The verification of the atmosphere boundary layer model by means of the Wangara data

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АПРОБАЦИЯ ЧИСЛЕННОЙ МОДЕЛИ ПОГРАНИЧНОГО СЛОЯ АТМОСФЕРЫ НА ОСНОВАНИИ ДАННЫХ ЭКСПЕРИМЕНТА WANGARA

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The purpose:
The approbating of one-dimensional numerical model for atmospheric boundary layer to reproduce its thermodynamic structure

Basic equations:

$$\frac{\partial u}{\partial t} = -\frac{\partial}{\partial z}\overline{u'w'} + f\left(v - v_g\right) \qquad \frac{\partial v}{\partial t} = -\frac{\partial}{\partial z}\overline{v'w'} - f\left(u - u_g\right)$$

$$\frac{\partial \theta}{\partial t} + A = -\frac{\partial}{\partial z}\overline{\theta'w'} + \varepsilon_\tau + \varepsilon_f \qquad \frac{\partial q}{\partial t} = -\frac{\partial}{\partial z}\overline{q'w'} - \varepsilon_q$$

'b-l' closure:

$$\frac{\partial b}{\partial t} = -\left(\overline{u'w'}\frac{\partial u}{\partial z} + \overline{v'w'}\frac{\partial v}{\partial z}\right) + \lambda\overline{\theta_v'w'} - \varepsilon - \frac{\partial}{\partial z}\overline{w'b} \qquad k_u = l_u\sqrt{b} \qquad \varepsilon = \frac{cb^{3/2}}{l}$$

The turbulent fluxes are parameterezated by gypotesis Businesqe:

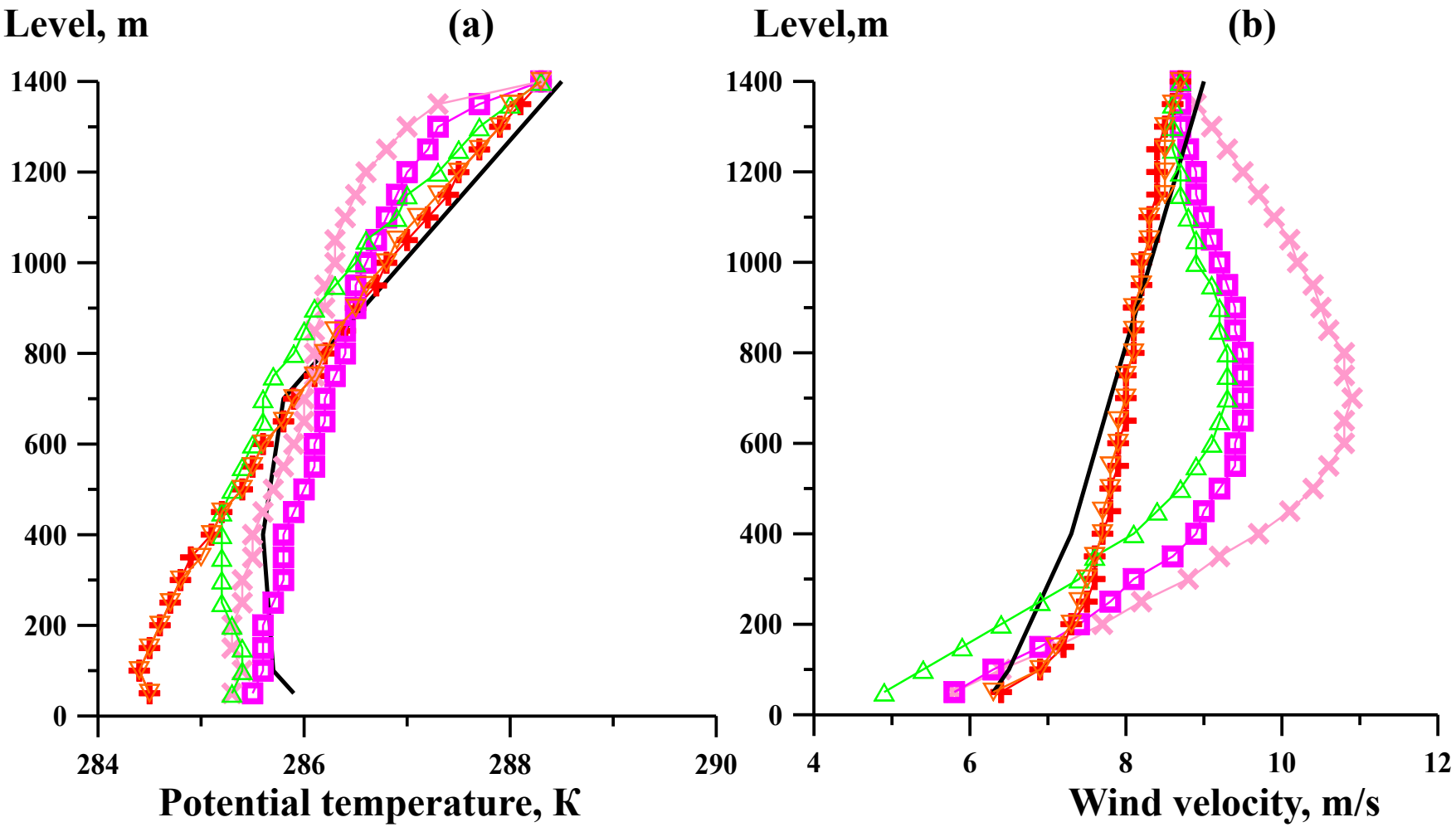
$$\overline{S'w'} = -K_S\left(\frac{\partial S}{\partial z} - \gamma_S\right)$$

Table 2 – Experiments with "Well corresponded to data": $\left.\begin{matrix} r_{xy} > 0,5 \\ k_{ij} < 0,3 \end{matrix}\right\}$ *on levels* ≥ 3

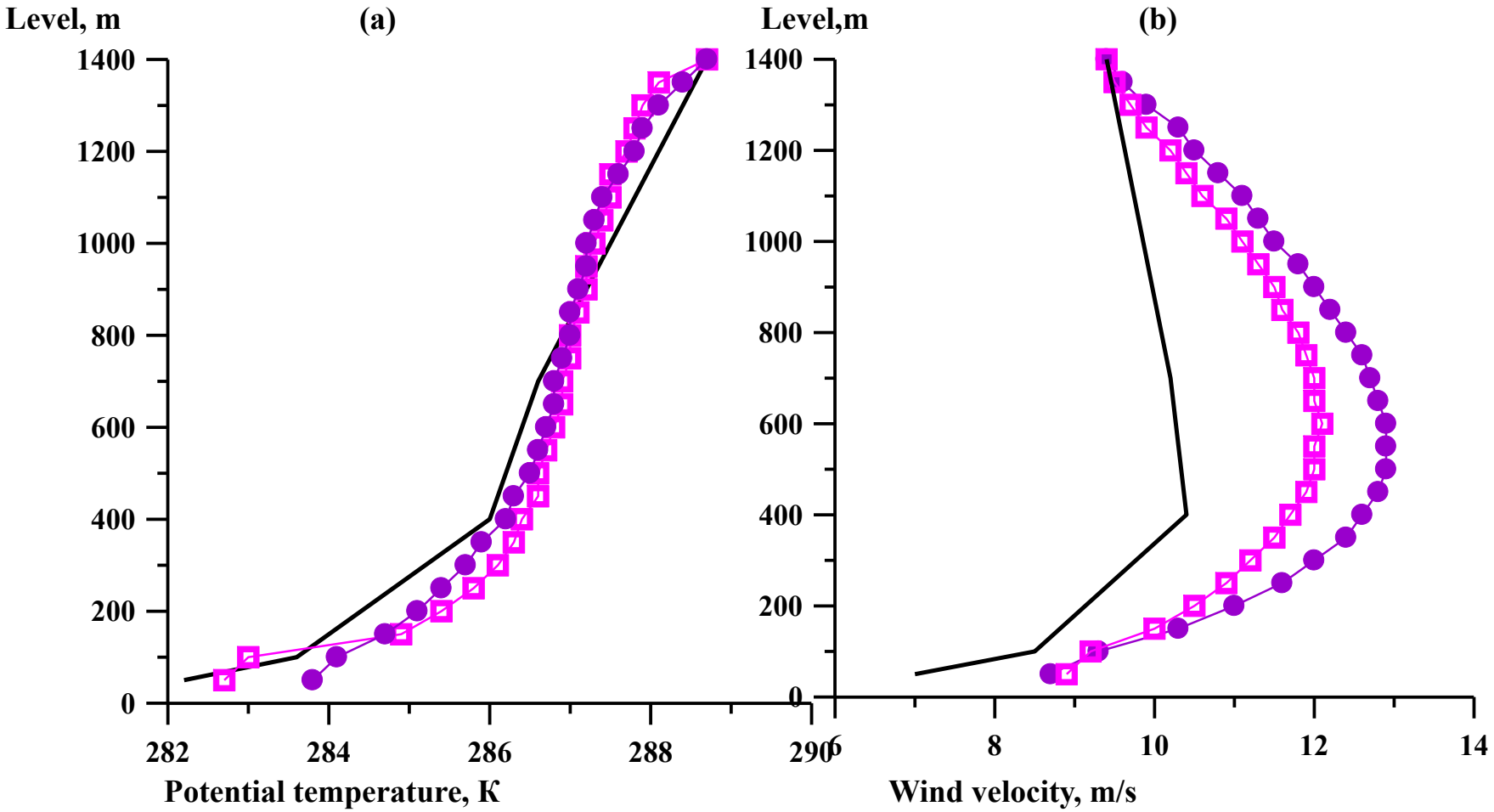
Time	9 h	12 h	15 h	18 h	21 h	24h
Experiments	E8 E9 E10	E0 E2 E5 E6 E8	E0 E1 E2 E4 E5 E6 E8	E1 E5 E6 E8 E9 E10	E2 E4	E2 E4

Averaged vertical profiles meteorological values (Black curve – fact) & calculated 12 hour,

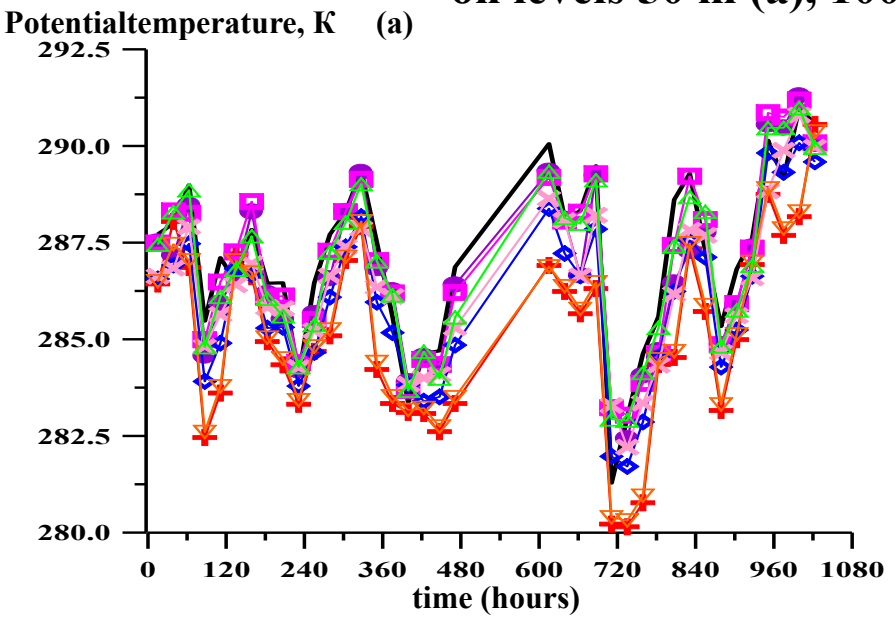
Exp. E0, E2, E5, E6, E8

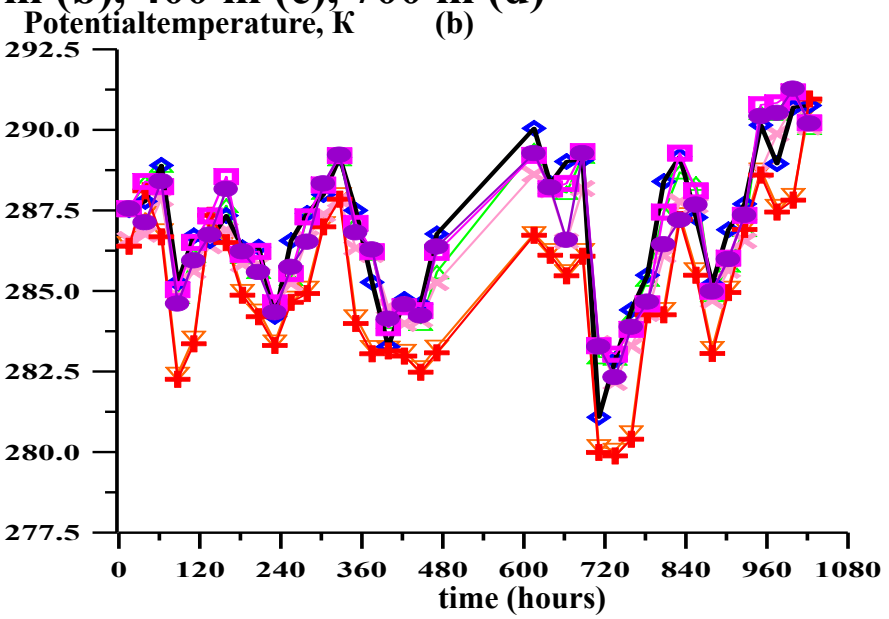


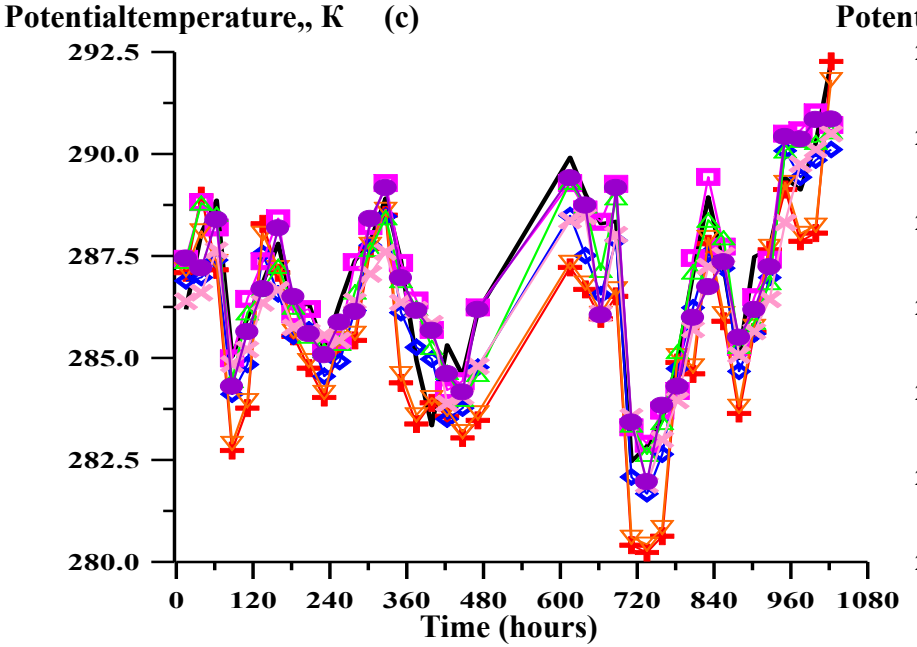
Averaged vertical profiles meteorological values (Black curve – fact) & calculated 24 hour, exp. E2, E4

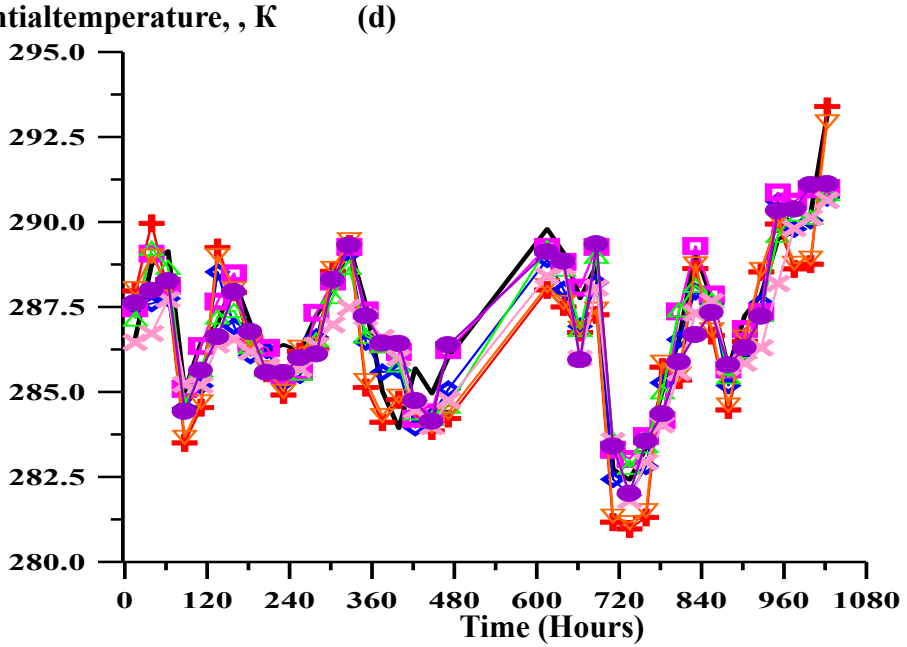


Temporal variability of Fact (black curve & calculated meteorological values 15 hour from Exp. E0, E1, E2, E4, E5, E6, E8 on levels 50 m (a), 100 m (b), 400 m (c), 700 m (d)









CONCLUSIONS

- 1. Well-mixed ABL may be parameterized by means of the one-and-a-half closure technique, in which the simplest expressions for determination of the mixing length and the first closure technique are applied.
- 2. In spite of application of the special approaches to determination of the eddy diffusivity, at the night hours (3- and 6-hour terms), almost all experiments, except the first closure technique, show a poor correlation between the modeled and observed data for the wind velocity, though for the temperature the correlation is good.
- 3. For the morning and evening hours the simulation of the ABL structure is satisfactory by means of the first closure technique, but with the eddy diffusivity, obtained from the higher closure models.