

Interactive comment on “Reconstructing lateral migration rates in meandering systems; a novel Bayesian approach combining OSL dating and historical maps” by Cindy Quik and Jakob Wallinga

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Overall, this is an excellent contribution that is innovative, and has the potential to add significantly to the successful estimation of age and position (and therefore migration rates) in fluvial channels over the late Holocene. This is of great importance both for the academic community interested in understanding details of past environmental change, fluvial channel migration patterns and hydrological response to external factors, but also for those charged with understanding river migration from a flood management and engineering standpoint.

As part of this approach, the paper provides a practical solution for integrating two very different sorts of constraints for fluvial system evolution. These are: 1) map data where the primary uncertainty is spatial accuracy related both to survey precision and changes in channel width or pattern, but with a well established date, and 2) young OSL age estimates, where the sampling position is known with very high accuracy, but problems of incomplete signal bleaching lead to large uncertainty distributions in age.

This solution neatly transfers the spatial uncertainty into a time-uncertainty within a Bayesian age model, using an iterative approach. This takes advantage of the fact that the meander scroll bars develop in a single direction, allowing the application of a spatial sequence within the Bayesian age model. This approach substitutes the lithostratigraphic relative age control often used in Bayesian geochronological models of samples in a single vertical sequence, with a morphostratigraphic sequence provided by the scroll bar morphology and relationship to the modern channel. Note that in the cases studied here, the end point of this lateral migration is represented by channels abandoned when the river underwent significant engineering work around the start of the twentieth century.

Similar spatial morphostratigraphic Bayesian age models have been employed in other contexts (such as sequences of river terraces, or the development of beach ridges), but in my opinion, the approach developed and presented here is particularly appealing and well described, and the manner of building in the spatial uncertainty for the river channels to the age model is clever and effective.

I have a long list of specific points that refer to locations within the paper. But note, these are designed as a conversation or debate, and I hope will help to make the paper clearer and more accessible, and represent suggestions for the authors. The paper is enjoyable to read, and the maps are highly appealing, and are very reproduced to a high standard.

Line 41 It is probably more appropriate to say “humans” rather than “man” here.

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Line 42 I suggest you add “and river management” after “land use”. I am thinking of things such as weirs, mills, cut-off channels, bank modification etc.

Line 53 There are some other papers that do this, e.g. including Kemp and Rhodes (2010) QSR, though I am not suggesting you include the citation.

Line 70 I very firmly agree that this is underexplored.

Line 100 I would use a comma instead of a dot to read “50,000” and similar in other locations including Table 1.

Line 118 Possibly add “multiple” before “hand-corings” to help clarify the sampling strategy.

Line 120 Replace “on” with “of”.

Line 127 “inform” is slightly awkward in this context; I understand your meaning, but it is usual to “inform someone of something. . .” so I suggest using “select” here.

Line 134 “Replace “stap” with “step”.

Line 138 This is an excellent selection of maps.

Line 140 Is “normalization” a recognised term here? I would possibly suggest “regularization” (not great) or perhaps simply “channel management works” (better).

Line 145 It is not clear to me what “otherwise used” includes.

Lines 147-152 It seems sensible to refer to the supplement here.

Line 175 It would be informative to know the values of what the range of spatial errors was here.

Line 199 “small” for the OSL emission seems wrong to me. I think of small as meaning size, not intensity. I would say “low intensity” instead.

Line 203 “The moment. . .” is not 100% accurate, as some electrons are emitted and

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recombine shortly after the light source is turned on. I would simply say “When” which has a lesser degree of suggestion of an instantaneous effect.

Line 204 As partial and incomplete bleaching are a feature of some samples, I would try and be more precise here. I suggest you say something like “the OSL signal is reduced (bleached) to a low level, often close to zero”.

Line 213 Replace “build” with “built”.

Line 225 The wording of “. . .generally easily be recognised. . .” is a little awkward. I suggest “. . .generally be recognised easily. . .”

Line 228 I suggest replacing “backing” with “supporting”.

Line 240 “. . .split in two fractions” does not quite work. “. . .split into two fractions” is better in terms of grammar, but is awkward to read and say, so consider rewording?

Line 244 It is useful to include the concentration and time of treatment for the HF here.

Line 260. We need a reference to the measurement conditions, which are presented in Table 2. It is useful to describe the equipment used and the filters used (probably U340 on a Riso set, but let’s be sure). Note, in Table 2, “10s cutheat to 180 deg. C” doesn’t make full sense. A cutheat by definition is for held for no time. I appreciate that the heat treatment in the second part of the SAR cycle is often referred to as a cutheat to distinguish it from the preheat before the main OSL measurement, so perhaps you could either just use “10s preheat at 180” here, or if you want to preserve cutheat, say “10s “cutheat” at 180. . .”?

Line 272 Replace “on” with “for” or “of”.

Line 282 Refer to Fig. 6b, which includes this distribution.

Line 322 The use of +/- to mean “approximately” is a little misleading, and not recognised scientific usage. Either use the “~” symbol, say “approximately”. I was misled when I read this, as I assumed this was an uncertainty value on the width, rather than

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the width value used. In fact, as you used this width value, there is not really any uncertainty on the value, only on whether it is appropriate (which I think it is!), so I would just say 30m here.

Line 335 It would be useful to know how much uncertainty in position there was here. Give us some typical or max/min values possibly.

Line 373 I would call these white symbols “crosses”; I don’t think “plusses” is a recognised term.

Lines 399-401. Some of this information is repeated from a few line above, so you can contract this first sentence a little.

Lines 404, 405 The shorthand “Fig. 7bd” and “7ac” need writing out correctly.

Line 408 Is “resolved” better than “solved”?

Lines 440-450 Is it possible that the channel widths varied significantly, for example during the progression downstream of a gavel slug?

Table 1 Add a comma into the large numbers in the map scales, to read 1:19,200 etc. Replace +/- with ~

Table 3 and elsewhere. Did you consider using CE (Common Era) rather than AD?

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