It still contains the kind of grammatical errors that were rife in the original.

Together with our experienced co-authors and team mates we read the manuscript carefully many times and fixed spotted grammar issues. However, we understand, that we could miss some minor things. If it turns out to be such crucial we will give our manuscript to the professional proof reading company for the next round of the review.

'wall function' – While the term is familiar to many, T.J. Craft of the Manchester School of Mechanical Aerospace and Civil Engineering mentions fourteen different approaches in an article on Wikipedia. For purposes of doing an adequate review, as well as for the general readership of HESS, a specific reference (there are three in the paper) and an equation are necessary. This particularly important since it appears that the wall function the authors chose, provides the basis for the simple model embodied in Eq. 1-3.

The temperature distribution in the turbulent boundary layer follows the logarithmic low except for the thin wall layer for the flows with very high Reynolds numbers (Landau and Lifshitz, 1987) (Pg. 9, 15-16 in the old manuscript). This low and hence our analytical approximation are not based on the wall functions. Wall functions are just numerical technique, which provide near-wall boundary conditions, so that the viscous sublayer does not have to be resolved.

The k-ε turbulence model, which we use, relies on several assumptions, the most important of which is that the Reynolds number is high enough, which is absolutely true for our case (it is proved in the manuscript). It is also important that the turbulence is in equilibrium in boundary layers, which means that production equals dissipation. These assumptions limit the accuracy of the model because they are not always true. The flow close to a solid wall is for a turbulent flow very different from the free stream as mentioned before. This means that the assumptions used to derive the *k*-ε model are not valid close to walls. While it is possible to modify the *k*-ε model so that it describes the flow in wall regions, this is not always desirable because of the very high resolution requirements that follow (Wilcox, 1998), in our case resolution should be ~0.5 mm. Instead, analytical expressions called wall functions are used to describe the flow close near the walls. The phrase in the manuscript 'It could be anticipated due to the use of wall functions' (Pg. 9, 17 in the old manuscript) just points that we understand a problem with boundary conditions in case of 'coarse' resolution because we cannot resolve viscous layer (our grid size is much larger) (see, Pg. 9, 17-20 in the old manuscript). We are interested only in the width of logarithmic layer, that is way we choose grid size which can resolve it, but 'coarse' enough to say we are 'out' of viscous layer and use standard wall function (ε-based models).

We gave a reference in the manuscript to COMSOL documentation where reader can find description of used wall functions. It seems to us that adding below mentioned formulas, which still are standard, will led reader astray.

The information below is taken from COMSOL documentation:

The wall functions in COMSOL Multiphysics are such that the computational domain is assumed to be located a distance δ_w from the wall (see Figure 1)

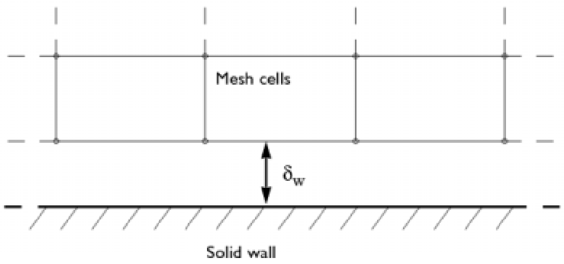

Fig. 1 The computational domain is located a distance δ_w from the wall for wall functions.

δ_w is calculated automatically and it is limited from below so that it never becomes smaller than half the height of the boundary mesh cell.

The boundary conditions for the velocity is a no-penetration condition

$$\mathbf{u} \cdot \mathbf{n} = 0$$

where $\mathbf{u}$ is the velocity vector field, $\mathbf{n}$ is the normal vector to the boundary and a shear stress condition

$$\mathbf{n} \cdot \sigma - (\mathbf{n} \cdot \sigma \cdot \mathbf{n})\mathbf{n} = -\rho u_\tau \frac{\mathbf{u}}{|\mathbf{u}|} \max\left(C_\mu^{0.25}\sqrt{k}, u_\tau\right)$$

where ρ is the fluid density, u_τ is the friction velocity, C_μ is the model constant with default value equals to 0.09 [1], k is the turbulent kinetic energy and the viscous stress tensor σ is defined as

$$\sigma = \mu(\nabla\mathbf{u} + (\nabla\mathbf{u})^T)$$

Cebeci [2] suggested a model, which adjusts the friction velocity for surface roughness

$$u_\tau = \frac{|\mathbf{u}|}{\frac{1}{\kappa_v}\ln\delta_w^+ + B - \Delta B}$$

where κ_v is the von Kárman constant (default value 0.41), B is a constant that by default is set to 5.2 and

$$\delta_w^+ = max\{11.06, k_s^+/2, h^+/2\}$$

$$\Delta B = \begin{cases} 0, k_s^+ \le 2.25 \\ \frac{1}{\kappa_v}\ln\left[\frac{k_s^+ - 2.25}{87.75} + C_s k_s^+\right]\sin[0.4258(\ln k_s^+ - 0.811)], 2.25 < k_s^+ < 90 \\ \frac{1}{\kappa_v}\ln(1 + C_s k_s^+), k_s^+ > 90 \end{cases}$$

where C_s is a parameter that depends on the shape and distribution of the roughness elements, h^+ is the height of the boundary mesh cell in viscous units, k_s^+ is the roughness height in viscous units

$$k_s^+ = \frac{\rho C_\mu^{0.25}\sqrt{k}}{\mu}k_s$$

The roughness height, k_s, is the peak-to-peak value of the surface variations and the wall is relocated to their mean level (see Figure 2). The values of the roughness parameters for the different characteristics of the riverbed are introduced by Nikuradse [3].

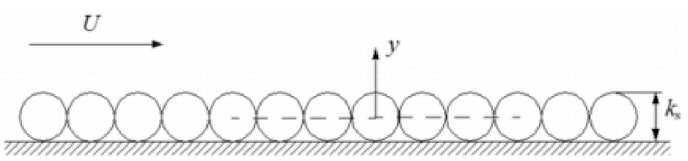

Fig. 2 Definitions of the roughness height and the modified wall location.

The turbulent kinetic energy is subject to a homogeneous Neumann condition

$$\mathbf{n} \cdot \nabla k = 0$$

and the boundary condition for turbulent dissipation rate ε reads

$$\varepsilon = \frac{\rho C_\mu^{0.75} k^{1.5}}{\kappa_v \delta_w}$$

See [4] and [5] for further details.

1. Landau, L.D., and Lifshitz, E. M.: Course of theoretical physics. *Vol. 6. Fluid mechanics*, Pergamon Press, Oxford, 2nd edition, *1987.*
2. D.C. Wilcox, Turbulence Modeling for CFD, 2nd ed., DCW Industries, 1998
3. T. Cebeci, Analysis of Turbulent Flows, 2nd ed., Elsevier, Amsterdam, 2004.
4. J. Nikuradse, “Strömungsgesetze in rauhen Rohren”, Forschg. Arb. Ing.-Wes., no. 361, 1933.
5. D. Kuzmin, O. Mierka, and S. Turek, “On the Implementation of the k-ε Turbulence Model in Incompressible Flow Solvers Based on a Finite Element Discretization,” Int.J. Computing Science and Mathematics, vol. 1, no. 2–4, pp. 193–206, 2007.
6. H. Grotjans and F.R. Menter, “Wall Functions for General Application CFD Codes,” ECCOMAS 98, Proceedings of the Fourth European Computational Fluid Dynamics Conference, John Wiley & Sons, pp. 1112–1117, 1998.

‘bootstraping’ (generally spelled with two p’s, as in ‘bootstrapping’) –A generic statistical technique, as described in Wikipedia article: “In statistics, bootstrapping can refer to any test or metric that relies on random sampling with replacement”. The reference provided in the paper links to a lecture comparing the results from using aspirin compared to using a placebo. If this is an important element in the paper (it’s not clear that it is) an explanation is in order.

The information about, how correlation coefficient was calculated, is important, but not crucial for the manuscript. The mentioned reference just gives an example how to use bootstrapping and what are the features of the technique. Below, the details for our particular case are given. We agree, that if we mention 'bootstrapping', it is desirable to provide more information to the reader about the results of analysis, because with bootstrap we can obtain robust estimates of standard errors and confidence intervals.

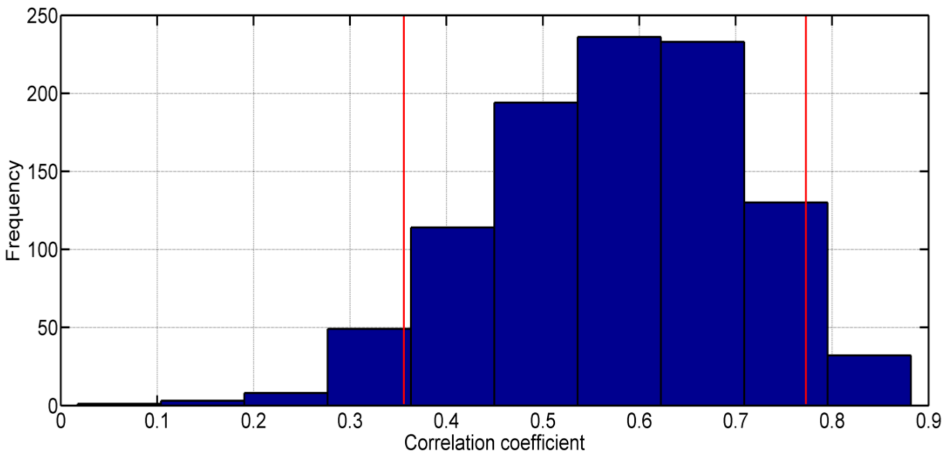

Fig. The correlation between times at Kusur GS and Habarova when the surface water temperature reaches the maximum. The lines confine 95% confidence interval. Since the lower end of our confidence interval is above zero, we conclude that our correlation is significant at the $p<0.01$ level (two-tailed). The data set contains dates for each year from 1951 to 2011, 61 data points are resampled to create 1000 different data sets and the correlation between the two variables is computed for each data set. The histogram shows the variation of the correlation coefficient across all the bootstrap samples. The mean of all the bootstrapped correlation coefficients is 0.5770. The original correlation coefficient is 0.5724.

In the new version of the manuscript we refer to simple Pearson approach for calculation of the correlation coefficient, because in this particular case additional information distracts the reader from the main focus of the manuscript.

‘optimization’ – There is a gesture in the direction of an explanation of this in the revised manuscript, but it’s one that really doesn’t provide enough detail for the reviewer or general readership. Furthermore, its application is highly questionable as a method for forcing the model to replicate the observations. In this regard, it is hard to believe that the high frequencies in the hydrographs resulting from the ‘optimization’, as shown in Figures10 and 11, bear a relationship to reality in the Lena River system. When solving an inverse geophysical problem in a highly underdetermined problem, as this is, an exercise of this kind reveals little about the actual behavior of the system.

We would like to improve, but we do not see clear point what should be added to the description of the experiment.

As we mentioned in Section 5.1 our analytical approach for the determining midstream Lena water temperature contains uncertainties, as a result optimized hydrograph can have oscillations, which are not attributed to the variation of the real total discharge from the tributaries. However, independently from previous estimates (see Section 5.1) of the total discharge we obtained nearly the same range solving optimization task. In frame of the 2d experiment our task was to show that it is possible to obtain water temperature at Habarova using results from the 1st experiment and atmospheric forcing.

During 2007 there was a situation, when solving optimization task does not give a result. We cannot find proper discharge to explain the difference. The reason is that temperature in the tributaries is higher or the same as in the Lena during 10 days. It means that tributaries should 'warm up' the measurements or do nothing. Also this situation takes place in the middle of September, when atmosphere tends to cool the water and experiment shows this process. But in reality within this period of time the difference between Habarova and Kusur was very large and as usual positive. This is also output of the experiment signalizing that in the system can be presented additional heat flux and this result does not attributed to the model or experiment features.

‘quality assurance and experimental design’ – Making sense of the long record at the Kusur gaging station is a worthy goal. The challenges associated with the location of the temperature monitoring site and the measurement method make it important that there be a well-designed experimental design. For purposes of evaluating the previous record, one made with questionable measurement methods, some effort should be made to characterize the uncertainty of the observations.

It is not clear to us what is assumed under a 'well-designed experimental design'.

Yes, it would be good to characterize uncertainty of the observations. However, we think it is nearly impossible to do, because the measurements were done for the last 70 years, using measuring devices, to which we do not have access and many of them do not exist anymore. Many hydrological notes, which are rich source of information, exist only in the printed version. We have collected a lot of them, but it is not enough to trace quality control during past 70 years. We have information about the measurement techniques and gave its description in the manuscript (Pg. 3, 7-13, old version of the manuscript). The described 'high temperature' problem exists nearly for all years of observations and it gives us confidence to talk about it.

Finally, after 16 pages, the authors can only conclude, (1) “The difference in the behaviour of stream temperatures at Habarova GS (sic) and Kusur and nonrepresentativeness of the measurements at Kusur GS (sic) for the whole cross-section indicate that the measurements at Kusur GS (sic) should be taken for analysis of water temperature changes in the delta head area with a great caution”, and, (2) “There are indications in favour of an unaccounted source of heat in the late summer/beginning of fall from the riverbed to the water in the area of the delta head. More analysis and observations are required to make further statements in this direction”. It is difficult to see how this paper in its present form significantly increases our knowledge of the dynamics of stream temperature in the Lena River system.

These two statements are only **small part** of Conclusion, that we made out of this work. In the beginning and middle of Conclusion we explicitly stated most probable reason of the anomalously high temperature at Habarova Station, quantitative and qualitative assessments of the impact of small rivers upstream Kusur on the water temperature measurements at Kusur Station, trend estimates for the water temperatures at two basin outlet stations. Also the key gaps and needs were formulated for the future work.