

Detection of Methane Emission through water and ground surface

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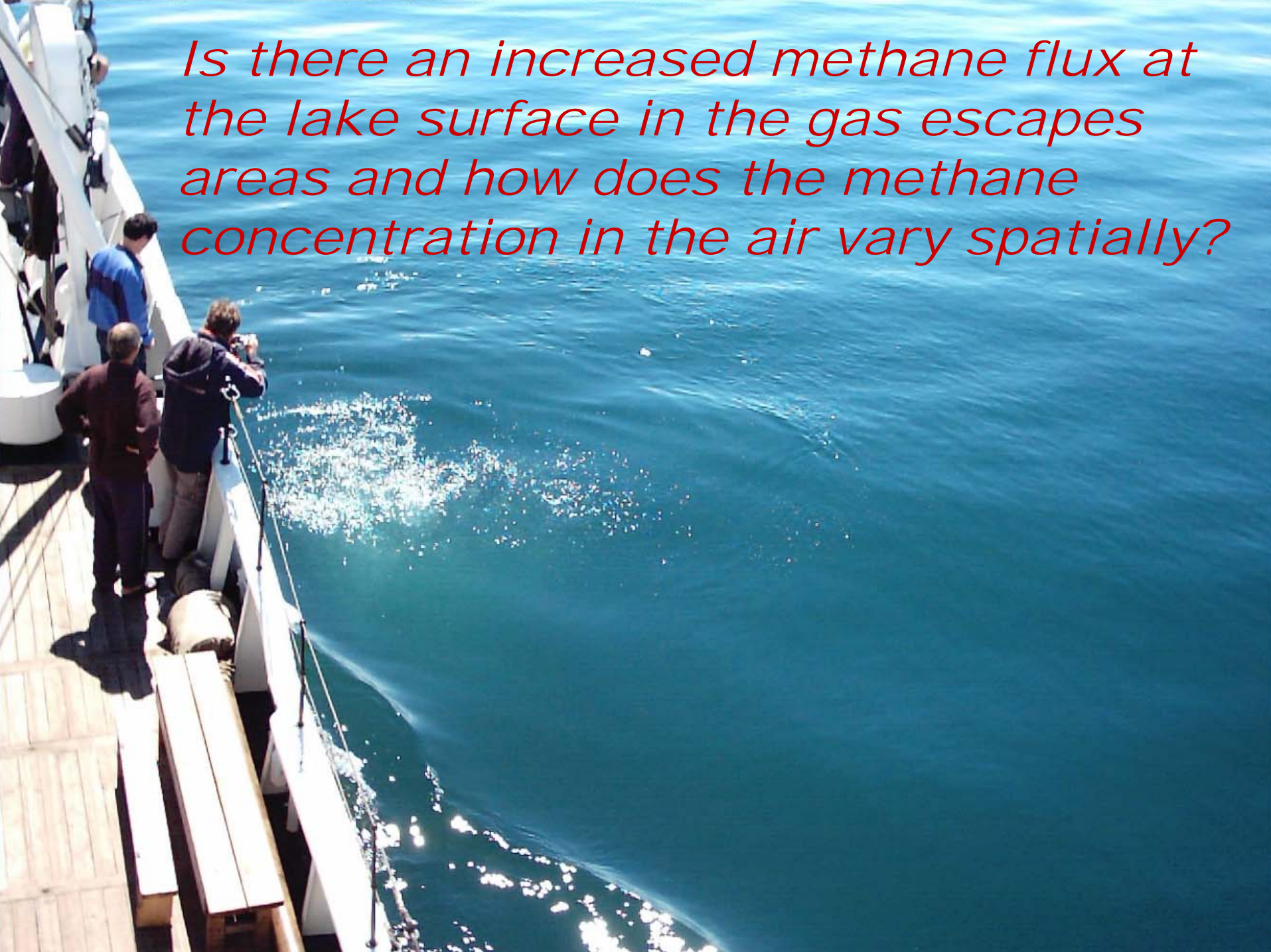
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And INTAS Project 01-2309 Partners

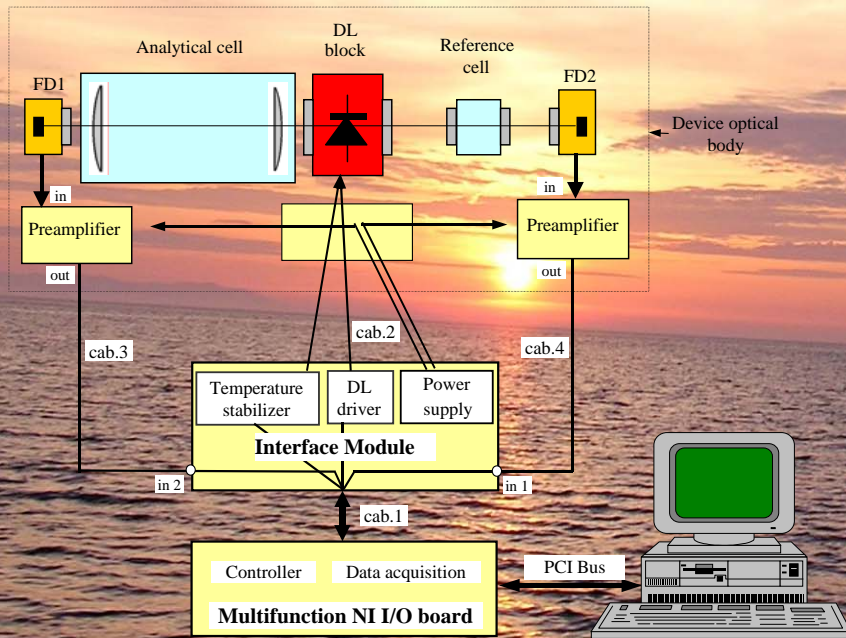
MULTISGAS INTAS Project 01-2309, 2003-2004

Is there an increased methane flux at the lake surface in the gas escapes areas and how does the methane concentration in the air vary spatially?



METHANE DETECTOR

Based on near-IR diode laser and multipass cell

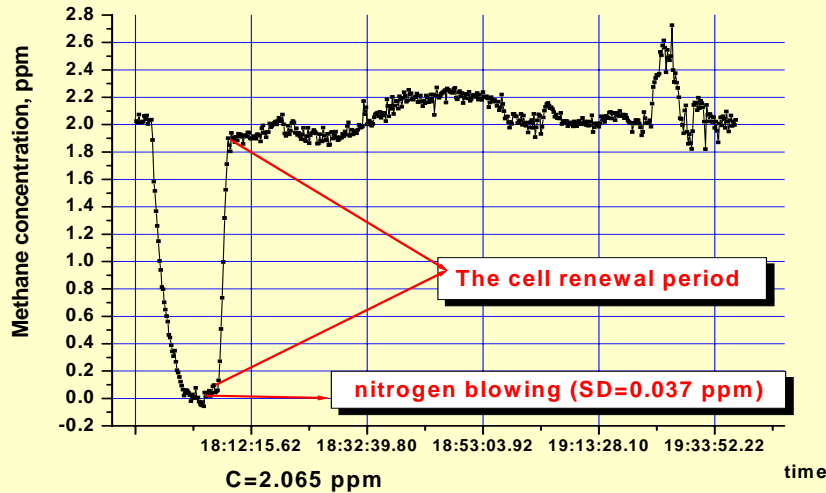


Methane Detector Block Diagram



Detector optical body design

Specifications of methane detector



Based on the device tests and field measurements, the main parameters of the device have been determined as follows:

- *Threshold sensitivity of methane detector is ~ 0.03 ppm.*
- *The error of air methane concentration measurements (2 ppm) is ~ 3%, (determined by scale of span gas)*
- *The cell response time is about 98s (450 m-17km/hour)*

INTAS EXPEDITIONS

FIRST YEAR

- methane diode laser gas-analyzer refinement
- v.Verechagin, June 2003, V.Kapitanov, joint work (POI)

SECOND YEAR

- v.Verechagin, August 2003, V.Kapitanov, N.Krivolutskii, methane seep location measurements
- Bolshie Koty, June 2004, V.Kapitanov, locality measurements
- v.Verechagin, June 2004, V.Kapitanov, N.Krivolutskii, methane seep location measurements

v.VERESHAGIN

air bleeding position

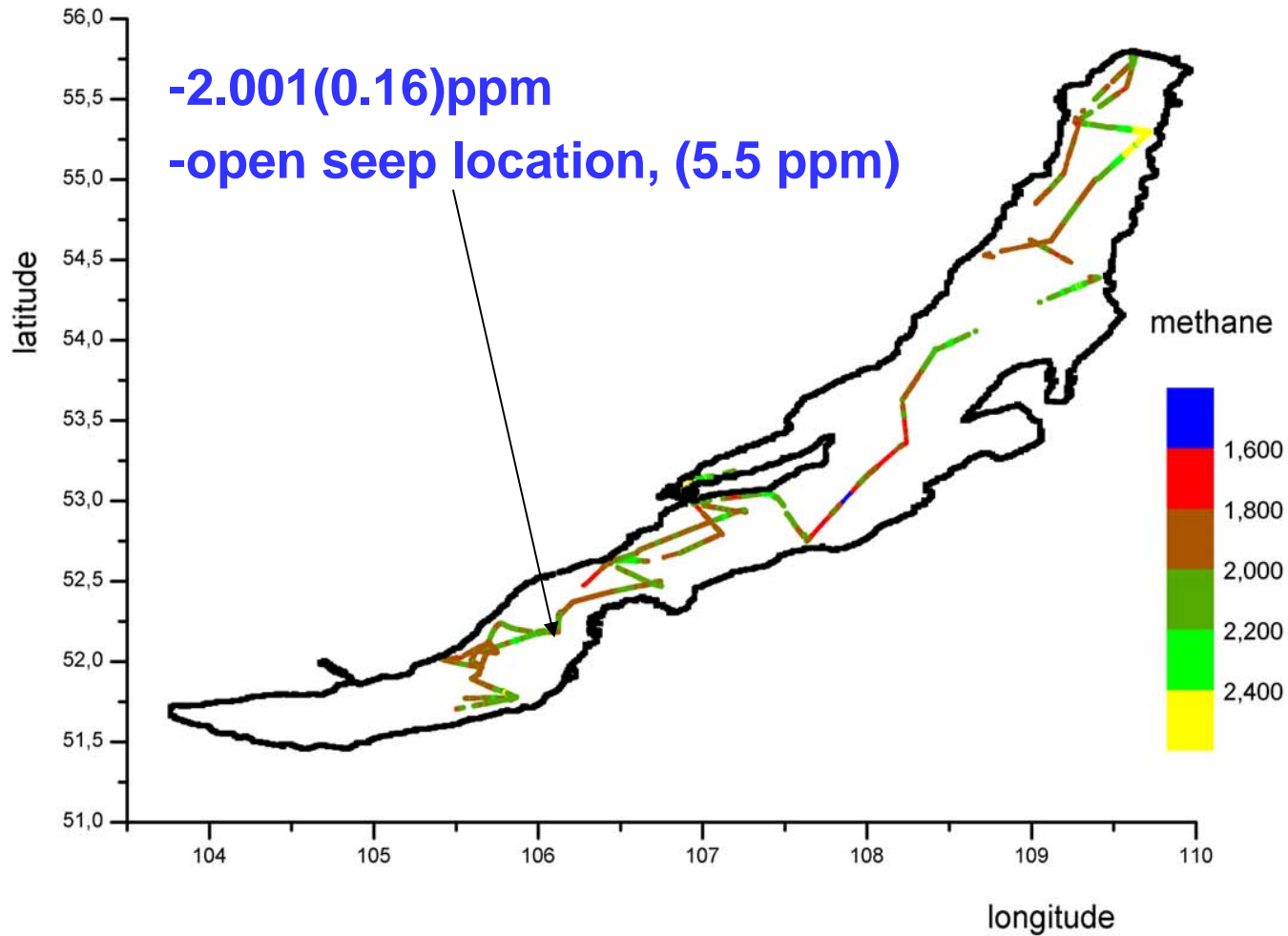


2003

2004

Chamber

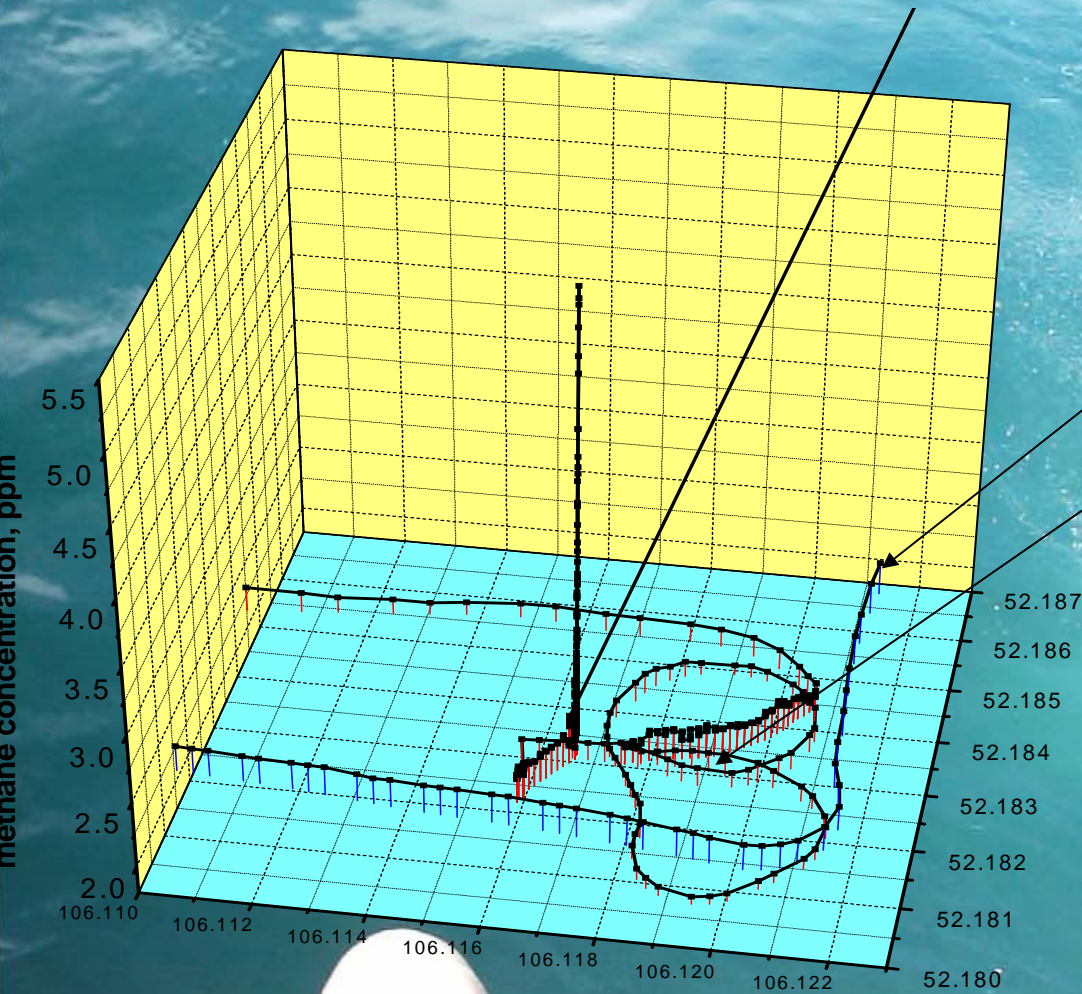
v.VERECHAGIN, 8-17 AUGUST 2003



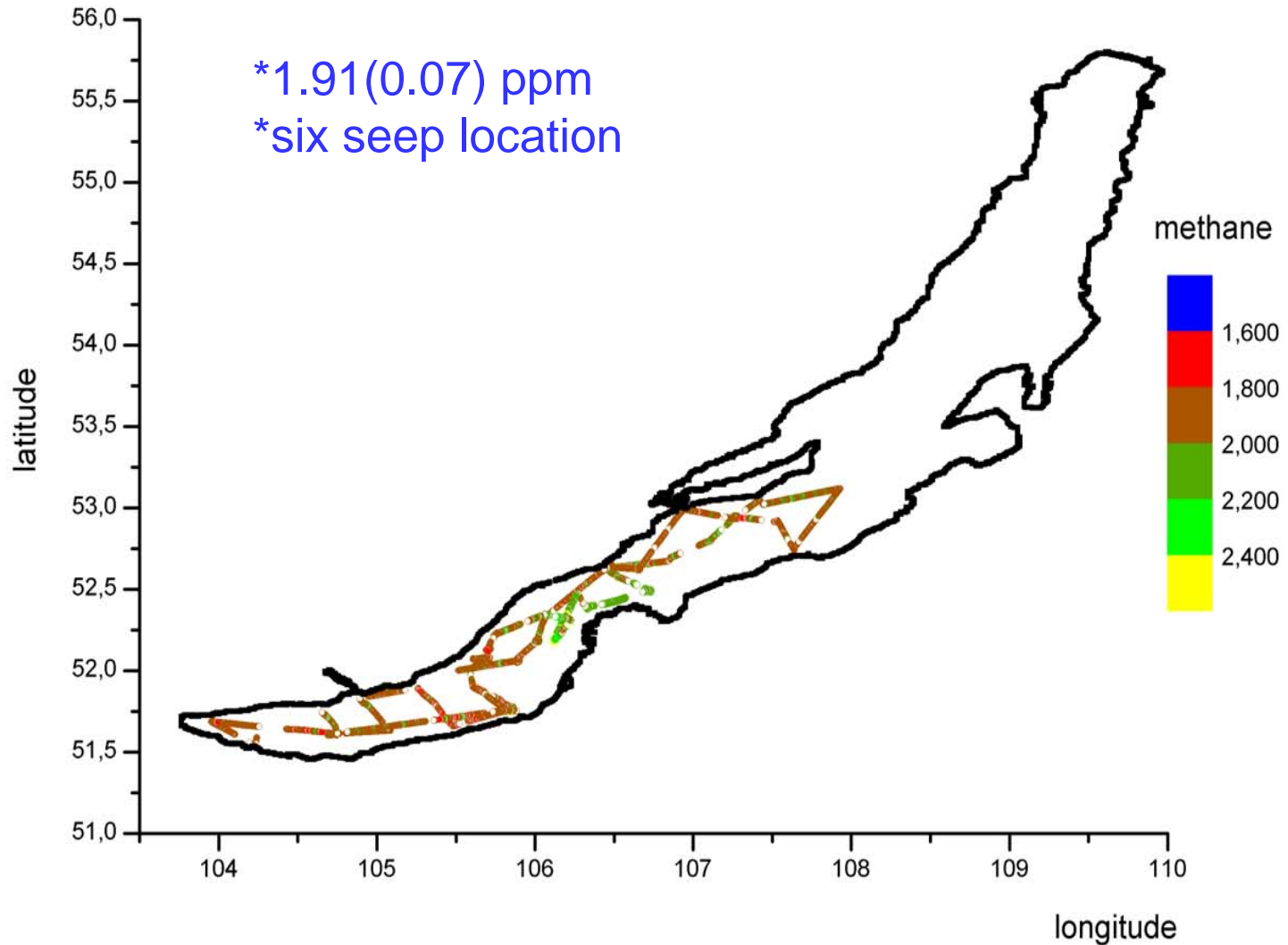
METHANE SEEP LOCATION

open seep near Selenga

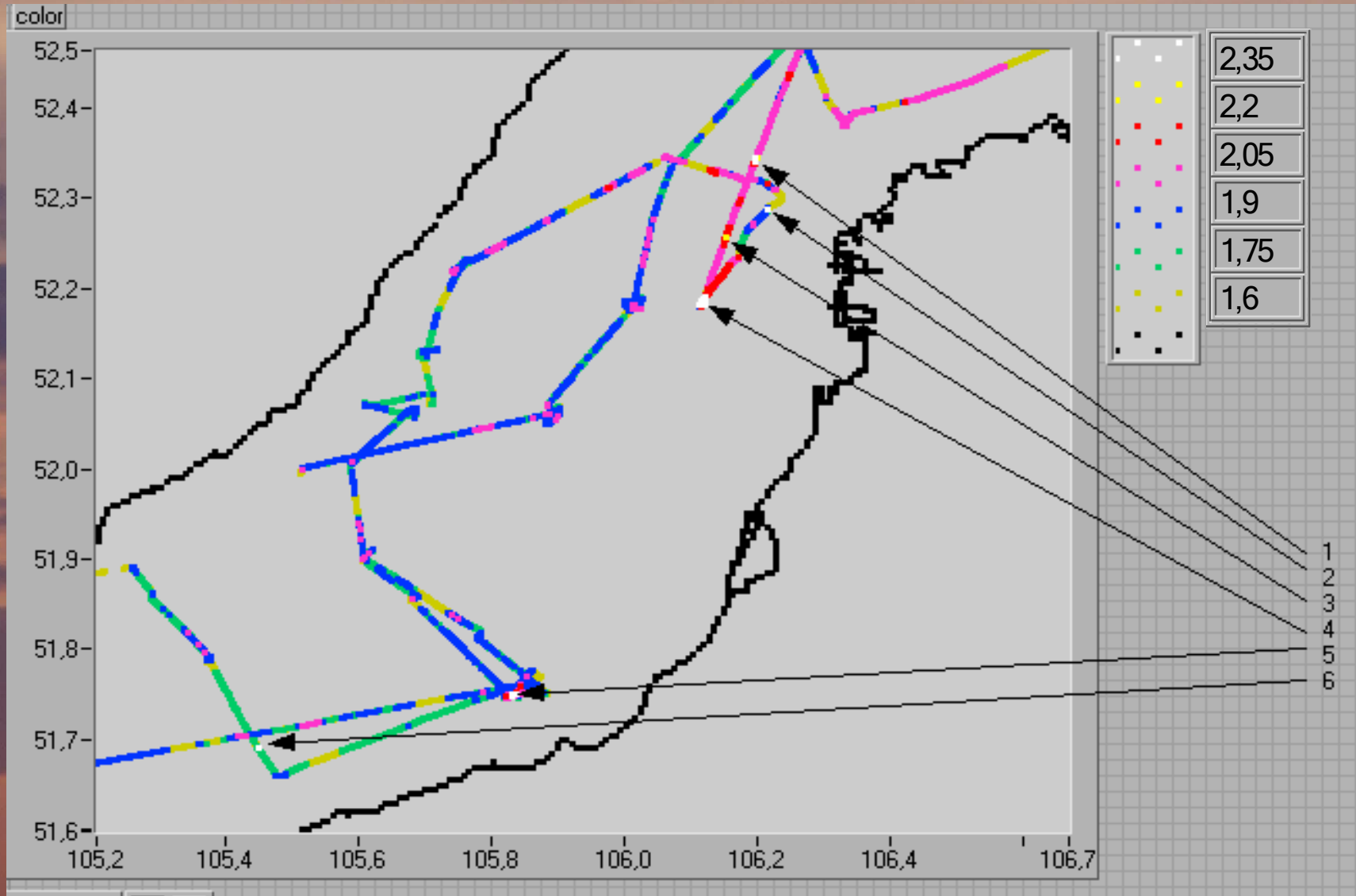
11.08.03
15.08.03



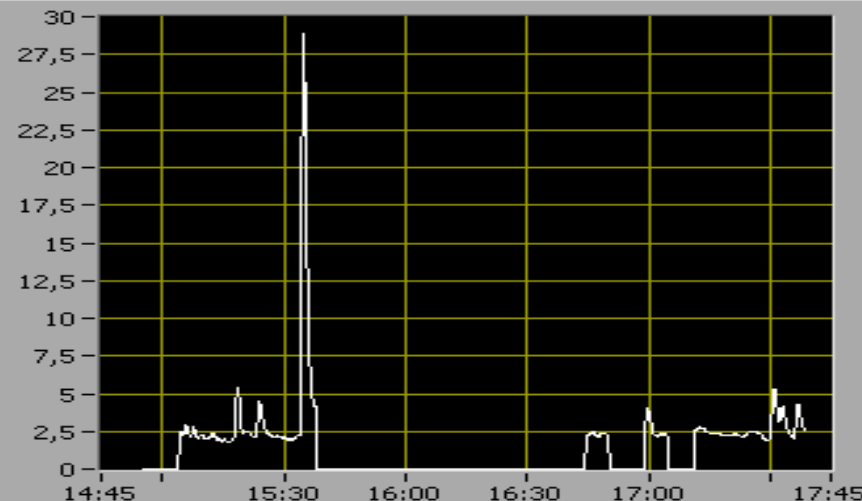
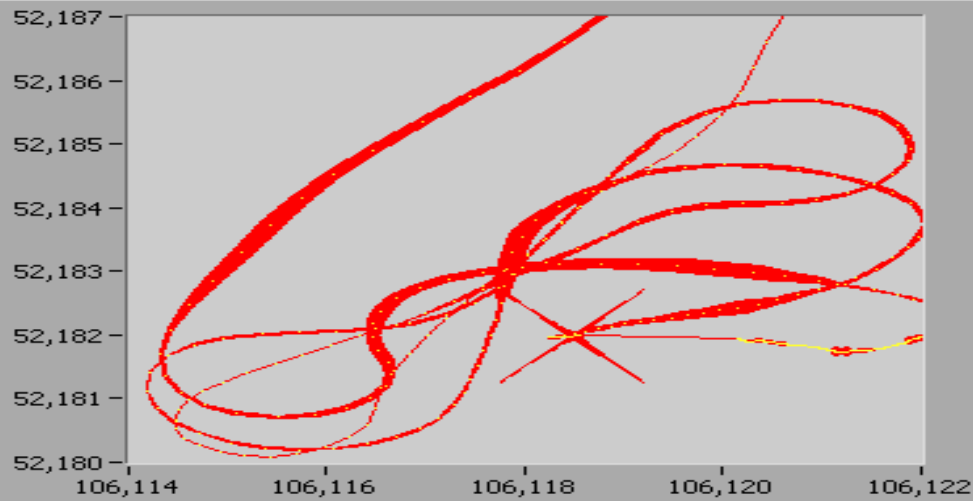
v.Verechagin, 16-24 June 2004



SEEP LOCATION, 16-24 June 2004

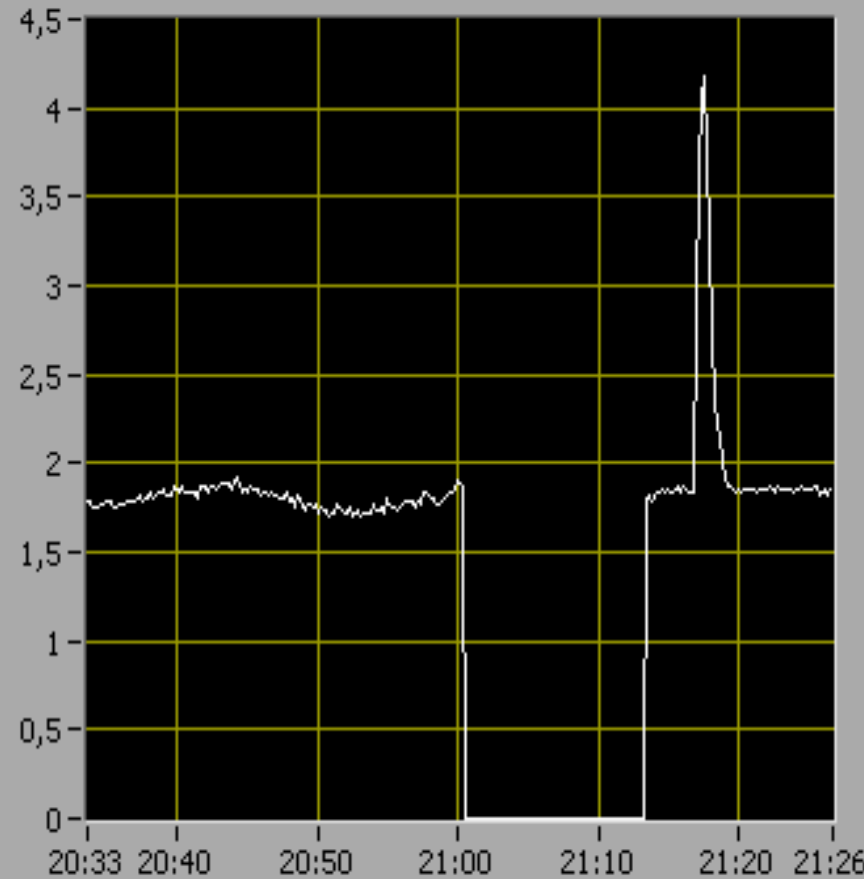
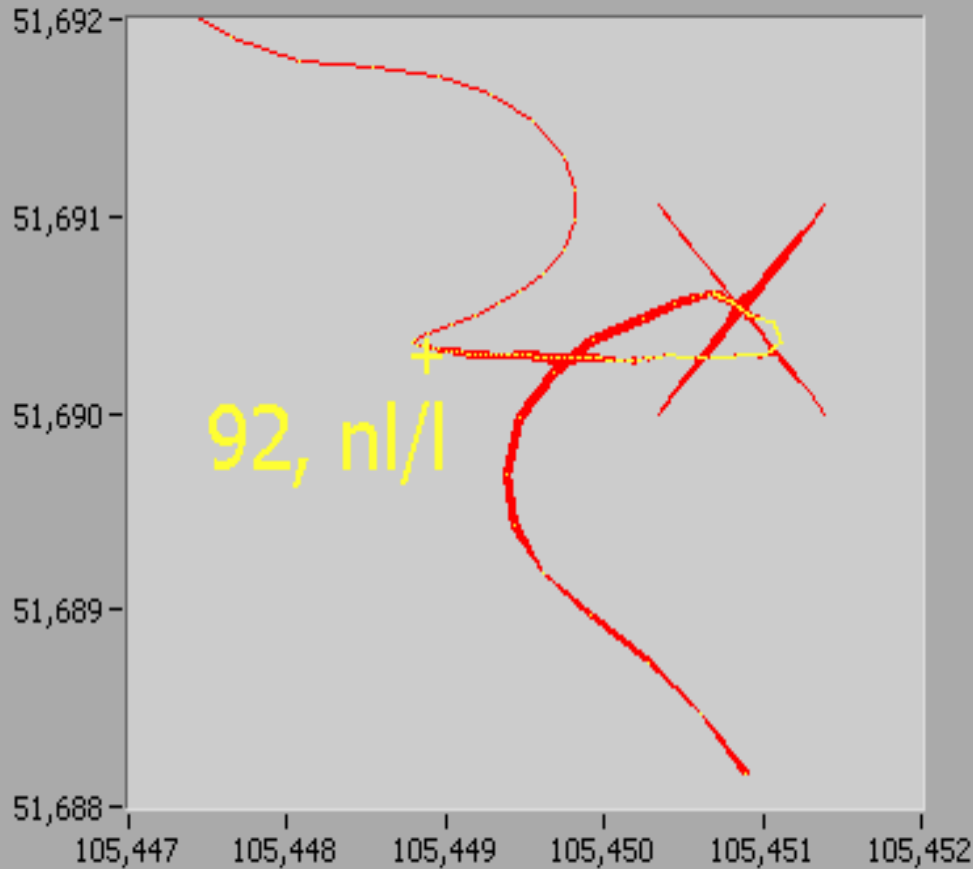


OPEN SEEP (Selenga's entry), 22 June 2004



DEEP-SEA SEEP

18.08.04 June, near Mishicha, depth ~ 1000 m



- ***Intercomparison (IAO+POI)***

Air sample for gas chromatograph was bled directly from air tube near detector

21.06.04

GC five air samples

- 1.89 (0.056) ppm

Methane detector

- 1.94 (0.054) ppm

22.06.04

GC two air samples

- 1.95 (0.056) ppm

Methane detector

- 2.02 (0.09) ppm

23.06.04

GC one air sample

- 8.98 (0.27) ppm

Methane detector

- 13.7 (0.09) ppm



Flux measurements



$$F = V * C / S * t$$

Where F is methane flux, (kg/m^2),

V – chamber volume, m^3

C – methane concentration residual, kg/m^3

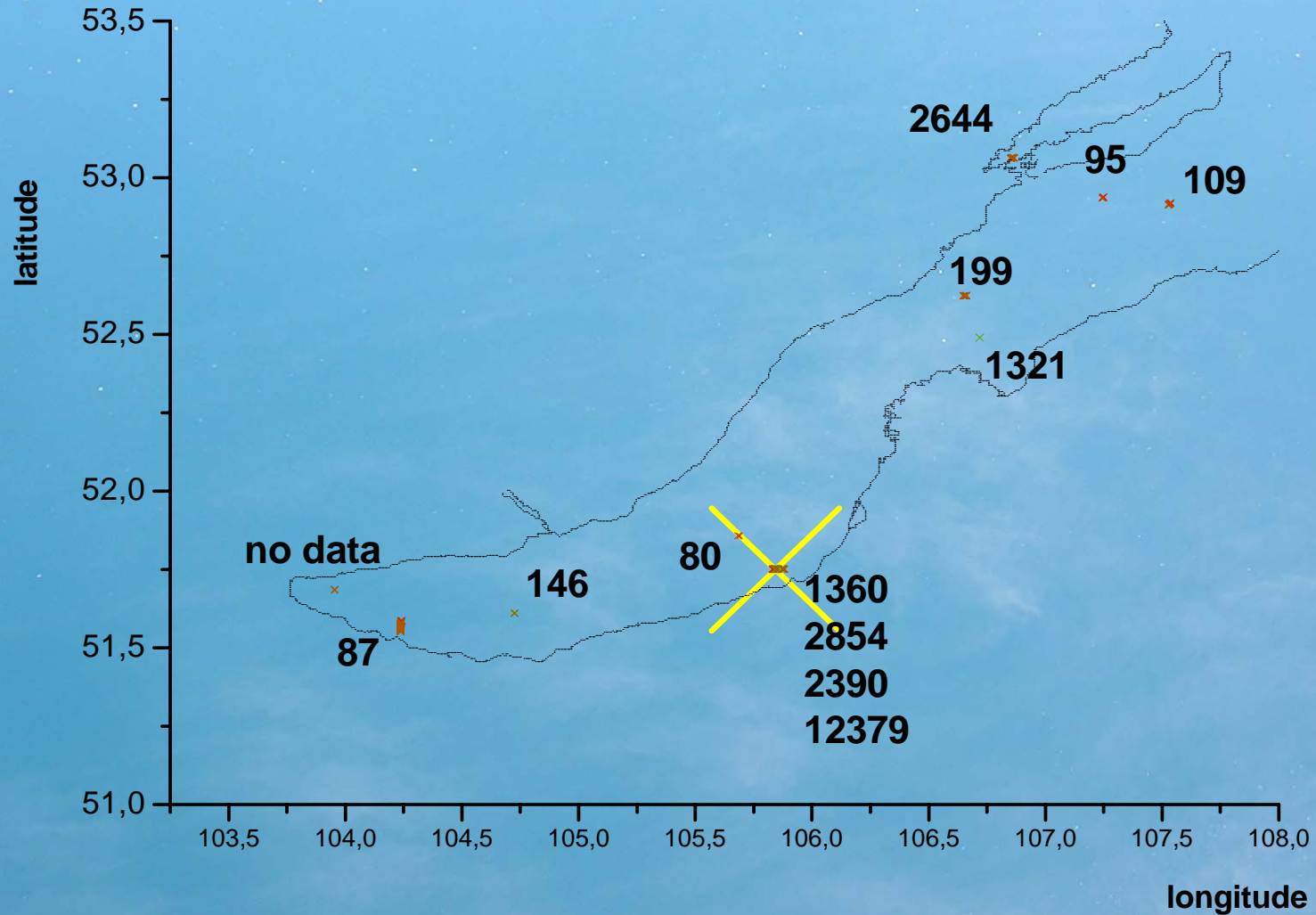
S - chamber area, m^2

t - acquisition interval, s

$V = 0.035 \text{ m}^3$

$S = 0.2 \text{ m}^2$

Flux measurements, methane surface water (IAO+POI)



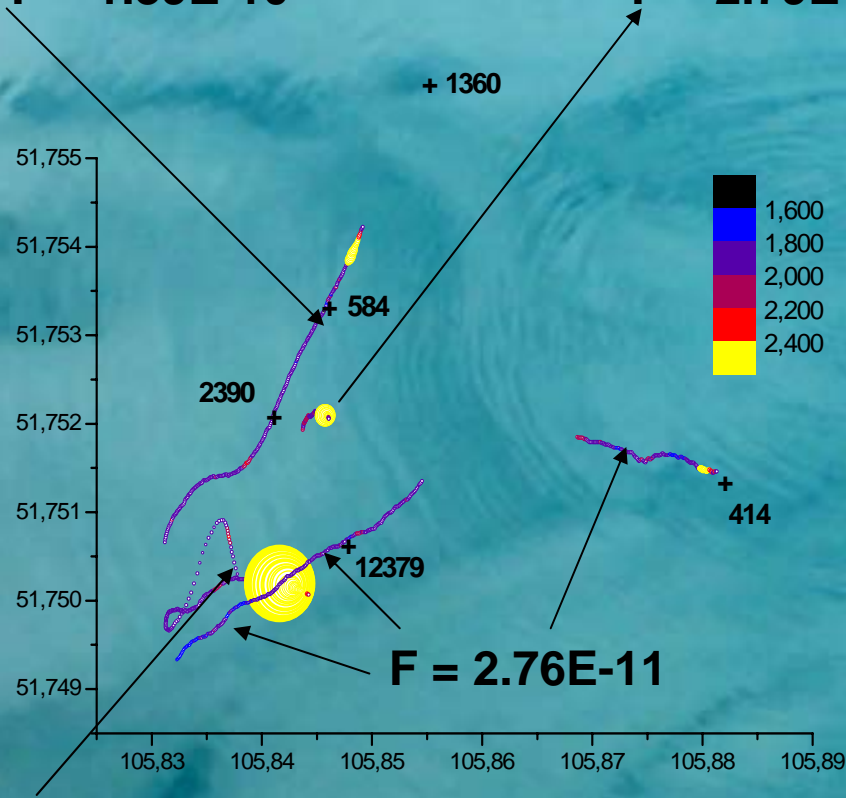
Flux measurements, methane surface water (IAO+POI)

19.06.04

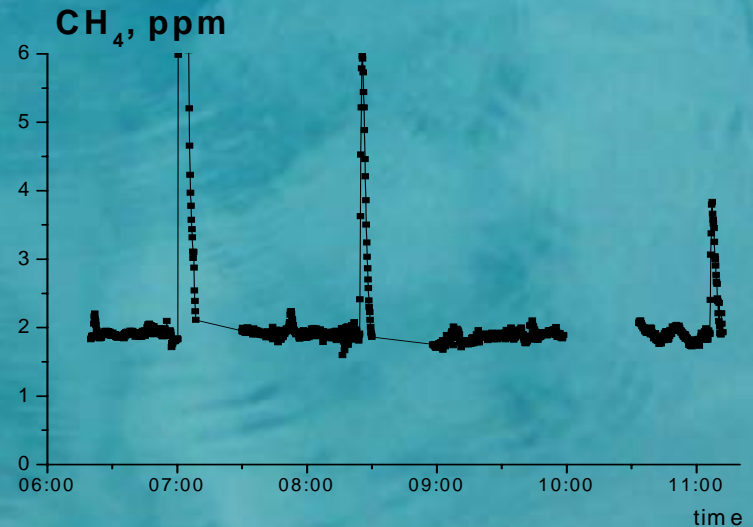
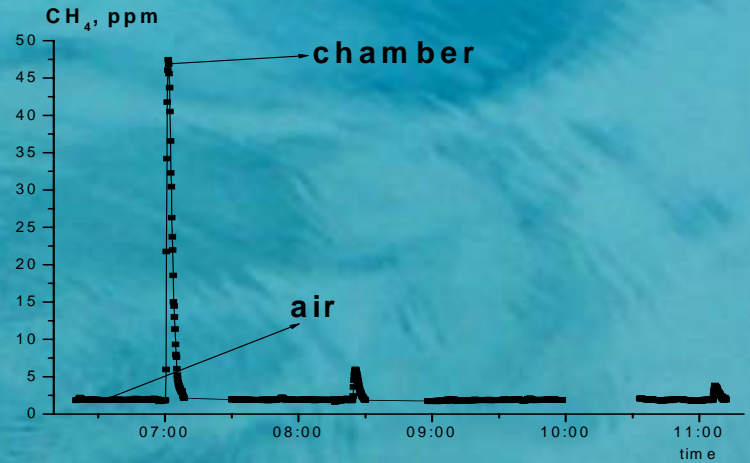
23.06.04

$F = 1.39E-10$

$F = 2.79E-10$



$F = 2.12E-9$



Methane flux in seep and non-seep areas in South and Middle Baikal (16-24 June 2004)

Date/ start time	Start position, latitude/longitude	End position, latitude/longitude	Storage time, s	C _{air} , ppm, (track average)	C _{cham} , ppm, (max)	Flux x10 ¹² , kg/s·m ²
17.06.04/ 15:30:03	51.6848/103.9560	51.6860/103.9550	7599	1.826(0.068)	1.788(0.03)	-0.5(1)
19.06.03/ 06:20:02 07:30:00 08:58:08	51.7502/105.8379 51.7506/105.8312 51.7493/105.8323	51.7502/105.8412 51.7538/105.8477 51.7515/105.8796	2411 3244 7670	1.915(0.066) 1.918(0.069) 1.878(0.078)	47.62(0.42) 5.95(0.045) 3.786(0.1)	2120(18) 139(1) 27.8(1.5)
20.06.04/ 16:12:03 18:42:48	52.9360/107.2435 52.9127/107.5270	52.9389/107.2497 52.9204/107.5378	3525 8948	1.866(0.05) 1.815(0.05)	1.92(0.02) 1.915(0.015)	1.7(1) 1.25(0.63)
21.06.04/ 16:08:06 21:22:04	53.0623/106.8517 52.6246/106.6612	53.0623/106.8513 52.6229/106.6601	1273 5884	1.882(0.025) 1.904(0.04)	2.086(0.02) 1.949(0.06)	17.9(2) 0.8(0.9)
22.06.04/ 06:43:05	52.4905/106.7180	52.4899/106.7184	1910	2.097(0.05)	2.187(0.044)	5.3(3)
23.06.04 13:02:03 17:32:12	51.8580/105.6893 51.7527/105.8381	51.8571/105.6830 51.7521/105.8456	6465 4787	1.876(0.063) 2.009(0.069)	2.688(0.049) 13.93(0.16)	14.1(1) 279(3)
24.06.04 01:37:08	51.6112/104.7263	51.6098/104.7247	12223	1.939(0.076)	2.27(0.036)	3(0.7)

Bolshie Koty, 8-16 June 2004

Point of air bleeding

