# Experimental investigation of snow cover regional contamination processes by the south of West Siberia cities

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The main stages and objectives of investigation:

1. Experimental investigation of regional contamination of environs by city areas of **Novosibirsk, Kemerovo, Tomsk and Barnaul**

3. Chemical and analytical investigation

5. Models of estimation of aerosol sedimentation fields

4. Computational analysis of experimental data (fields reconstruction, estimation of total eruption and componential composition)

I. Experimental investigations

Novosibirsk

Kemerovo

Barnaul

Tomsk
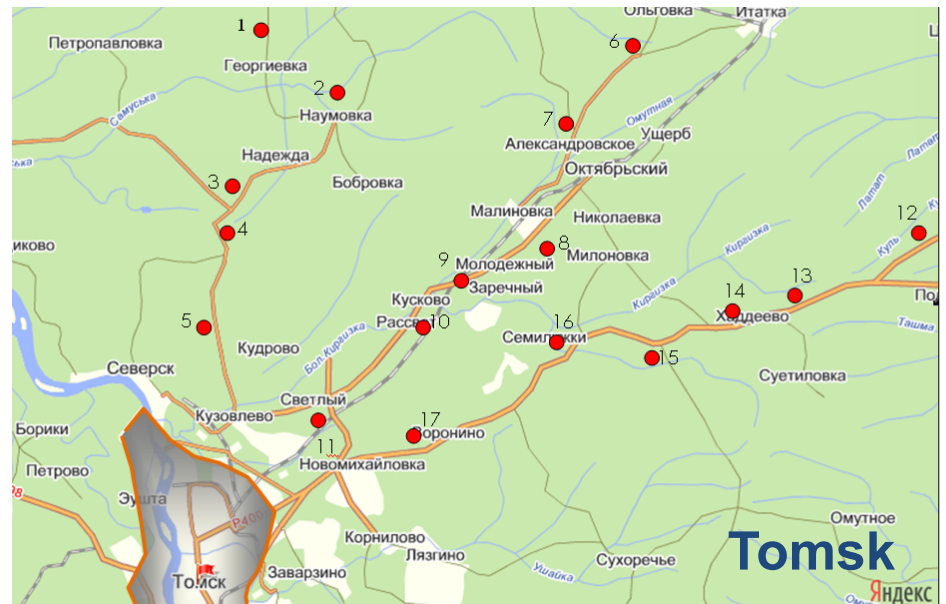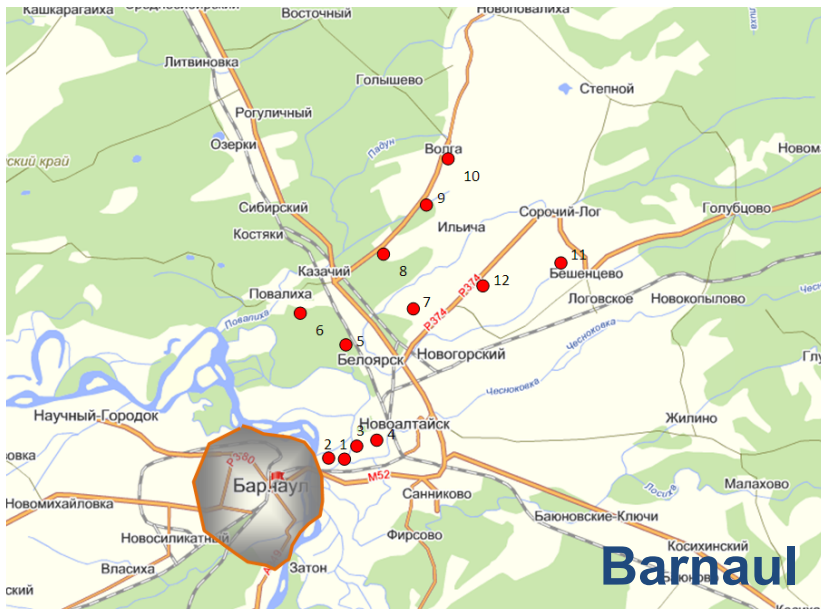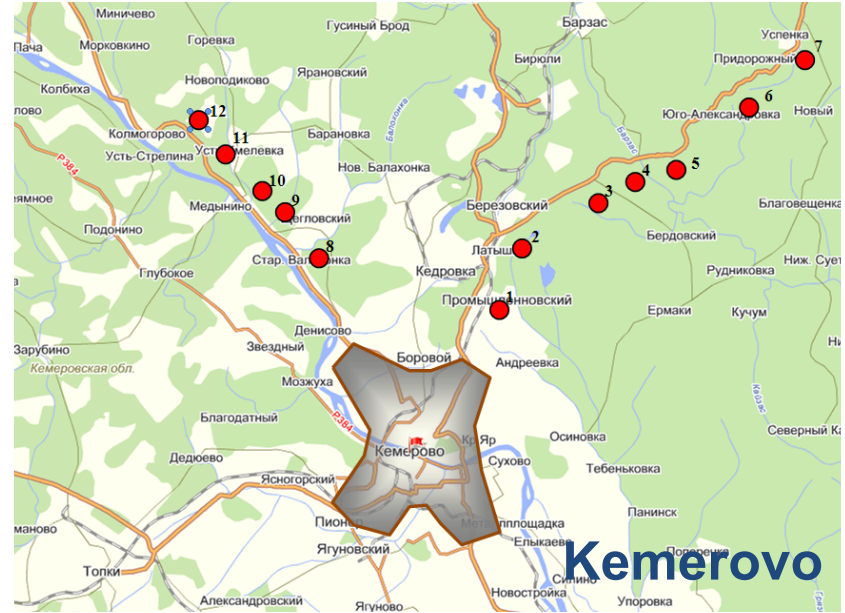
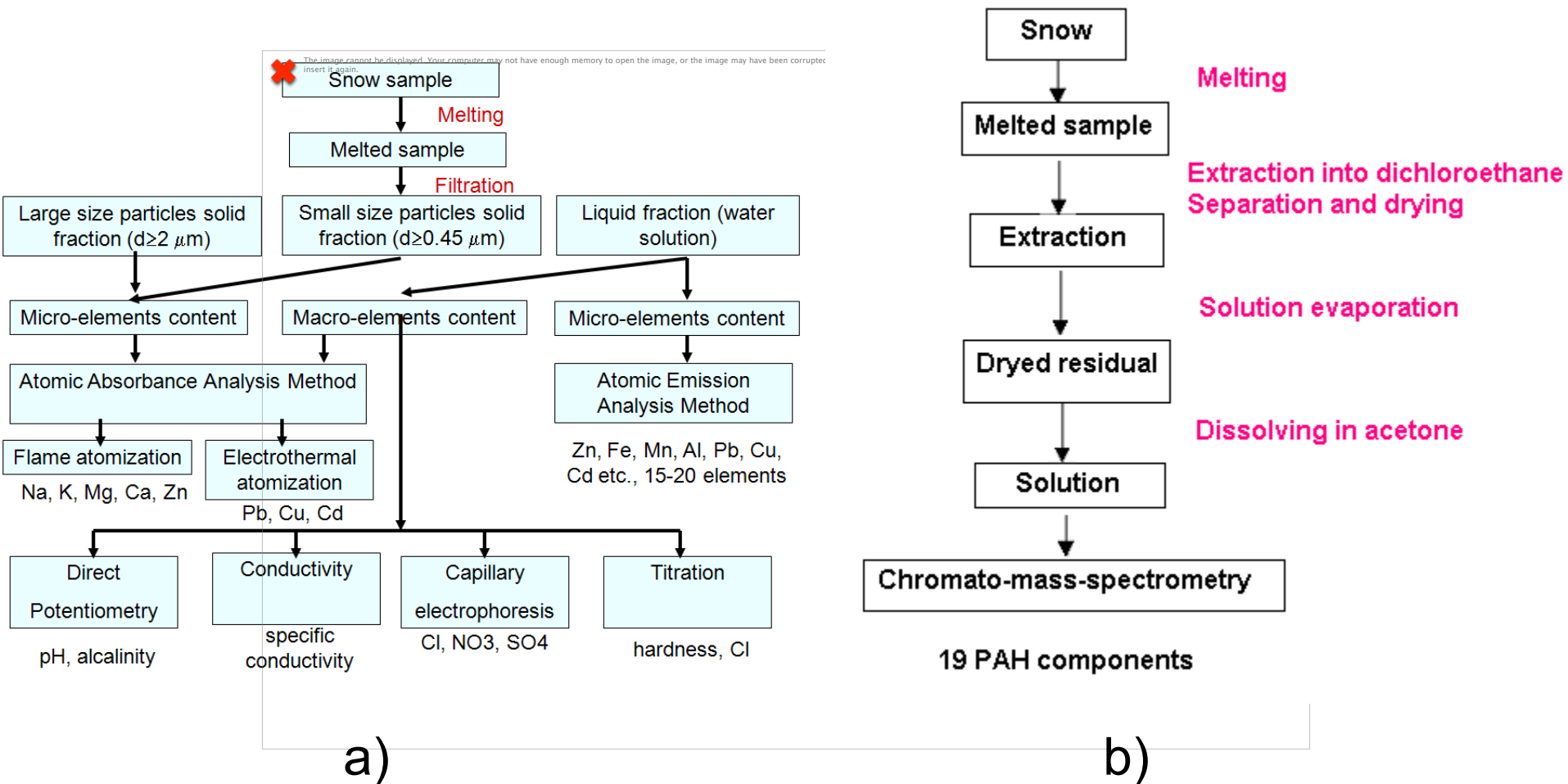# II. Chemical and analytical investigations

a)

b)

Fig. 1. Inorganic (a) and organic (b) components of snow determination schemes

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III. Models of estimation of aerosol sedimentation fields

1) Point-type source

$$\overline{q}(r,\varphi) = \frac{M \cdot g(\varphi)}{2\pi \cdot u \cdot h \cdot r}, \qquad \textbf{(1)}$$

$$\overline{p}(r,\varphi) = \frac{\theta \cdot g(\varphi)}{r}, \qquad \theta = \lambda \cdot M /(2\pi \cdot u \cdot h), \qquad \textbf{(2)}$$

$$\overline{p}(r,\varphi) = \frac{\lambda \cdot Mg(\varphi)}{2\pi r} \iint\limits_{\Omega} \frac{B(u',h')}{u' \cdot h'} d\Omega = \frac{\theta' \cdot g(\varphi)}{r} \qquad \textbf{(3)}$$
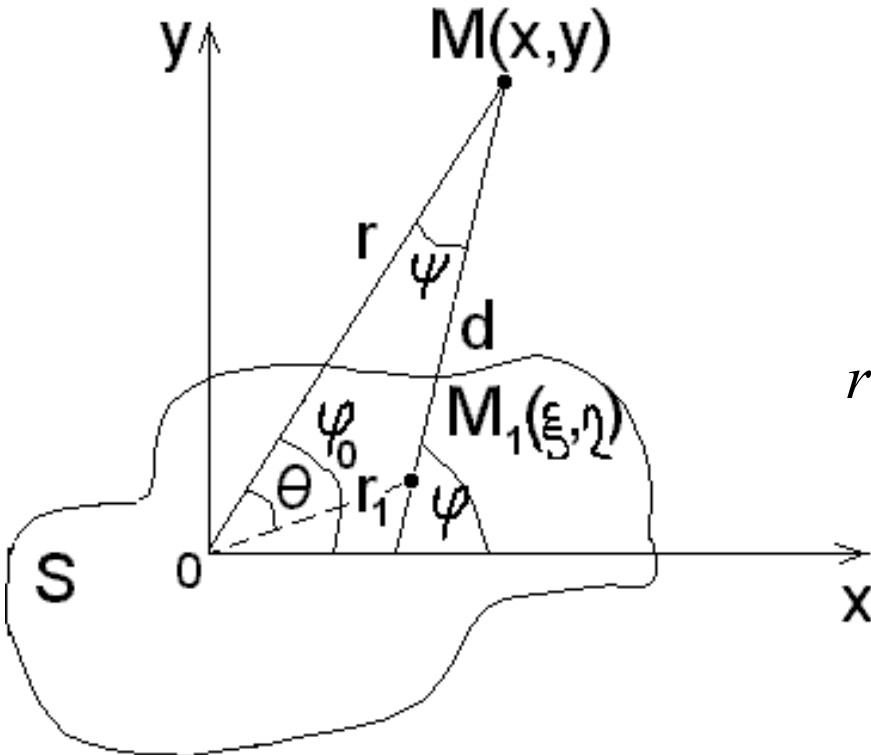
$$\theta' = \frac{\lambda \cdot M}{2\pi} \iint\limits_{\Omega} \frac{B(u',h')}{u' \cdot h'} d\Omega$$

2) *Area-type source*

$$Q(x,y) = \frac{\lambda}{2\pi u h} \iint_S \frac{m(\xi,\eta)G(\varphi + 180°)}{d} d\xi d\eta \quad \textbf{(4)}$$

$$\varphi(\xi,\eta,x,y) = arctg\left(\frac{y-\eta}{x-\xi}\right), \quad d = |M_1 M| = \sqrt{(x-\xi)^2 + (y-\eta)^2}$$

Asymptotic row

$$\frac{1}{d} = \frac{1}{r\sqrt{1+\alpha^2 - 2\alpha\mu}}$$

$$r = |OM|, \quad r_1 = |OM_1|, \quad \alpha = \frac{r_1}{r}, \quad \mu = \cos\theta$$

$$\frac{1}{d} = \frac{1}{r}\sum_{n=0}^{\infty}\alpha^n P_n(\mu) \quad \textbf{(5)}$$

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$$Q(x,y) = \frac{c}{r} \sum_{n=0}^{\infty} \iint_S \alpha^n P_n(\mu) m(\xi,\eta) g(\xi,\eta,x,y) d\xi d\eta = Q_1 + Q_2 + Q_3 + \ldots$$

$$Q_1(x,y) = \frac{c}{r} \iint_S m(\xi,\eta) \left\{ g(\varphi_0) + \left(\frac{\pi}{2} - 1\right) g'(\varphi_0) - g'(\varphi_0) \left(\frac{x}{r^2}\xi + \frac{y}{r^2}\eta\right) \right\} d\xi d\eta =$$

$$= \theta_1 \frac{g(\varphi_0) + \left(\frac{\pi}{2} - 1\right) g'(\varphi_0)}{r} + \theta_2 \frac{g'(\varphi_0)x}{r^3} + \theta_3 \frac{g'(\varphi_0)y}{r^3}$$
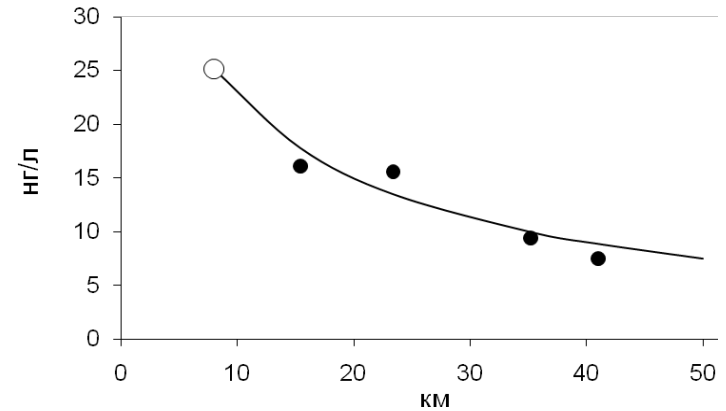
Remark

$$g'(\varphi) \approx 0$$

IV. Numerical analysis of experimental data

Novosibirsk

Бенз(а)пирен С-В (Новосибирск)

Кальций С-В (Новосибирск)
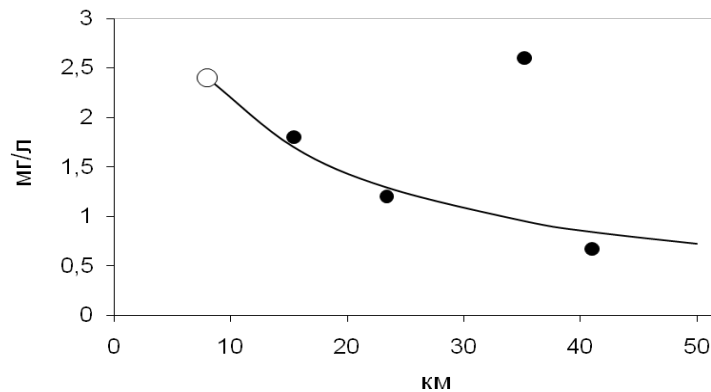
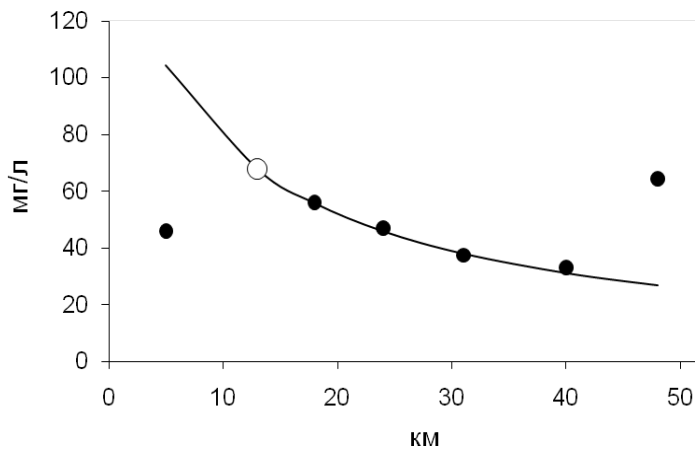Бенз(а)пирен ССЗ (Новосибирск)
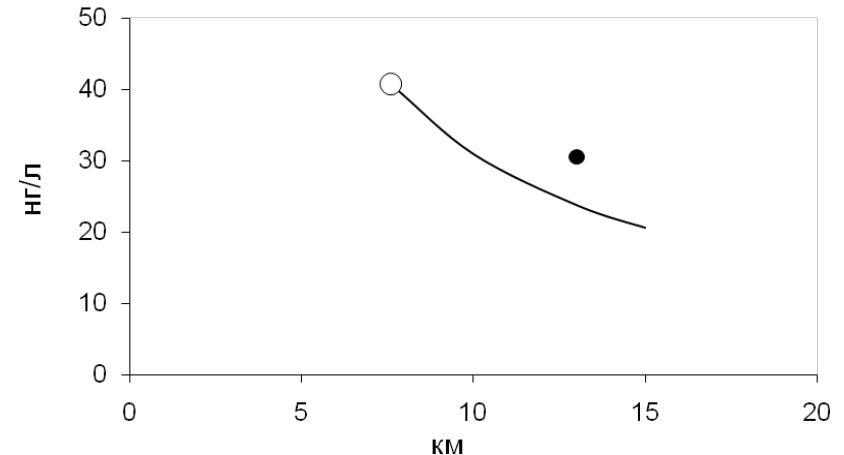
O - basic points, ● - points for control
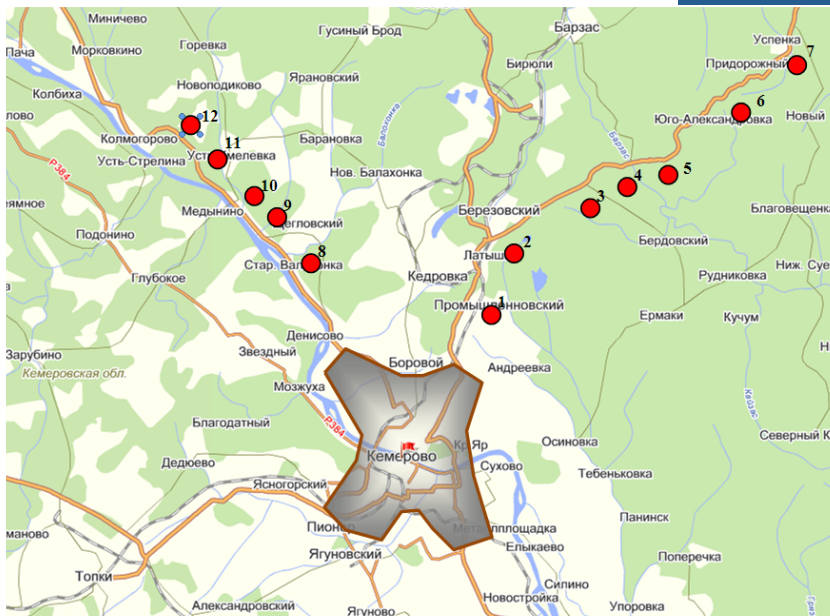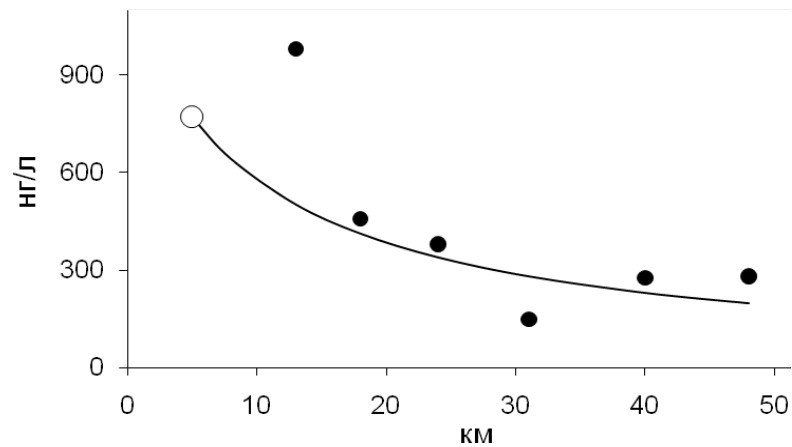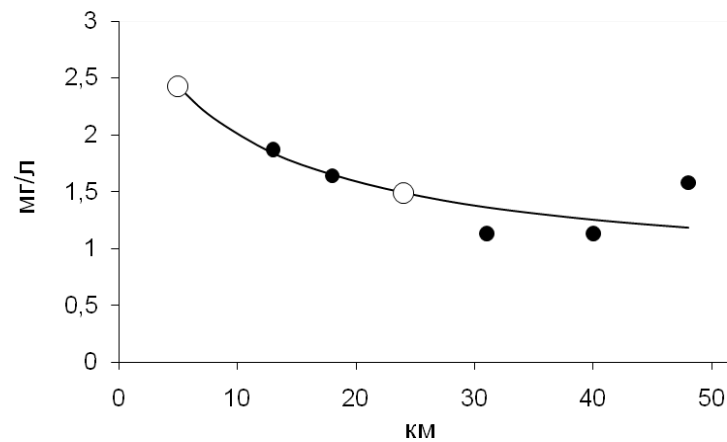
Kemerovo

Barnaul

Scheme of stationary meteo-posts location in the city of

Comparison of average logarithms of PAH concentration (ng/L) for **Barnaul** meteo-posts and the city trace
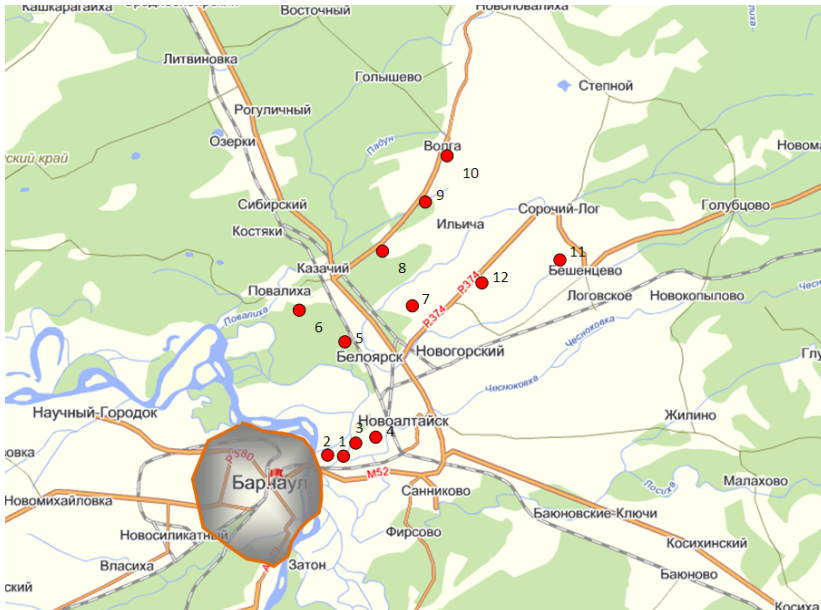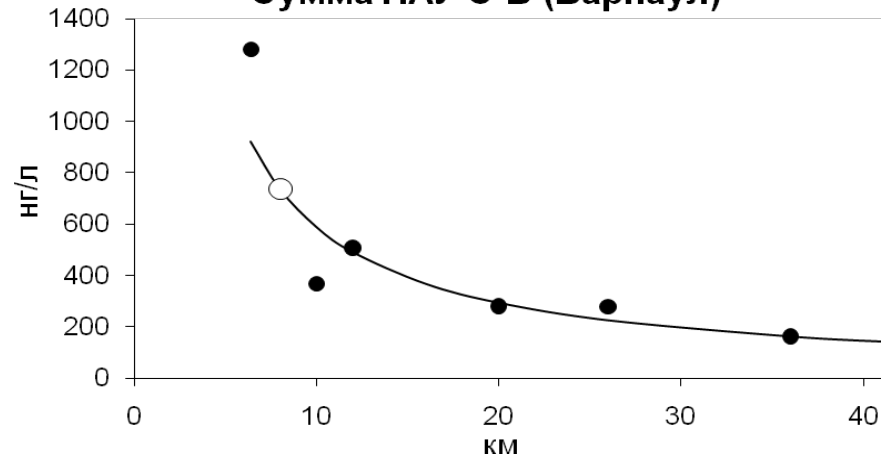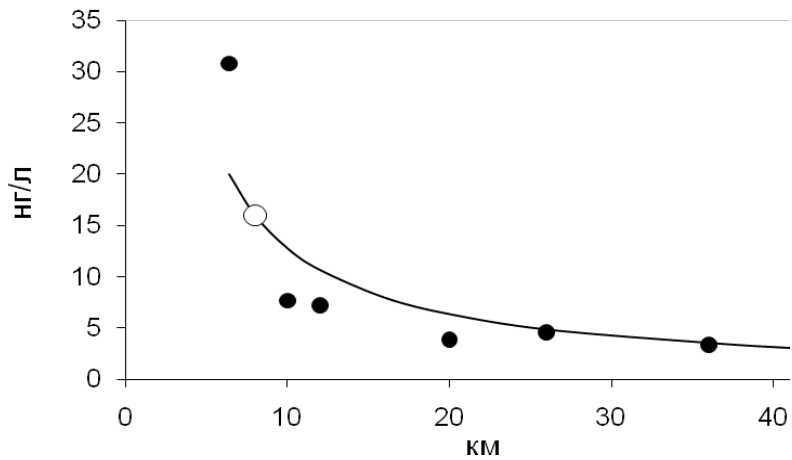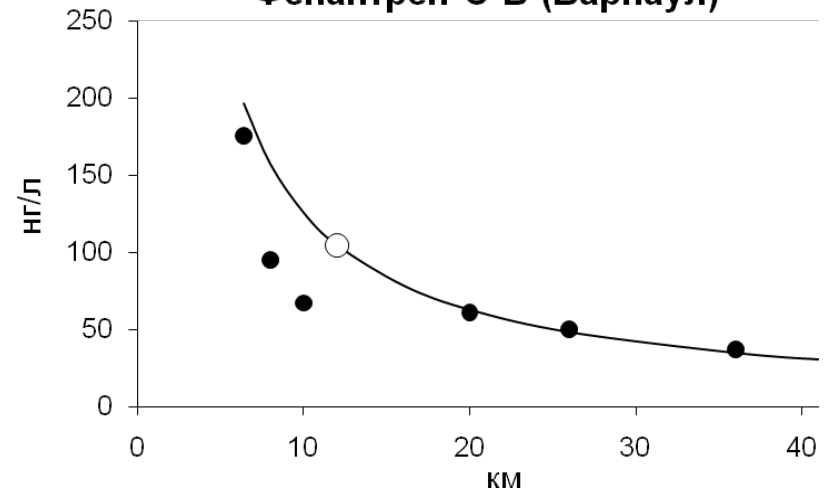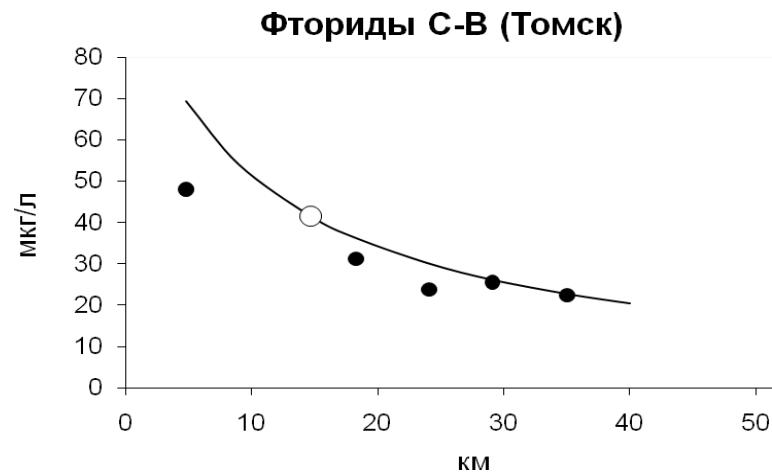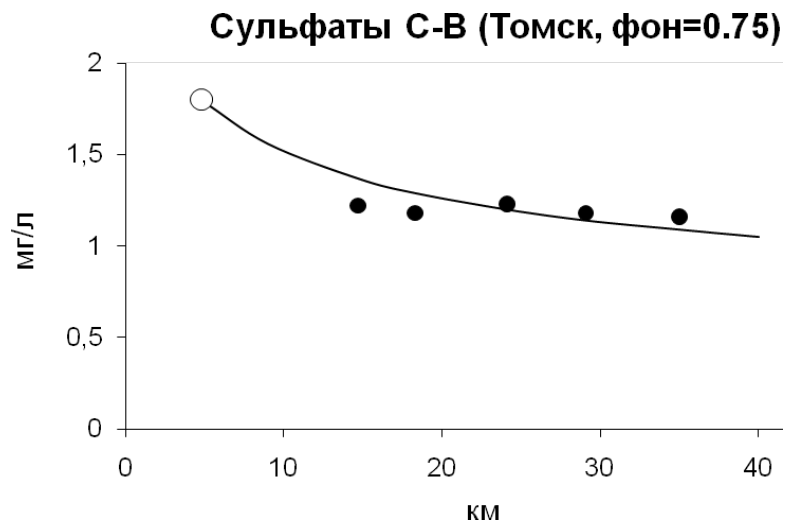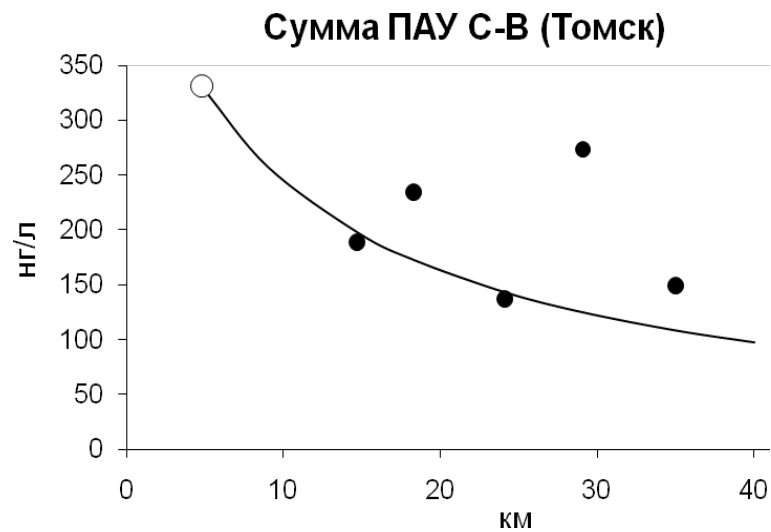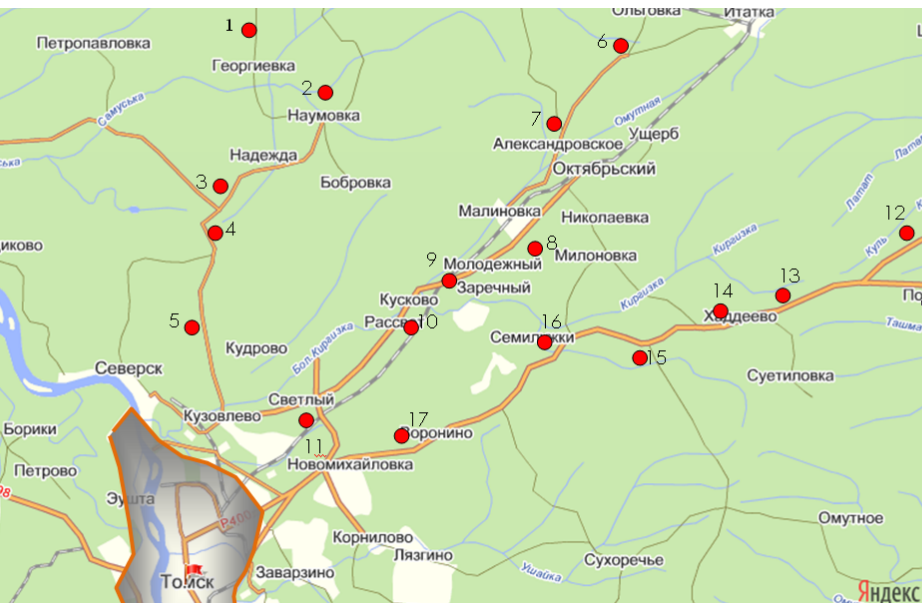
Tomsk

Seversk (Tomsk region)
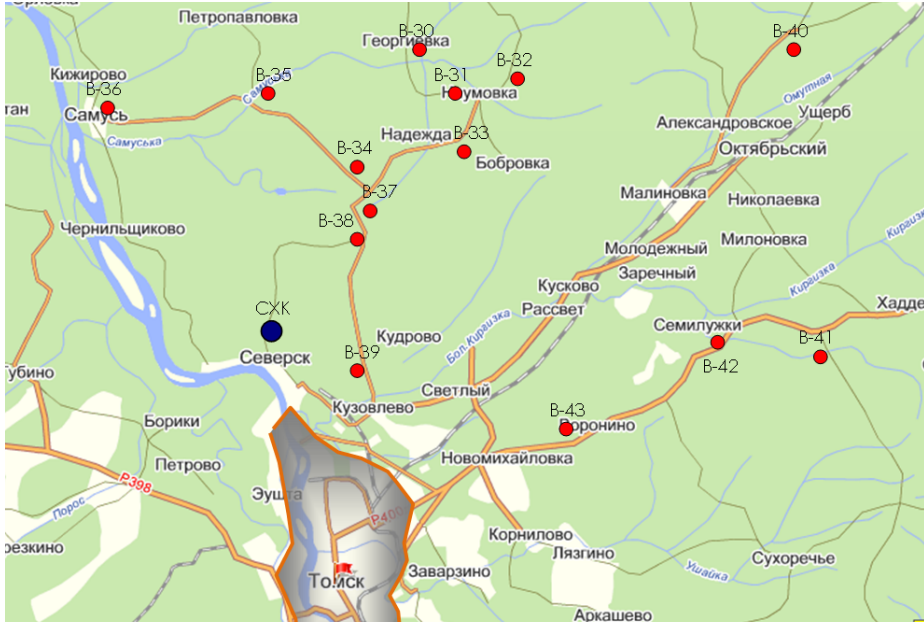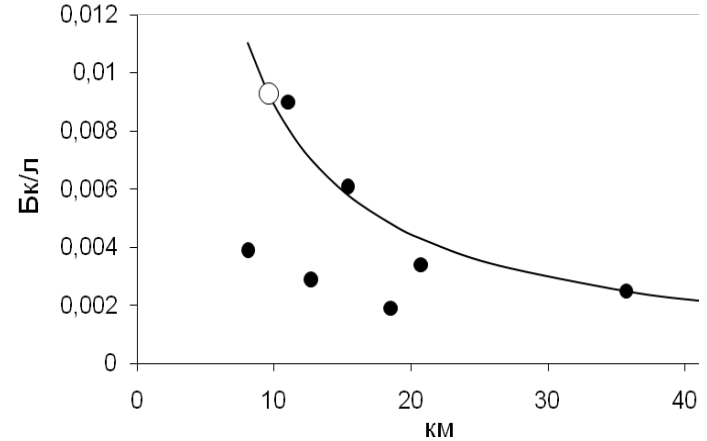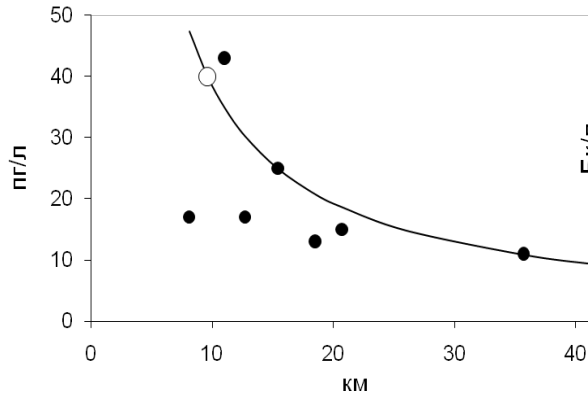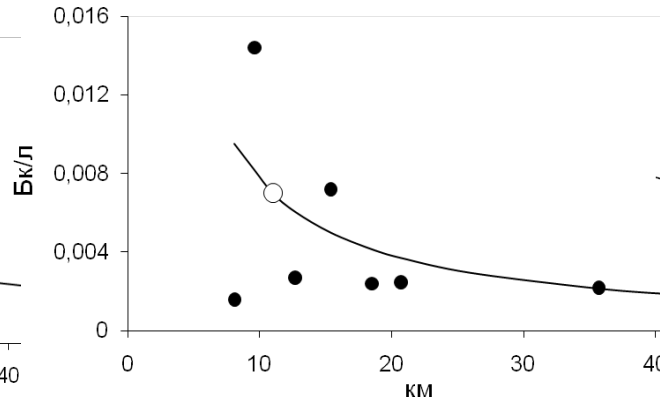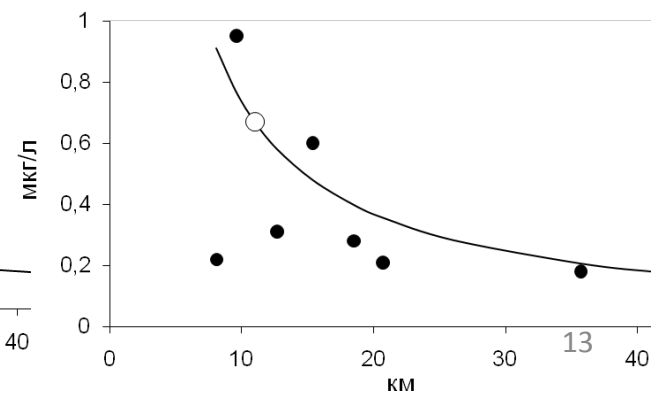
Measured and reconstructed according to model activity and quantity of sediments of ^{234}U and ^{238}U in the Noth-East direction from SChC

Conclusion

- Experimental and chemical-analytical studies of polycomponent contamination of snow cover in vicinities of large city areas of West Siberia south were organized. The low-parametric models of reconstructions of the long regional aerosol fallouts from area sources were worked out.

- Using numerical methods for experimental data analysis, the quantitative regularities of regional trace contamination fields of dust, heavy metals, PAH, ionic composition are obtained.

- It was shown that snow cover is a reliable quantitative indicator of atmosphere contamination by verious organic substances, macro- and microcomponents. Snow control is an economical method for estimation of long-term contamination of city territory and its environs.

Thanks for
Your attention