

Interactive comment on “A simple lumped model to convert air temperature into surface water temperature in lakes” by S. Piccolroaz et al.

Anonymous Referee #1

Received and published: 7 May 2013

General Comments

The paper describes a useful method for predicting lake surface water temperatures from air temperatures. The simplifications to the process-based equations and the reduction to a small amount of parameters using the GLUE method are elegant and easy to follow. The paper is well written, clear and well structured and the English is of a reasonable standard.

The model lies in-between an empirical (data-based model) and a process-based numerical model, since it is an ordinary differential equation (ODE) whose parameters must be calibrated. When the number of parameters are reduced and the model is applied to just the non-ice periods (NDBC data) it appears to be almost identical in

C1508

form to the Kettle et al (2004) model (which is the integrated version). However, the inclusion of a non-dimensionalised mixed layer depth gives the model wider application than the Kettle et al model.

Regarding the title I am confused as to what the authors mean by a 'lumped model' but I accept that this may be my ignorance!

I believe the model and the methods described in this paper are a valuable addition to the field of lake water surface temperature modelling.

Specific Comments

In the Abstract please mention that: 1. you use the GLUE method, 2. you are only considering long time scales (seasonal, annual and inter-annual) and 3. that the model is an ODE.

Section 3: Make it clear that you use the GLERL data in order to obtain winter water surface temperatures. The correspondence between NDBC and GLERL data does not look very good to me (particularly if the annual cycle was removed)...this should be commented upon.

In both Figs 5 and 7 I would like to see another plot below it showing $T_w(\text{obs}) - T_w(8 \text{ par})$ and $T_w(\text{obs}) - T_w(4 \text{ par})$. Due to the annual cycle it is hard to see how well the model is actually performing without plotting these differences.

Solving an ODE using an explicit Euler scheme is very straightforward but I think it might be worth including the equations in the Appendix to make it easy for others to reproduce this model themselves. Or, if not, it might be worth mentioning in the text that ODE solvers can be easily used in R, matlab etc.

In the Discussion the authors mention that their model performs as well as process-based numerical models, but perhaps these models do not require calibration and so are truly predictive? The disadvantage of a data-based model is that it requires water temperature data for calibration.

C1509

I would like to see a Table showing the range for each of the p parameters (with units) and a summary of what role the parameter plays in the model is e.g. p8 is related to ice formation and so on. I would also like to see Tr, Dr and delta in this table. Since the meaning of the parameters changes as the number of parameters changes this would also have to be included.

Technical Corrections

The numbering of figures is not correct as they should be mentioned in the text in numeric order (e.g Fig. 8a is mentioned before Fig .4).

First sentence in the Abstract is not very clear and should be rewritten.

P2698 L19 change to '18 yr are used'

p2705 L12 change 'to notice' to 'noting'

Fig 3 caption change 'localization' to 'location'

P2712 L11 change to 'In the light of this evidence'

P2713 L21 change 'yields to another' to 'yields another'

P2714 L1 change 'It it worth to note' to 'It is worth noting'

P2717 L2 change 'anyway' to 'however'

P2717 L22/23 change to 'Parameter sets'

P2718 L4 change 'On' to 'In'

P2718 L16 change 'these evidences' to 'this evidence'

P2718 L17 change 'principles' to 'principle'

C1510

P2718 L18 change 'in' to 'as'

P2719 L22 change 'annaul' to 'annual'

P2719 L24 change 'the' to 'these'

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 2697, 2013.

C1511