

Оценка максимальных потоков метана в вегетационный период 2012 и 2013 годов на мезоолиготрофном болоте Медла-Пэв-Нюр
Estimation of the maximum methane (CH₄) fluxes during the vegetation period of 2012 and 2013 on the peatland Medla-Pev-Nyur (Ust-Pojeg)

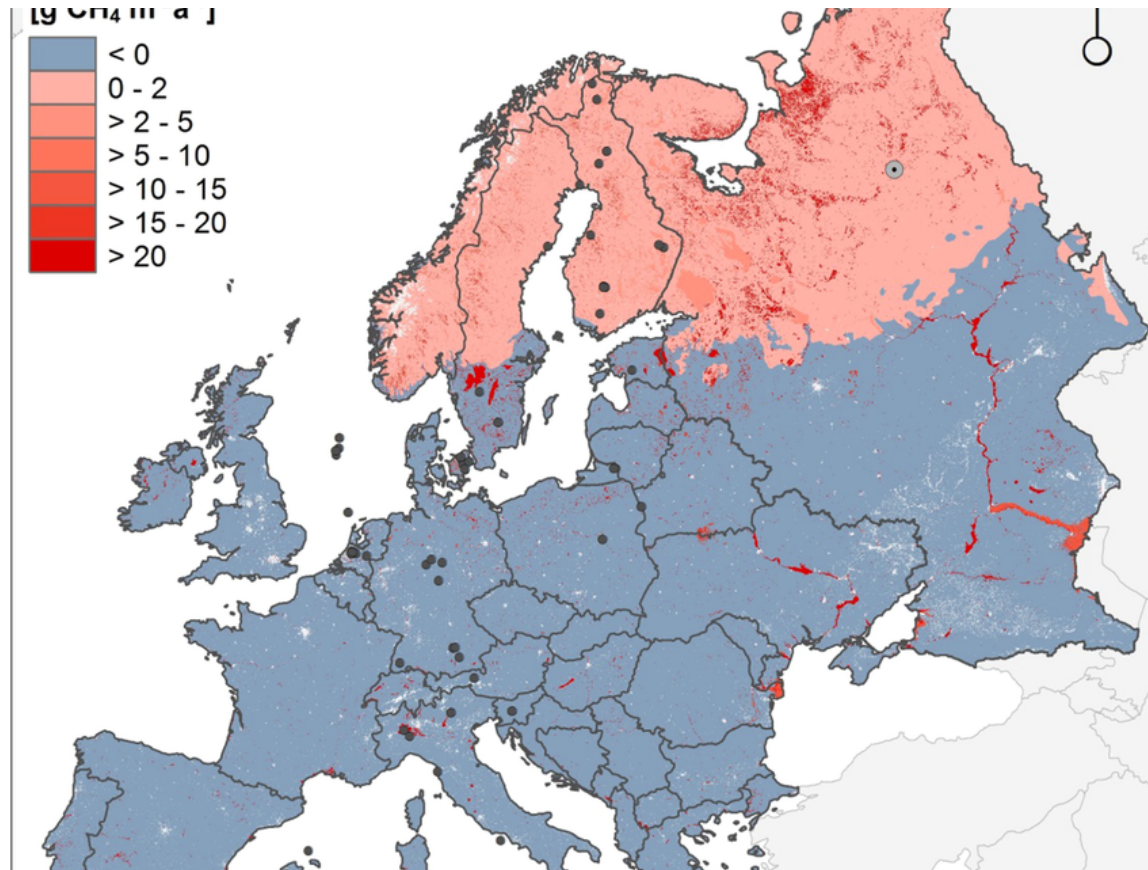
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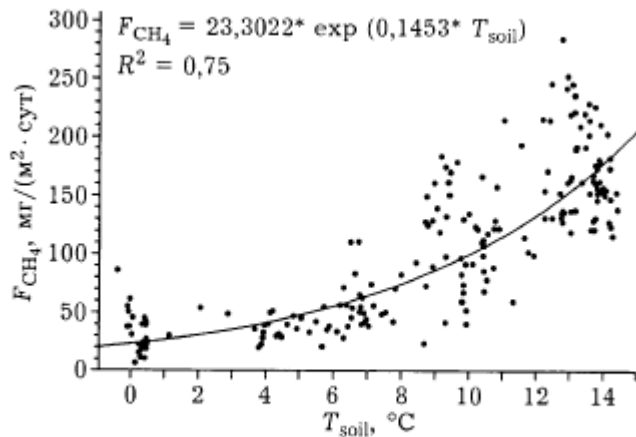


Map of mean annual natural methane fluxes in Europe; dots indicate the flux measurement sites used for the upscaling of CH₄ fluxes in this study, circled dot indicates the Ust-Pojeg investigation site.

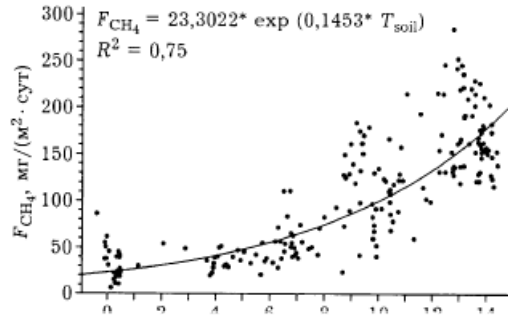
Взято из работы Julia Schneider et al, 2016

CH₄ fluxes estimation formula

- To get an individual flux estimate for each measurement plot ,CH₄ fluxes empirically modeled using the following exponential function
- $F_{CH_4} = a_1 * \exp(a_2 * T)$, (1)
- Where T is soil temperature and a1, a2 are fitting parameters. (Schneider et al., 2016, Mikhaylov et al, 2015)



contradiction



Эмиссия метана, доля от максимальной в зависимости от температуры почвы

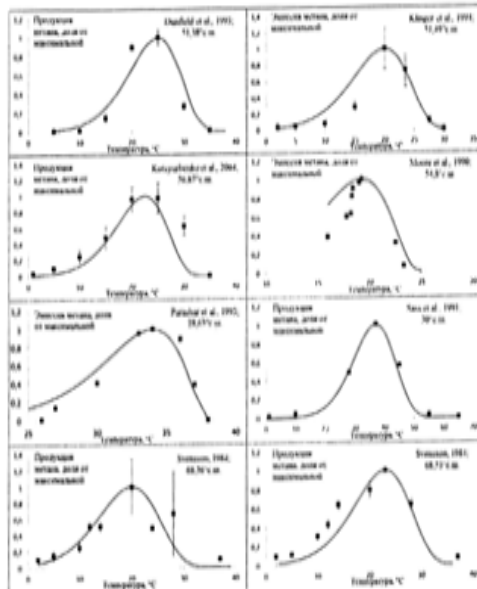


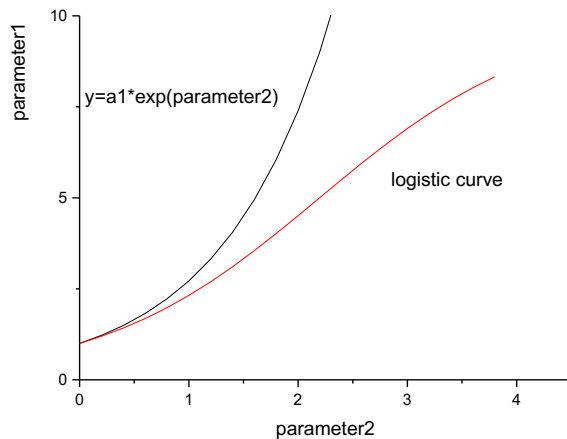
Рис. 1. Температурный фактор (F1), заданный по О'Нейку, для различных природных зон (точки — экспериментальные данные; кривая — расчет).

If the formula (1) is right, then the derivative on temperature of the soil of a stream of methane is directly proportional to the stream from exponential function.

As show calculations, it not so. The coefficient of correlation is very small and changes in time.

Data of supervision on a large scale don't confirm universality of use of exponential dependence.

Logistic curves



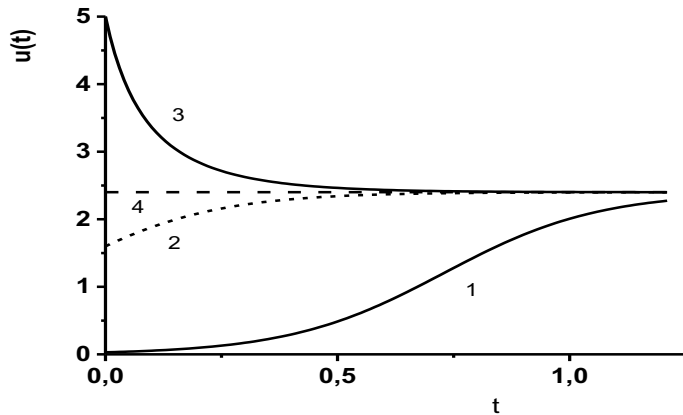
- Exponential is the solution of the equation of Malthus

$$\frac{dN}{dt} = AN$$

- Logistic curve is the solution of the Verhulst-Pearl equation

$$\frac{dN}{dt} = AN - BN^2$$

- Line $y=A/B$ is asymptote logistic curve.



Dependence of behavior of the solution of the equation depending on entry conditions. Parameters: A=6, B=2,5.

- The Verhulst-Pearl equation description is

$$\frac{D FCH_4}{D T_{s1}} = A FCH_4 - B FCH_4^2$$

where

FCH₄ – vertical methane fluxes (mmol m⁻² c⁻¹),

T_{s1} – soil temperature at the depth about 25cm,

A, B – are model parameters.

Experimental data and estimation of maximum fluxes of methane

month	n	Min FCH4	Max FCH4	Average montly	Estimate	T _{s1} min	T _{s1} max
June 2012	13	1.2e-6	1.05e-4	6.28e-5	1.26e-4	10.53	12.58
July 2012	31	7.62e-6	1.92e-4	7.09e-5	2.3e-4	12.48	15.08
August 2012	30	1.94e-5	2.3e-4	8.44e-5	2.4e-4	11.18	15.34
September 2012	30	-3.18e-5	5.8e-4	6.44e-5	1.09e-4	8.8	10.8
October2012	20	-5.48e-5	3.26e-5	4.35e-6	3.61e-5	6.06	8.54
April 2013	16	-3.38e-5	6.41e-5	2.018e-5		-0.16	0,45
May 2013	21	-1.18e-5	8.33e-5	2.12e-5	1.04e-4	2.88	8.9
June 2013	30	-2.12e-5	1.5e-4	4.49e-5	9.23e-4	8.7	13.02
July 2013	31	4.74e-6	1.78e-4	8.29e-5	1.3e-4	12.16	14.25
August	21	-1e-5	1.75e-4	3.85e-5	1.6e-4	13.59	14.39
September	21	-2.5e-5	4.88e-5	1.977e-5	1e-4	7.75	10.75
October	31	-1.25e-5	8.19e-5	1.96e-6	6.7e-5	3.77	7.40

Conclusions

- The Verhulst-Pearl's equation is suitable for the estimation of maximum CH_4 fluxes.
 - For specification of the received estimates it is necessary to use more detailed data, for example, average half-hour intervals.
 - In my opinion, the CH_4 fluxes may be described the Verhulst-Pearl equation c variable parameters, where parameter $A=0$ under $T>T_{\max}$, $B=\text{const}$.
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- **Thanks you for your attention!**

References

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