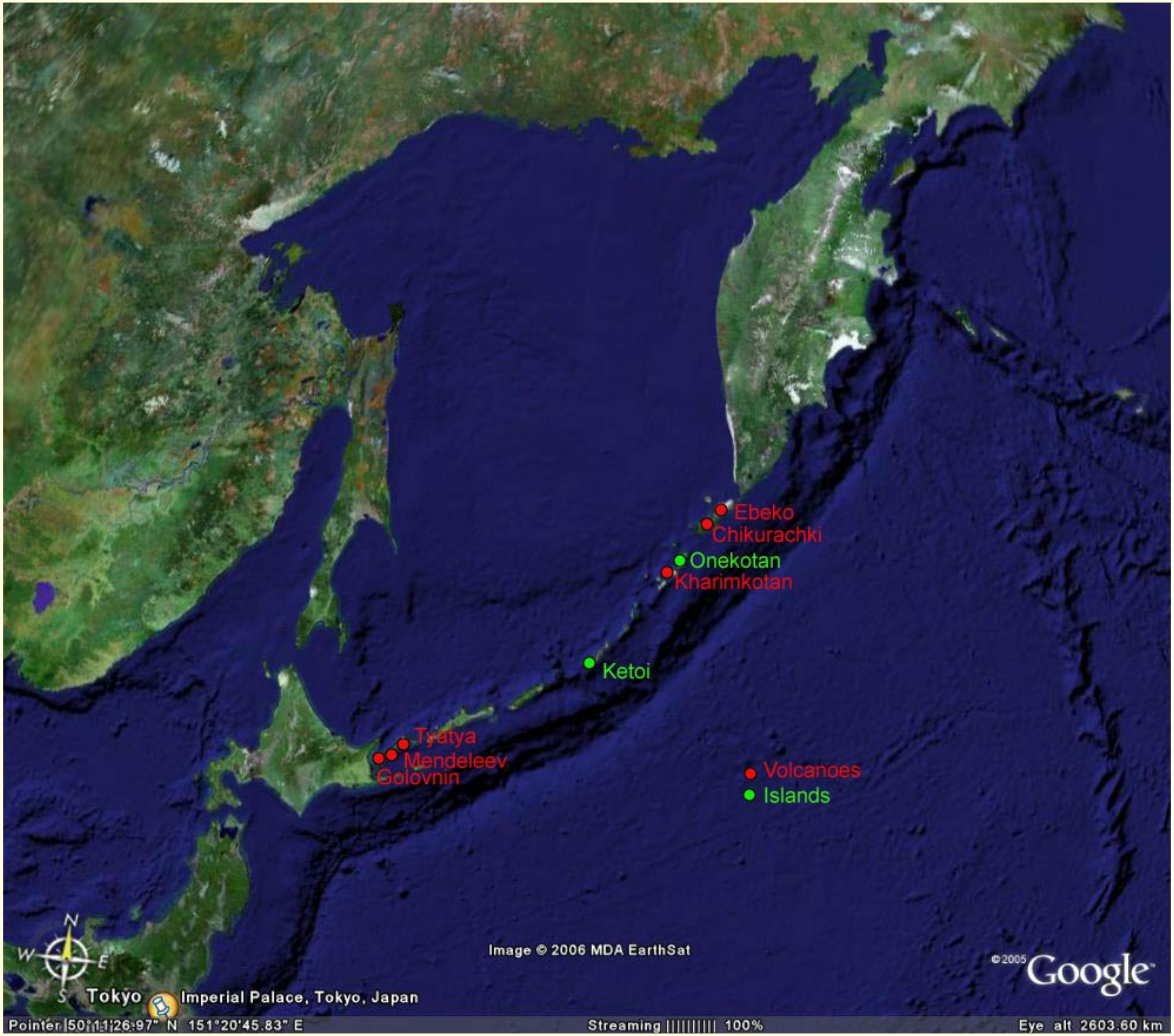
NUMERICAL RECONSTRUCTION OF VOLCANIC ASHES SEDIMENTATION FIELDS

T.V. Jaroslavtseva, V.F. Raputa

Institute of Computational Mathematics and Mathematical Geophysics, Siberian Branch of the Russian Academy of Sciences , Novosibirsk, Russia

1. Experimental research



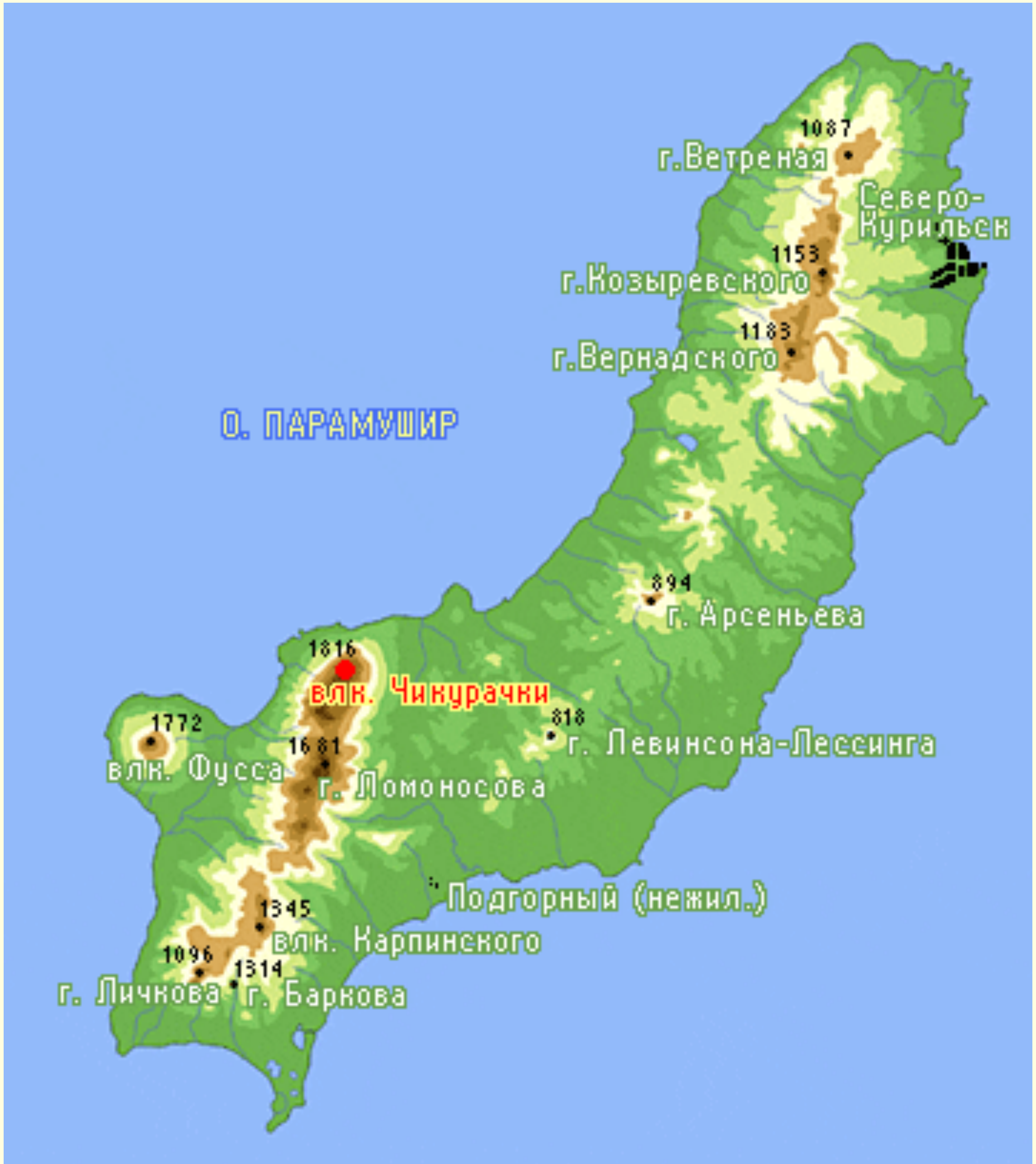


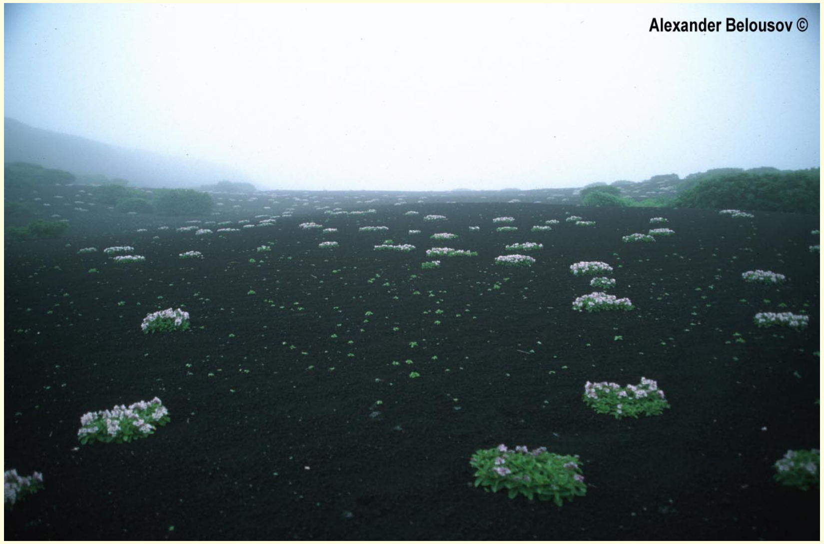
Fig. 2.

Island of Paramushir, Kuriles.

Volcano of Chikurachki

The volcanic eruptions (2003, 2007)

Tephra after the eruptions of 1853 and 1986



2. Inverse problem setting

$$\frac{H}{w} = \frac{x}{U} \tag{1}$$

$$f(x,y) = \frac{1}{\sqrt{2\pi\varphi_0 x}} e^{-\frac{y^2}{2\varphi_0{}^2 x^2}} \tag{2}$$

$$N(w) = \frac{a^{n+1}}{\Gamma(n+1)} w^n e^{-aw}, \quad n \geq -1, \quad a = \frac{n}{w_m} \tag{3}$$

$$P\left(x, y, \vec{\theta}\right) = \theta_1 x^{\theta_2} \exp\left(-\frac{\theta_3}{x} - \frac{\theta_4 y^2}{x^2}\right), \qquad \textbf{(4)}$$

$$\theta_1 = \frac{T\,a^{n+1}\left(U\,H\right)^n}{\sqrt{2\pi}\varphi_0 \Gamma\left(n+1\right)}, \quad \theta_2 = -n-1, \quad \theta_3 = a\,U\,H, \quad \theta_4 = \frac{1}{2\varphi_0^2}$$

$$J\left(\vec{\theta}\right) = \sum_{j=1}^{M} \sigma_j^{-2}\left[r_j - P\left(x_j, y_j, \vec{\theta}\right)\right]^2 \to \min_{\vec{\theta} \in \Omega} \qquad \textbf{(5)}$$

3. Numerical reconstruction

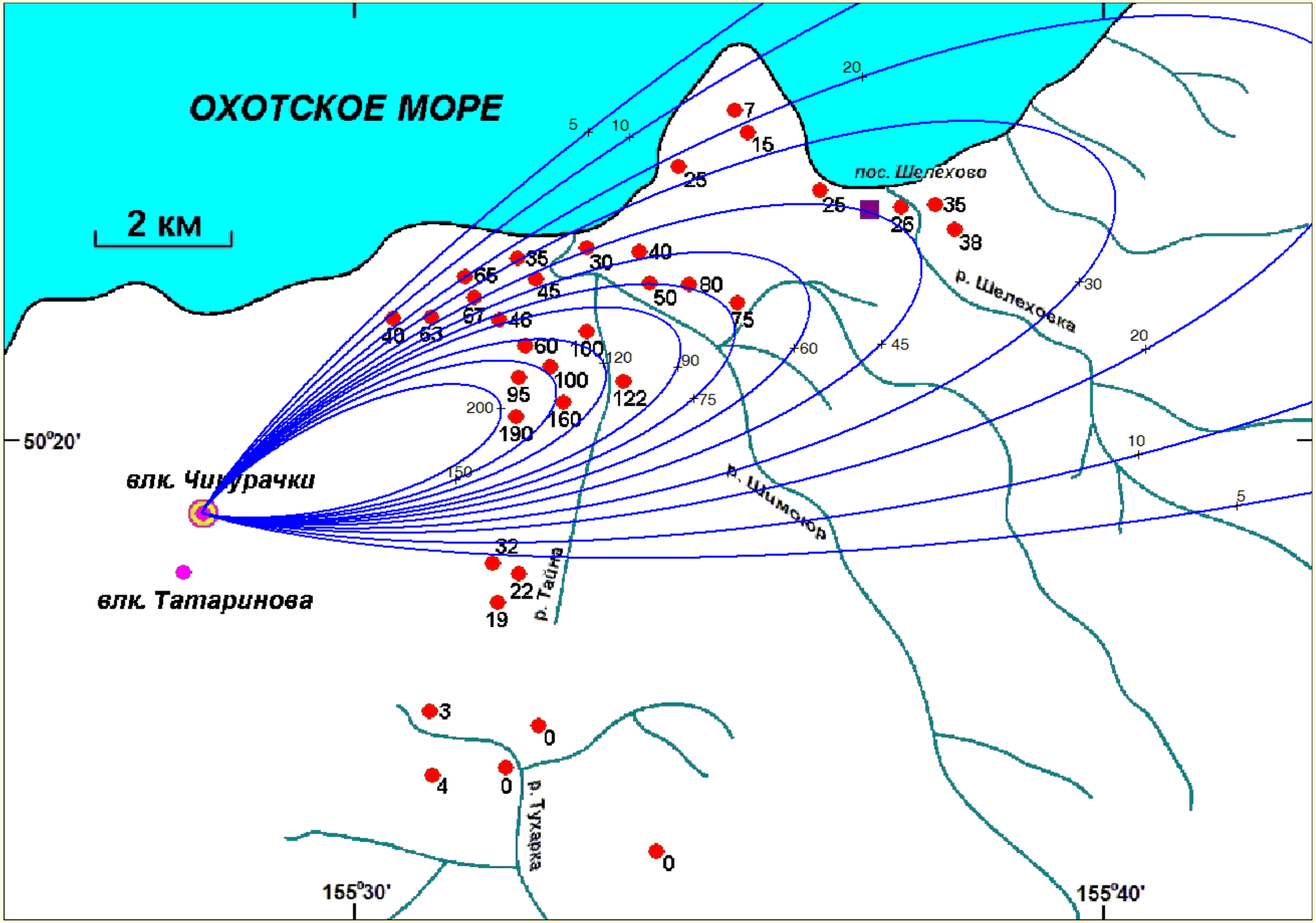


Fig. 2. Scheme of sampling tephra around Chikurachki volcano eruption in [1853.](#) Recovered by model (4) field fallout. ● - position of sampling points.

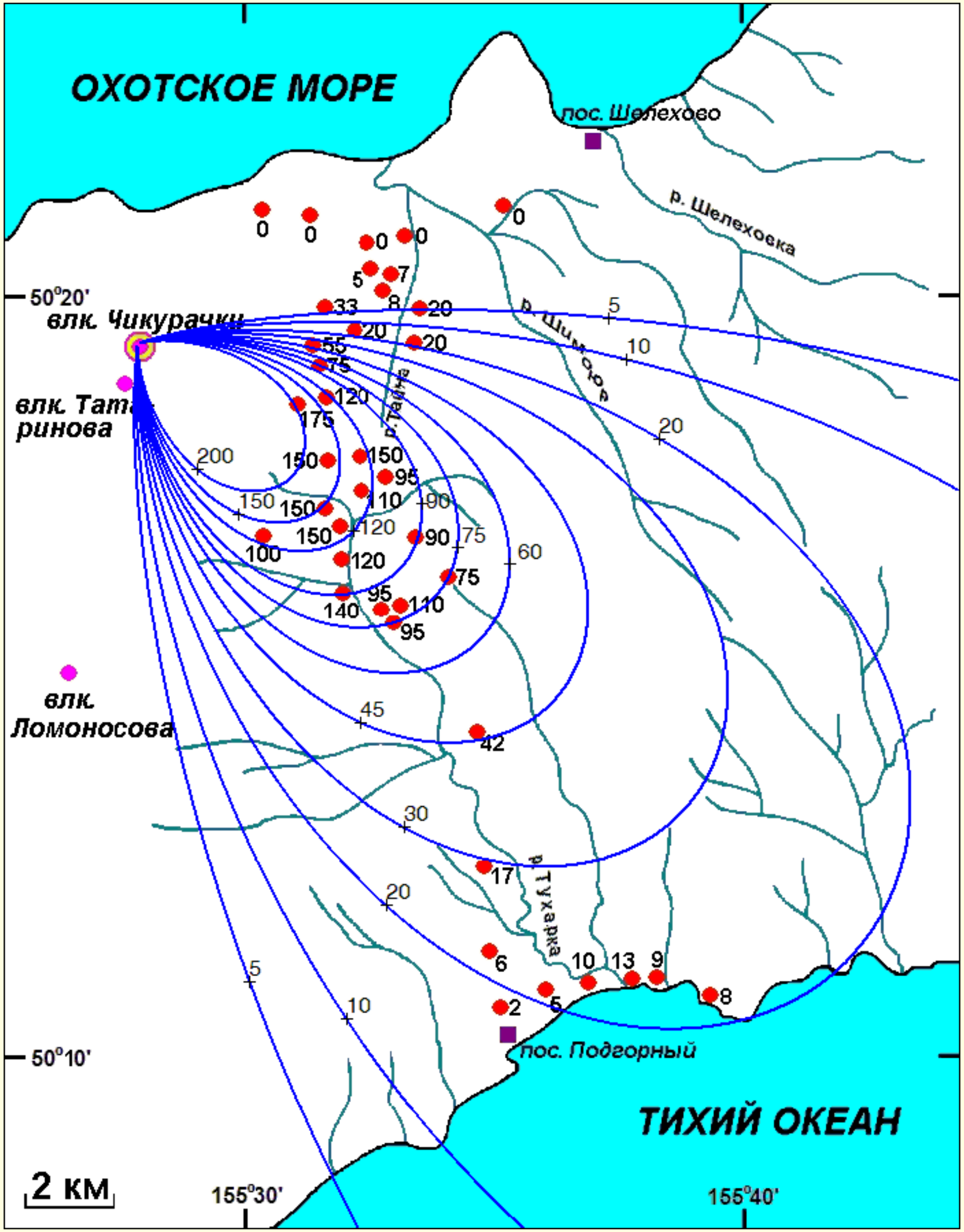


Fig. 3. Scheme of sampling tephra around Chikurachki volcano eruption in **1986.**

Recovered by model (4) field fallout.

● - position of sampling points.

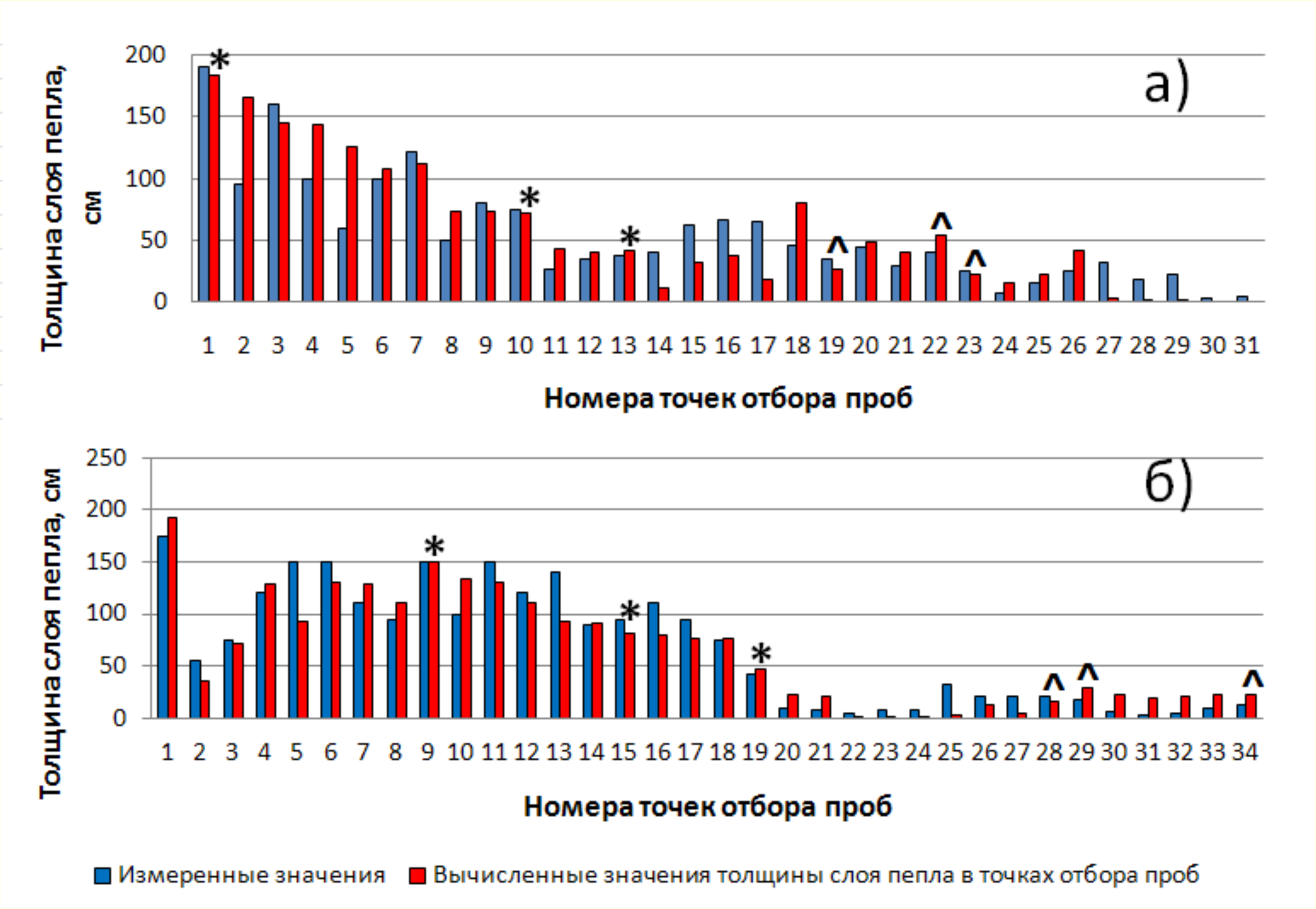


Fig. 4. Measured and numerically reconstructed layer thickness of fallout tephra in probotbora points:

а) The eruption in **1853**, **б)** eruption in **1986**

Conclusion

- Developed few-parametric model of fallout polydispersed reconstruction allows numerical analysis of observational data across the wake axis;

- This is particularly important in estimating the volume of ash fallout, even at significant distances from the volcano;

- For the reconstruction of the field deposition can be used very limited number of measurement points, which creates certain advantages in the analysis of available data.

Thanks
for attention

Извержение Эйяфьяллайекюль (Исландия)