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Hydrology and Earth System Sciences Discussions

Interactive comment on "Coupled daily streamflow and water temperature modelling in large river basins" *by* M. T. H. van Vliet et al.

Anonymous Referee #2

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Review of "Coupled daily streamflow and water temperature modelling in large river basins" by M.T.H. van Vliet et al.

This is a well-written paper where a framework is introduced for coupled daily streamflow-temperature modelling by combining VIC and RBM. The paper serves as the background for a recently published paper in Nature Climate Change where the effect of climate change on European and North-America surface water temperature was analyzed in a framework of cooling water availability for energy production.

The authors present a convincing case that their framework is able to simulate observed yearly, seasonally and daily surface water temperatures as well as multi-year variation for the Snake and Rhine rivers.

However, to my opinion there is one problem with this approach: the fact that the temperature model uses a Direchlet upstream boundary condition, i.e. the so-called headwater stream temperature, which then has to be calibrated, albeit indirectly, as a parameter. This makes the model less suitable for scenario's where upstream water temperature is influenced by changes in groundwater contribution to streamflow as a result of changes in land use, water consumption and climate. This is a pity. And I do not really understand why this approach was chosen. After all, VIC has a full surface energy balance model and hydrology that could be used to provide upstream boundary conditions (both flux and water temperature). Why was this approach not used? Is it because VIC is not accounting well for groundwater discharge? This should be discussed at length in the Discussion part of the paper.

Minor remarks:

- Equations (1a)-(1c): Usually such relationships are used to calculate channel dimensions, not active channel depth. Then, Q is so-called bankfull or channel-forming discharge (estimated as the discharge with a return period of 2-3 years). From this channel depth D and with W can be calculated. Next, from velocity U based on e.g. Manning, method of characteristics or and assumed constant velocity, water depth H = Q/(WU) can be calculated. So, I think that this is a bit awkward way of deriving water depth.

- Title 3.1: not only daily river discharge is simulated and evaluated, but also yearly. So the title is somewhat confusing.

- Page 8350, line 10: does NBIAS=-0.5 not mean an under-estimation of 50%? This does not seem accurate. - Title 3.2: the same goes for temperature.

- Page 8351, line 23: can it be that the lack of an ice-model is the cause for the too steep a drop of autumn temperature, as ice-formation limits the temperature drop of the water below.

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9, C4110–C4112, 2012

- Line 14 on page 8355: the authors should add here that van these numbers of Beek et al. (2012) pertain to the entire globe, not to a selection of basins. Also, no calibration was used, whereas the regression to estimate the parameters of equation (5) is a form of indirect calibration.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 8335, 2012.