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Hydrology and Earth System Sciences Discussions

Interactive comment on "Uncertainty in computations of the spread of warm water in a river – lessons from Environmental Impact Assessment" *by* M. B. Kalinowska and P. M. Rowiński

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Authors are grateful to the Reviewer for His/Her in-depth comments to the paper and for raising interesting questions. The fact that some of those questions were asked suggests that we need to work upon more precise formulations. We do not share, however most of the doubts that the Reviewer has.

To explain, we claim that we consider "the environmentally most severe situation" in

the sense that heat pollution (in the considered amount) threatens the river particularly in low flow conditions. Therefore for computations the averaged low flow was used to properly represent that severe situation (this is what designers expect from Environmental Impact Assessment study).

The dispersion coefficients were taken from a very broad range just to cover a variety of admissible situations (the proportionality factor a in the longitudinal dispersion coefficient formulae ranged from 30 to 3000). Since we do not know the value of this factor in the considered case, we conducted a series of simulations for different values of a. In this paper we present results for $a = 100$, 500 and 1000. We are quite surprised with the statement of the Referee that the dimensionless longitudinal dispersion coefficient in the manuscript are several orders of magnitude higher than those for 2D dispersion coefficient. Firstly we used dimensional dispersion coefficients. Secondly note that for mean values of h and u^* longitudinal dispersion is ca 34 m^2s^{-1} (for $a = 500$) and ca 7 m^2s^{-1} (for $a = 100$). We doubt whether it is several orders of magnitude higher than in 2D situation.

But the Referee raised an important issue of how to determine longitudinal dispersion coefficient in 2D situations. It was one of the key problems discussed in the paper. Indeed we should not provide the range (Eq. 7) taken from 1D studies; although the lower limit of that range most likely corresponds to 2D situations. It will be better addressed in the paper. Note that the main information resulting from the study in this respect is that the uncertainty in the knowledge of dispersion coefficients (particularly the longitudinal one) is crucial in those kind of computations – the specific numbers are not important for the message that the reader may get from the paper. In other words, the information how the concentration cloud responds to changes in dispersion coefficients is the key information. After all we may debate what are the values of dispersion coefficients in Vistula River but before we perform tracer tests there (which is logistically extremely difficult and expensive) that dispute will not lead to any final values. We may refer to a very good work of Piasecki et al. (Identification of stream dispersion coefficients by adjoint sensitivity method, *J. Hydraulic Eng.* 125,7, 714-724, 1999) showing a great effort that results in ranges of dispersion coefficients that might be used in 2D model. This is possible when detailed geometric and bathymetric data is provided (which is rarely the case) – that study of Piasecki et al. was performed for Potomac River. It only strengthens the point underlined in the paper which concerns the frequent situations when one needs to answer detailed questions (in this case related to warm water jet) when the provided data is very scarce!

We of course do not discuss with the evaluation of our English which is not our primary language. We have asked a native speaker to help us improving the quality of the language and this aspect will be definitely improved when submitting final version of the paper.

Responses to specific comments:

1. The title may become more accurate when we mention that we base it upon a case study, namely: *Uncertainty in computations of the spread of warm water in a river – lessons from Environmental Impact Assessment case study.* Thank you for that remark.
2. We agree and abstract will be more informative.
3. The range for parameter a in 2D case is not known and to the best of our knowledge not provided anywhere in literature. We doubt, however that it may be so much smaller than the lowest values taken in the study.
4. Conclusions may be rewritten in the mode proposed by Referee.
5. This remark most likely arose from a misunderstanding. Firstly the numerical scheme was well checked to conserve energy. One cannot forget that Fig. 7 just

represents the cross-section and we consider the 2D situation with the continuous release of warm water! To make the picture more complex please remember that the riverbanks do cool the heated water as well. The referee claims that the peak temperature should decrease with increasing the value of parameter a. It is just opposite: in case of larger dispersion coefficients the heated water is taken from the source more quickly which causes that at particular point temperatures are higher than in the case with smaller dispersion coefficients.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 5871, 2012.