Interactive comment on "How good are hydrological models for gap-filling streamflow data?" *by* Yongqiang Zhang and David Post

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Overall comments:

Generally a clear well-written paper. The underlying science appears to have been undertaken robustly, methodically and consistently. My main thoughts, having digested the submission, were to the wider scientific significance of the work presented. Has this been suitably explored within the context of the work? Currently the paper has a colloquial emphasis (Australia) and as a reader in the UK, I would like the authors to make a comment on whether the results are transferable elsewhere and also on how much dependency there is on the type of model used for infilling and patterns of missing data. Even for a more direct audience (e.g. users of Australian streamflow data

/ those wising to understand the reliability of trend detection analysis in an Australian context) the benefits/implications of the outcomes of the work could be drawn out in the paper a little more. At the very end of the paper the authors tantalise the reader by hinting at other patterns within the dataset, beyond the scope of the study to explore at this point. Ideally for me, this paper would give more value if it took a stance of saying, having established that gap filling does not impact on trend analysis, what the trend analysis on the gap-filled data shows and whether this changes our perception on the strength and direction of trend for either individual sites or regionally. Finally, what a shame the paper does not address the potential payback of infilling with modelled data compared with other methods (like interpolation or correlations with nearby sites for example). Would there be less confidence in the trend analysis results if modelling had not been used as the gap filling method. Having said the above, I would not object to publication of this paper in its current form (no suggested corrections to the text). It is a self-contained work that no doubt many hydrologists will find useful.

Specific comments:

Abstract: The point that springs to my mind is that if gap filling has so little impact, then why bother to undertake it in the first place? Presumably the gap filling is being undertaken de rigour/as part of data QA for reasons of consistency / completeness and the purpose here is to show this does not have negative impact on key hydrological analyses (of which trend analysis might be just one?). The abstract also states there is a lack of quantitative analysis of gap filled data. Is this really true, across the entirety of the international body of scientific literature.

Data and methods: I'm interested to know whether the timing of missing data impacts on the trend analysis outcomes. Presumably the % rates are across the period of record of each site? Could you explain reasons for the gaps in the records, e.g. are all the stations gauged in the same way or are some types of station/ river more vulnerable to gaps than others (e.g. stations on smaller flashy rivers). Was there consideration of data quality outside of periods with gaps. Are stations with more gaps likely to suffer

poorer data quality overall.

Results: It is stated that the model performance is not as good for high flows, but the analysis considers annual trends (annual average flows?). Was any analysis of trends in high flow patterns attempted and if so was there a different outcome. I'd also like to see more exploration and explanation of differences seen between the SIMHYD and GR4J results. Does one model theoretically out perform the other? Are the differences between the infilled trend analysis for the two models the same order of magnitude as between trend from filled and unfilled series etc. I just wonder if we need more discussion in this section to draw out some useful implications or provisos. Should one model be preferred or give a greater payback (i.e. Gap filling is just as good but the model is more practicable to use/more straight forward to parameterise).