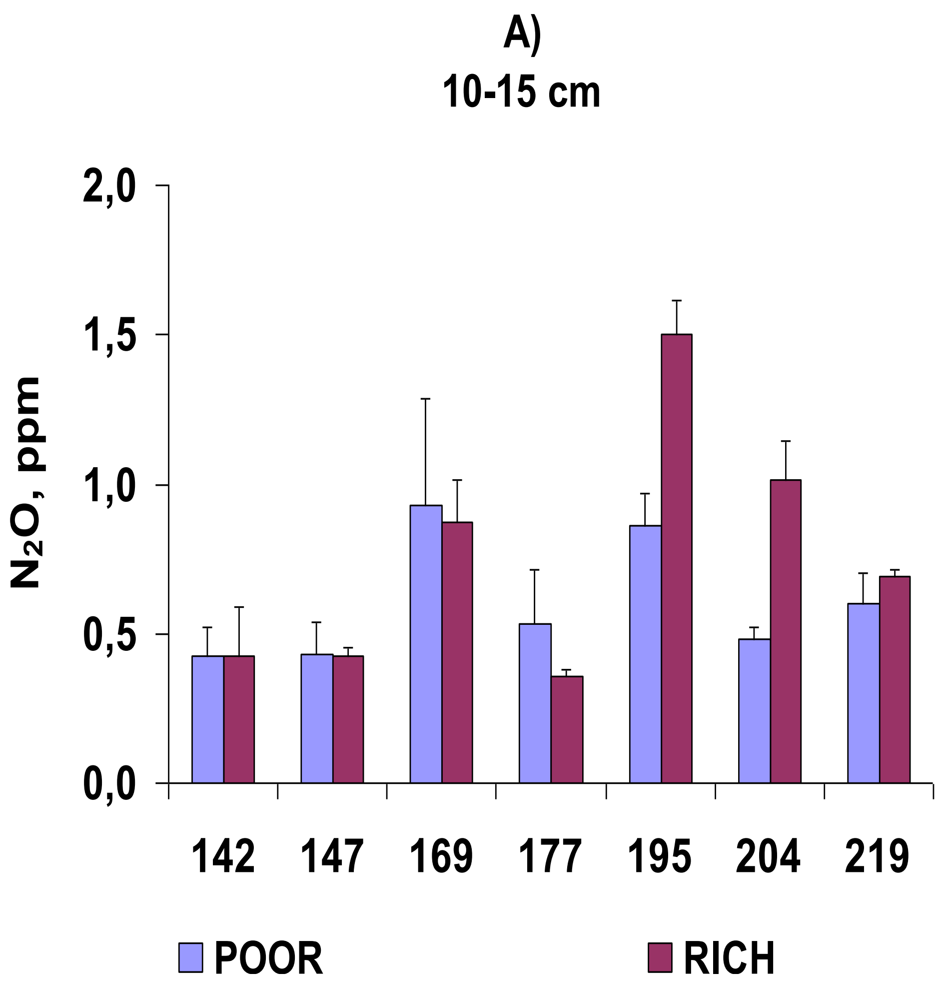
DYNAMICS OF MEAN AIR TEMPERATURE FOR MAY – SEPTEMBER IN 1985-2010

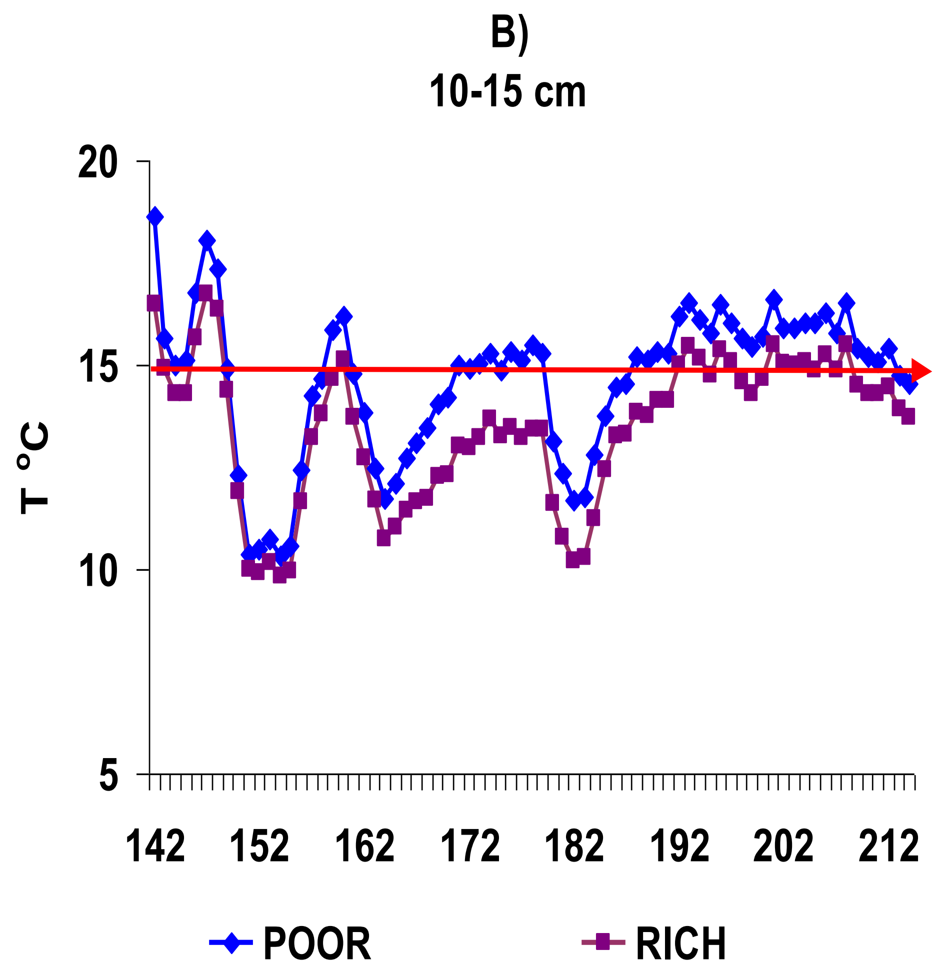


DYNAMICS OF PRECIPITATION FROM 22 MAY (142) TO 7 AUGUST (219 Julian day), 2009



DYNAMICS OF N_2O CONCENTRATION (A) AND SOIL TEMPERATURE (B) AT THE DEPTH OF 10-15 CM





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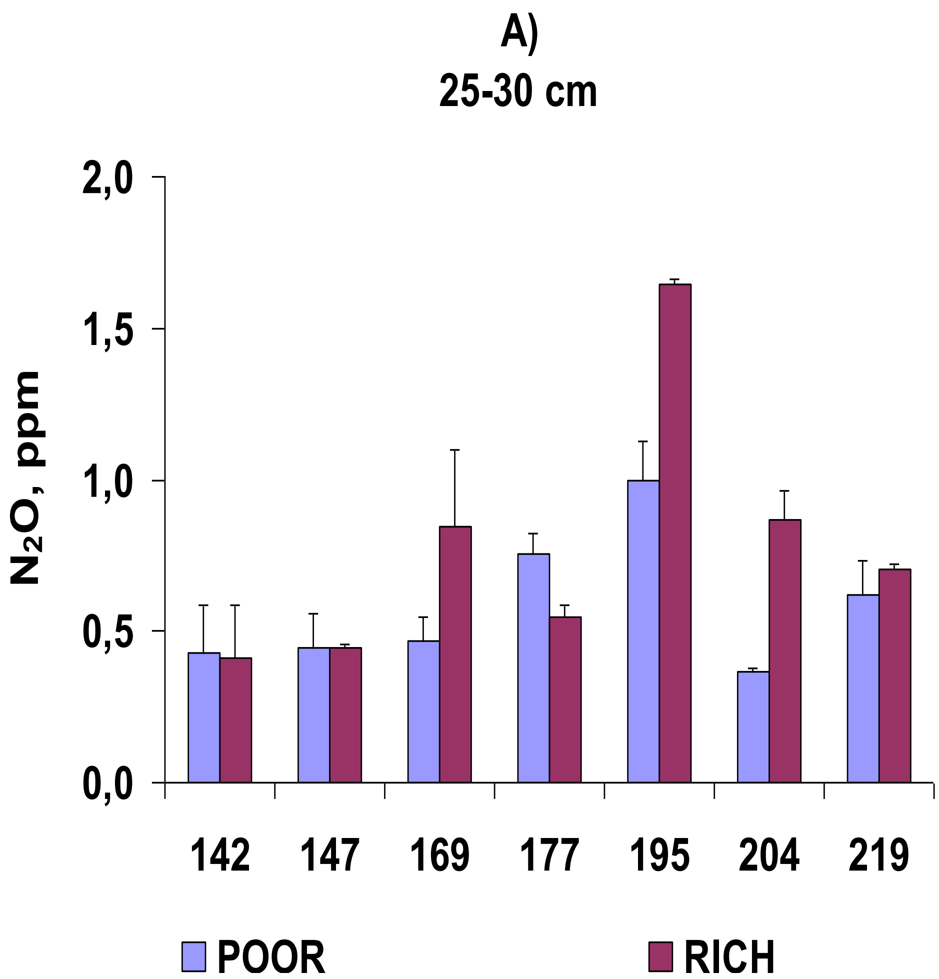
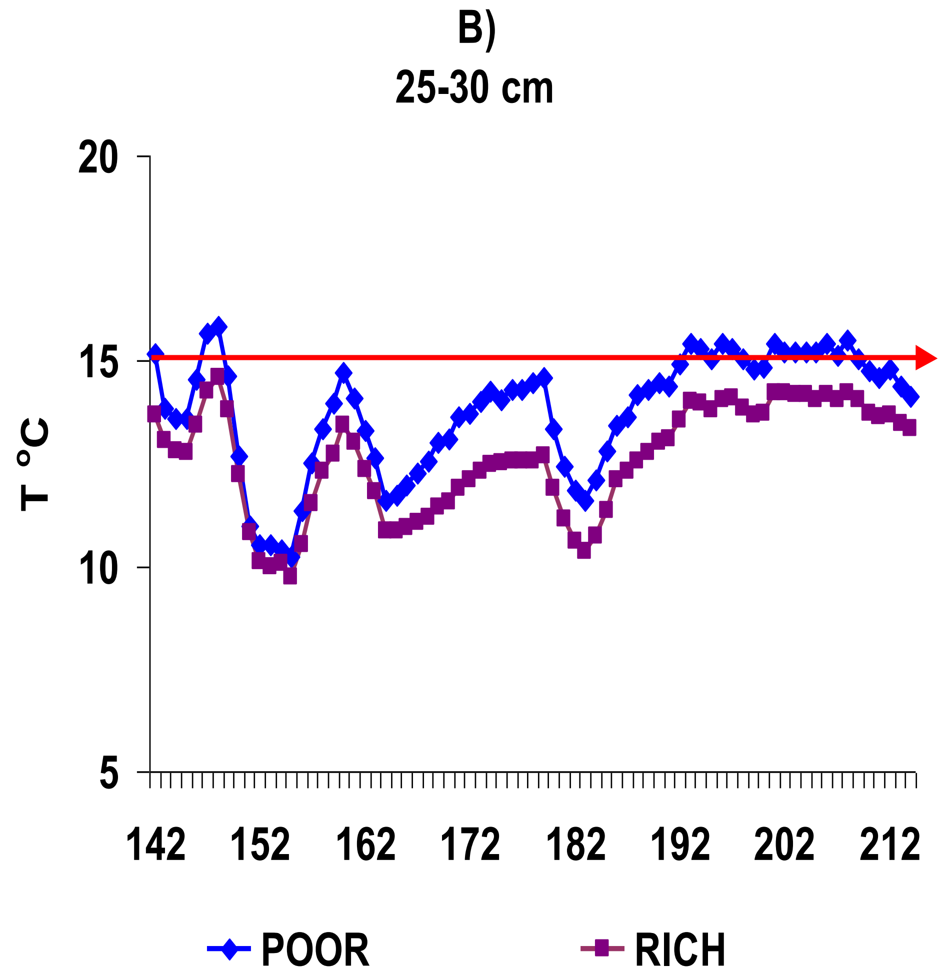
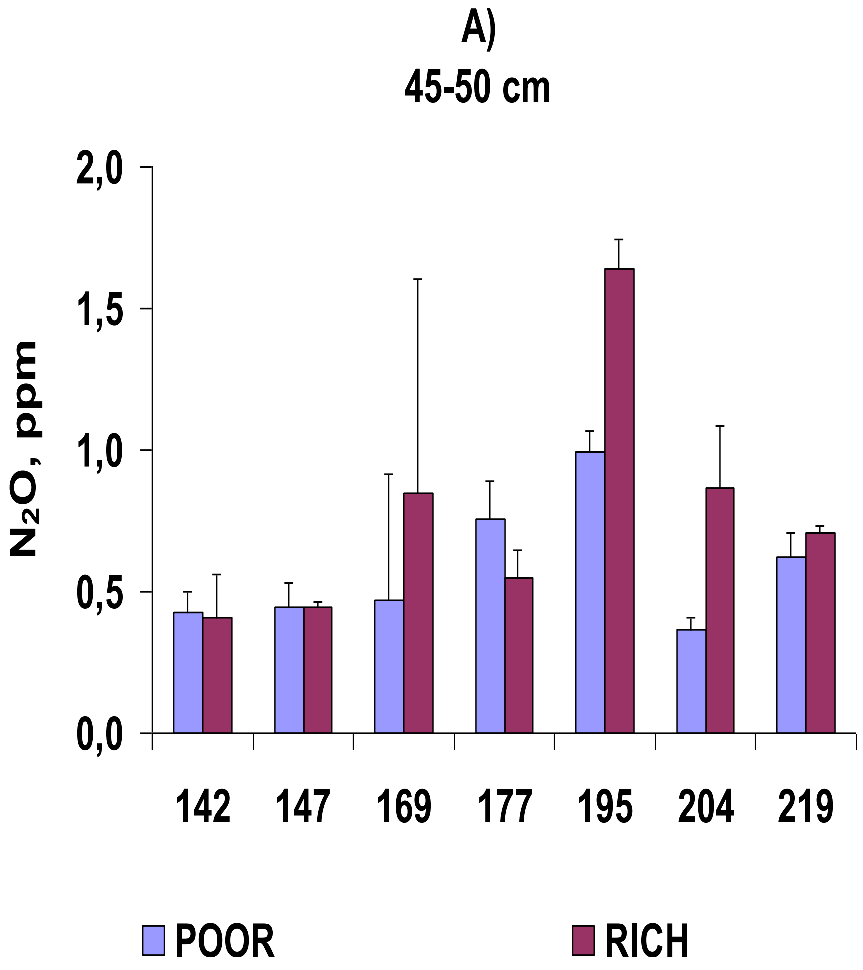
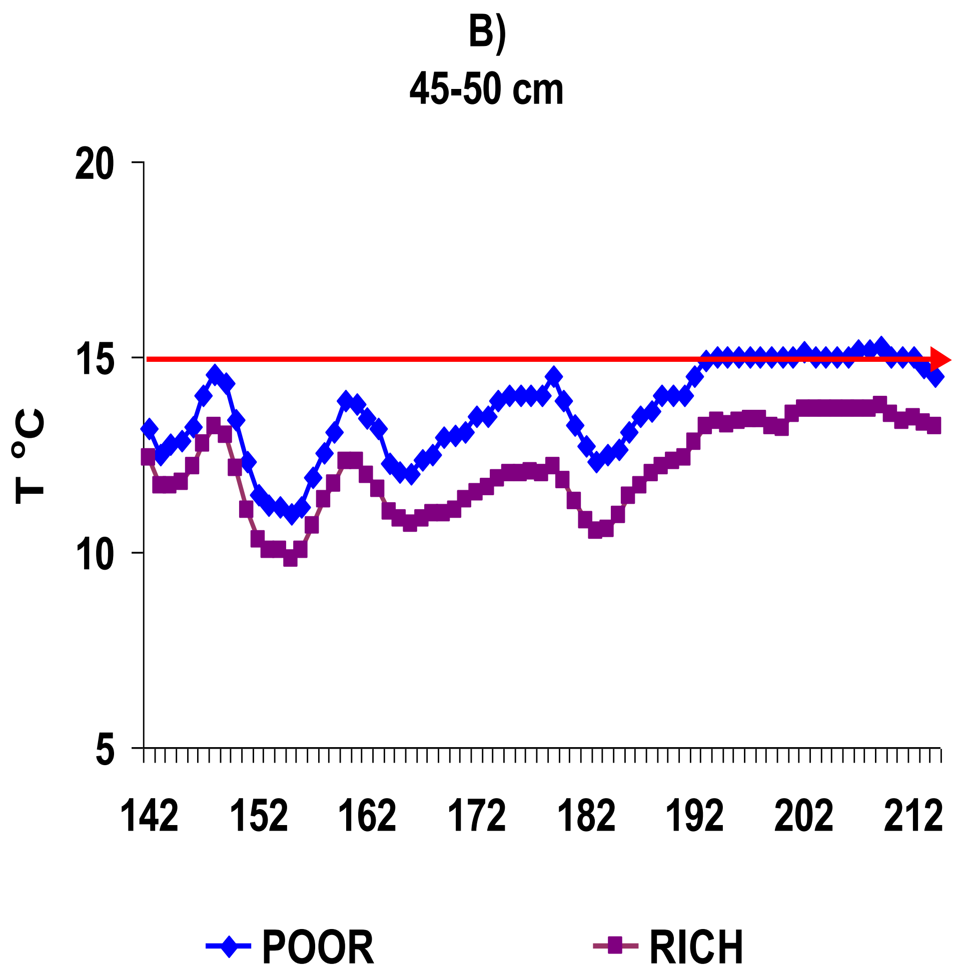
DYNAMICS OF N_2O CONCENTRATION (A) AND SOIL TEMPERATURE (B) AT THE DEPTH OF 25-30 CM





DYNAMICS OF N_2O CONCENTRATION (A) AND SOIL TEMPERATURE (B) AT THE DEPTH OF 45-50 CM





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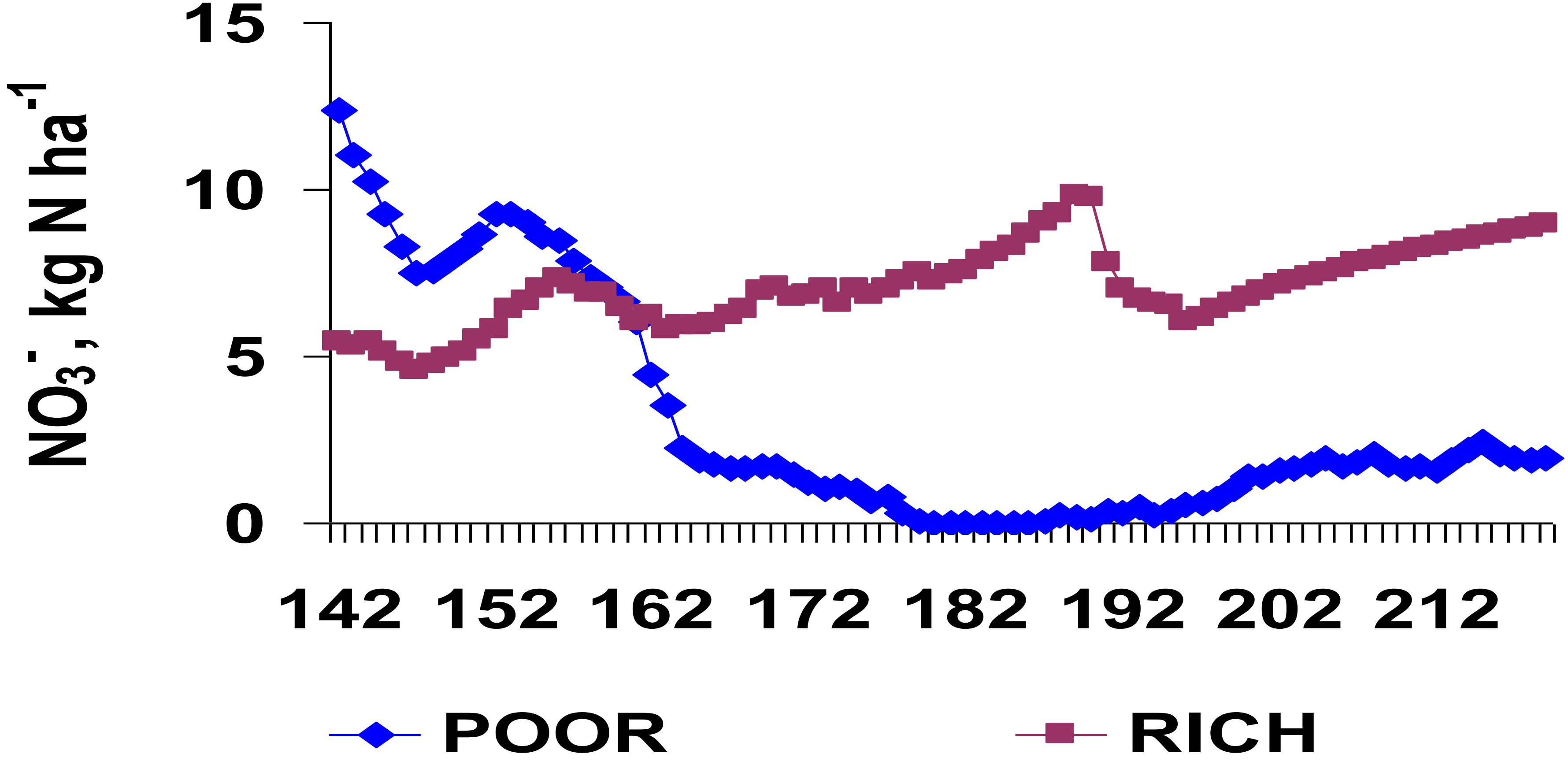
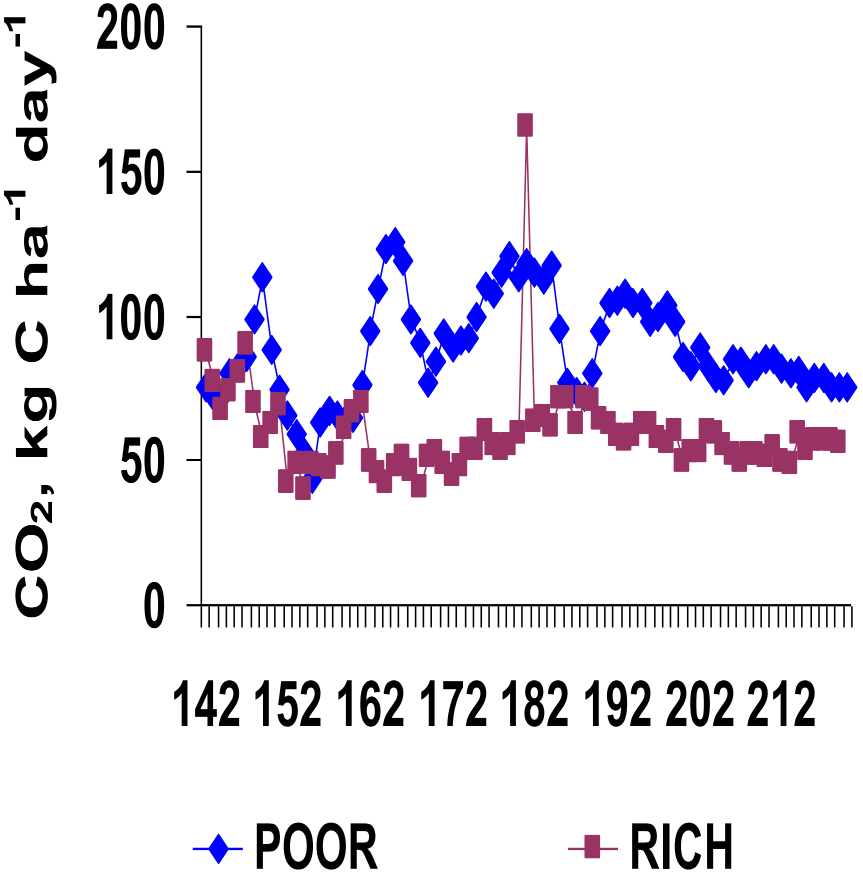
DYNAMICS OF NO_3^- CONTENT AT THE 10-CM DEPTH (DNDC MODEL)

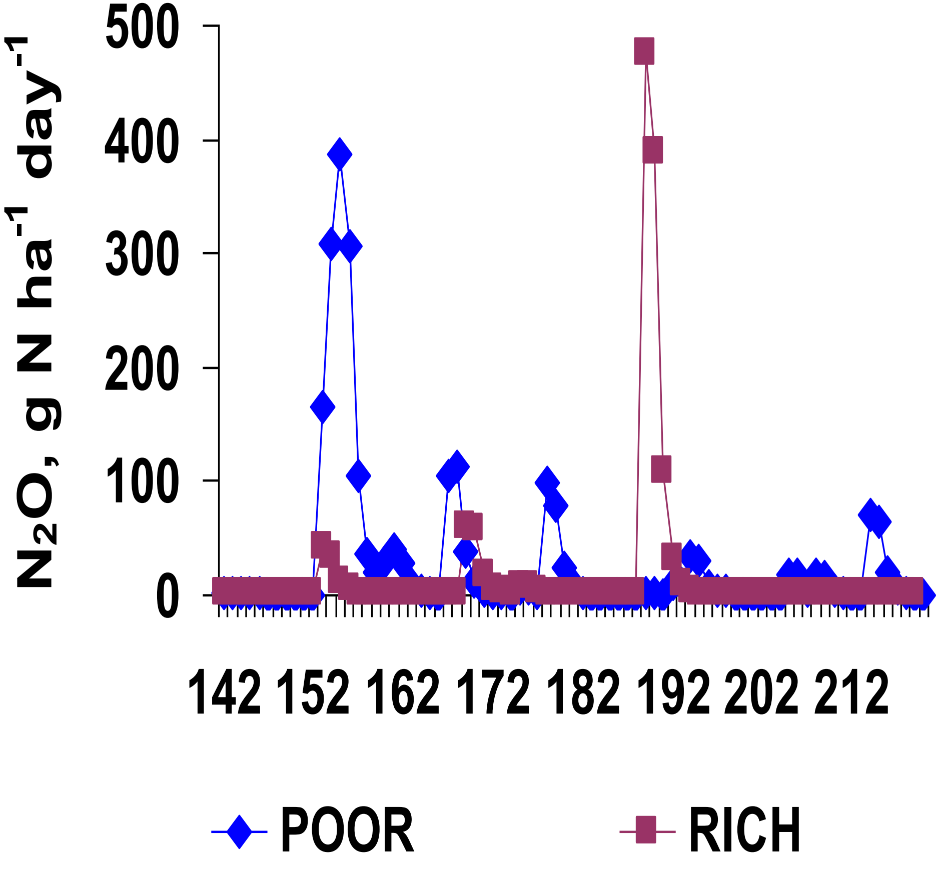


DYNAMICS OF TOTAL ECOSYSTEM RESPIRATION (A) AND N_2O EMISSION (B) FROM SOIL (DNDC MODEL)

(A)



(B)



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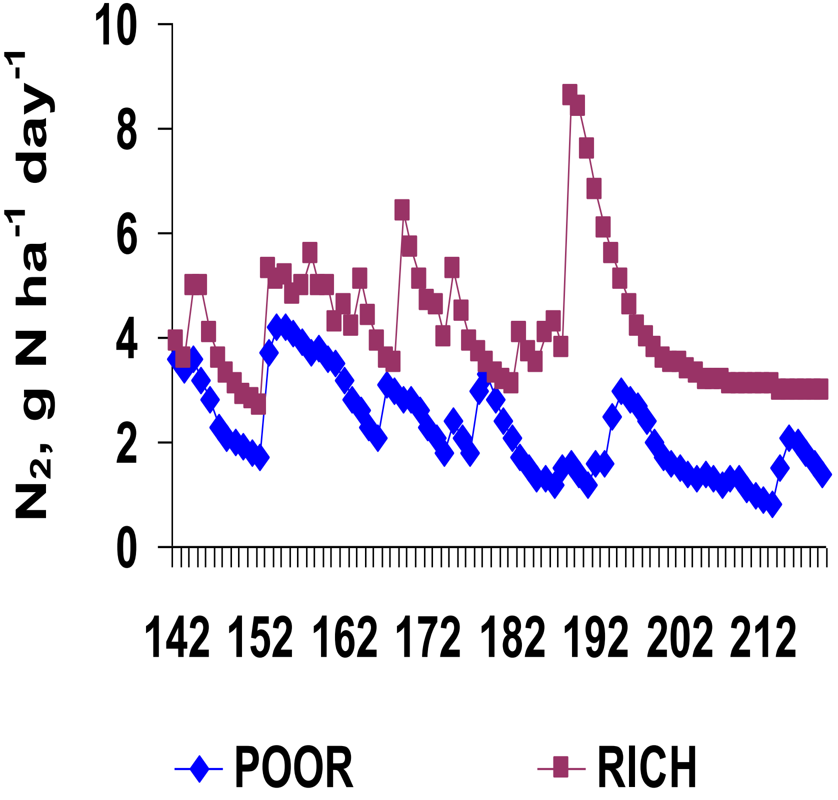
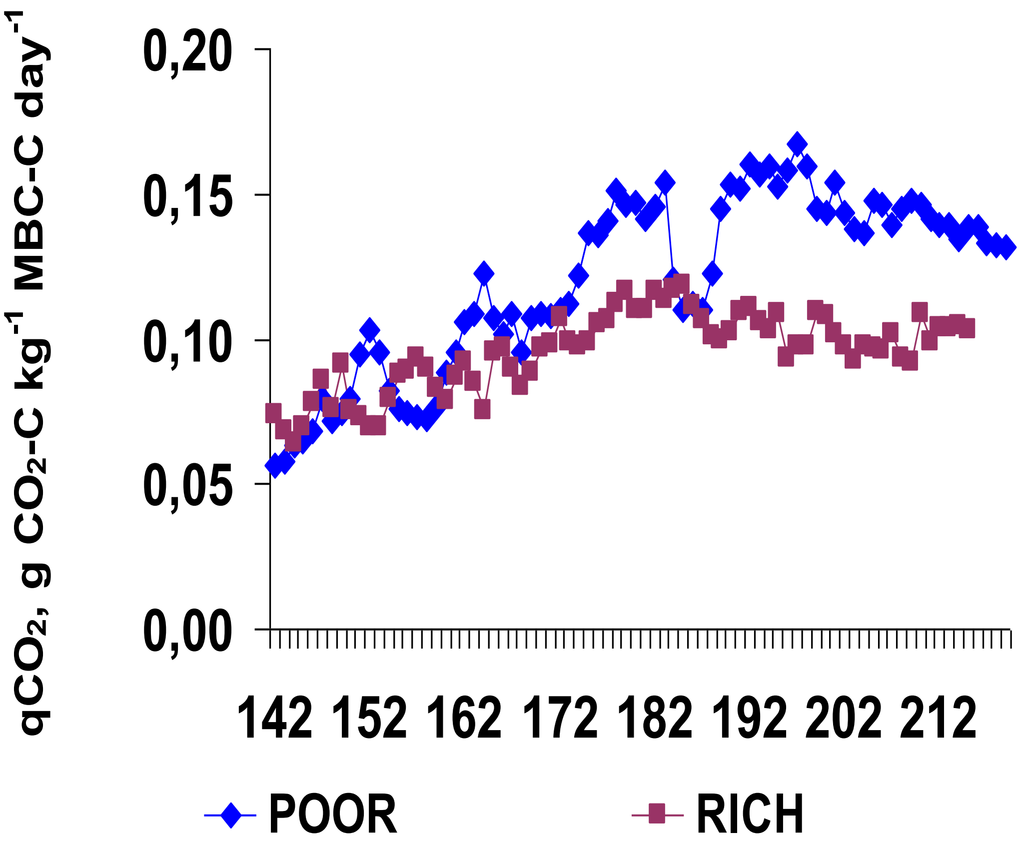
DYNAMICS OF N_2 EMISSION (A) AND METABOLIC QUOTIENT - qCO_2 (B) ACCORDING TO DNDC MODEL

(A)



(B)



CONCLUSIONS:

1) The highest mean N_2O concentrations were observed at the depth of 10 to 15 cm of the poor and rich soil during the growing season for spring barley.

2) The mean N_2O concentrations were higher in the upper 50-cm layer of the rich soil than the poor soil.

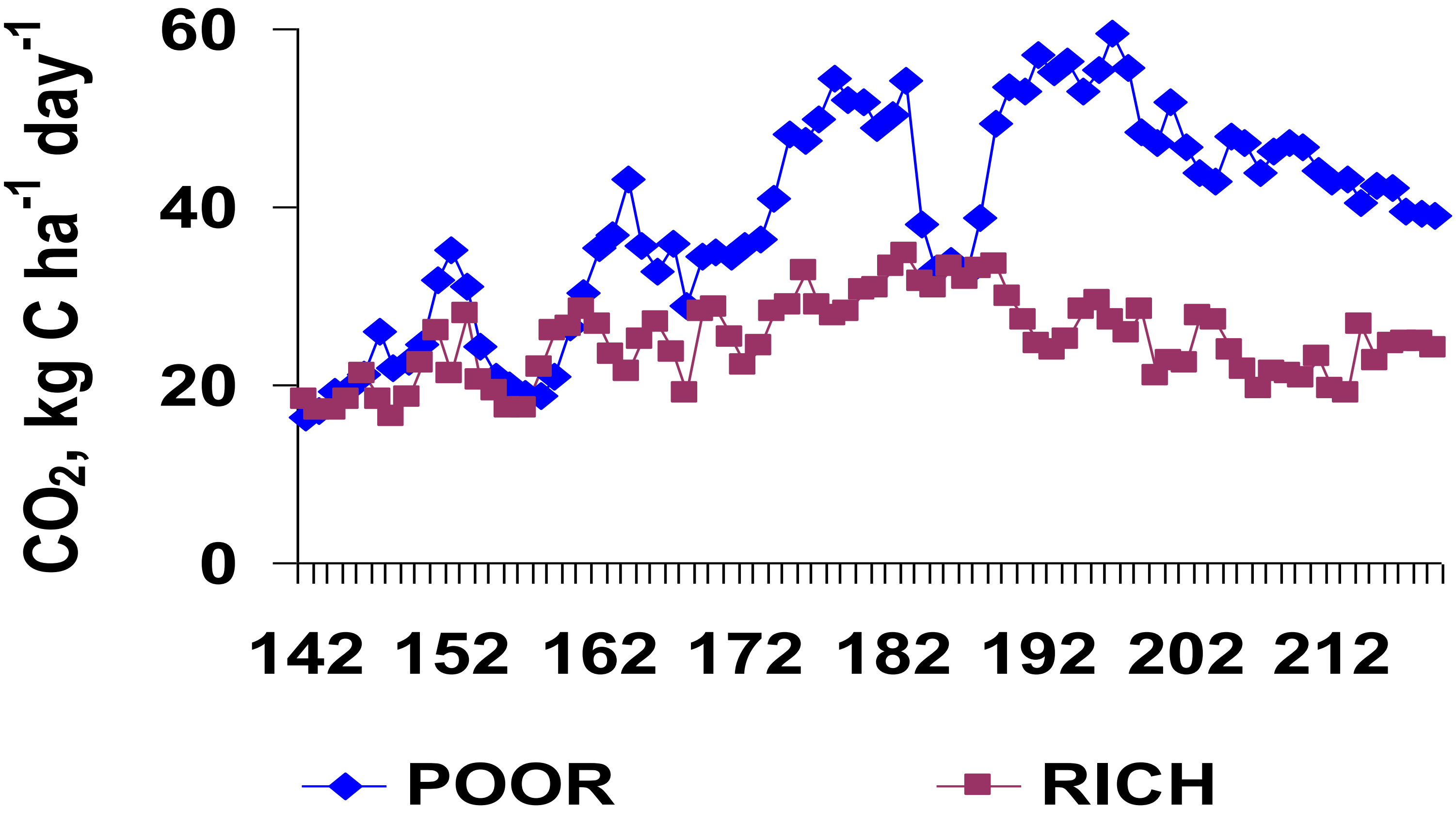
3) The modeled N_2O fluxes, total ecosystem respiration and organic matter mineralization were greater in the poor soil than in the rich soil.

THANK YOU FOR YOUR ATTENTION FROM:

Dr. Natalya Buchkina **Dr. Elena Rizhiya**

and myself!

DYNAMICS OF ORGANIC MATTER MINERALIZATION ACCORDING TO THE DNDC MODEL



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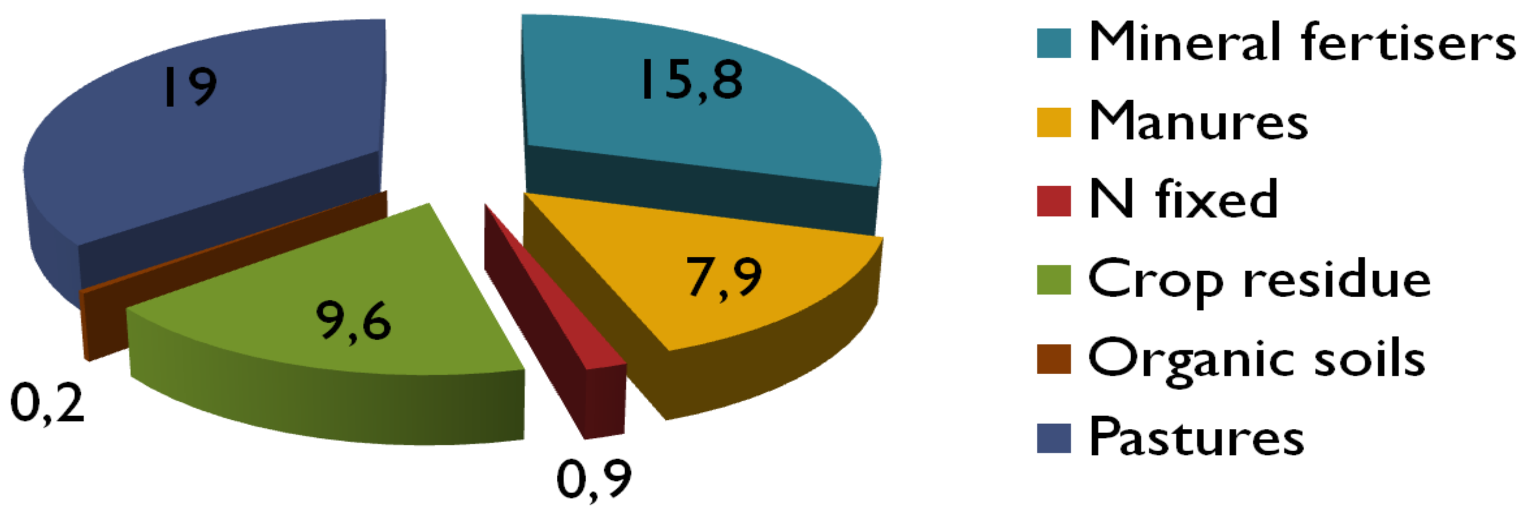
METHODS

DS1921G Thermochron iButtons for measurement of soil temperature

INTRODUCTION

Sources of N_2O emission from agriculture around the world



Braun et al., 2001