Response to Referee #3

(All referee comments are in Italics.)

1. *The authors show that simple statistical theory can give a method which uses the covariances between variables in the calculation of correction factors when upscaling (in time) the parameters of hydrological models. They demonstrate the method using pan evaporation data but suggest that the method has wide applicability in hydrological modelling (they describe it as a "framework"). From the responses the authors made to comments from Reviewers 1 and 2, I suspect I am part of the particular audience the authors had in mind when writing the paper: a hydrological modeller at the sharp end of model development and use who would benefit by being told or reminded about existing practical methods for upscaling.*

We agree.

2. *It is quite possible to write an original research paper that takes well known results and demonstrates their relevance using a simple problem as an example. It is said at the start of the Discussion and Summary section that the pan evaporation problem is "simpler than the problems faced in hydrology, e.g. catchment water balances". One area where the paper fails is that the simple problem does not appear to have been explored fully. From a practical point of view, Figures 2 and 4 are interesting in that they show the direct results from applying the method. However, given that this is a simple problem, are there really no other practically useful results to show, that demonstrate various ways in which the method can be applied operationally?*

Following similar comments from Referee#1 we have extended the approach using the idea of a mean diurnal cycle and this has proved fruitful. We will incorporate that into the revised manuscript.

3. *If the potential originality and strength of the paper is that it demonstrates the relevance of an upscaling approach that might find widespread use in hydrological modelling, substantial discussions are needed on how the method can be used in a range of realworld hydrological modelling problems that have forms more general and testing than the reproduction of pan evaporation data. This should include, for example, discussions of practical real-world situations where there are real advantages in using high frequency data sets to calculate covariances for use in upscaling. Presumably, such data sets might often be better used in other ways, including in the direct calculation of time-step values for derived variables such as evaporation loss or flow resistance or flow rate.*

As the reviewer has already noted, our example, i.e., pan evaporation, is as simple as it gets. That was actually our motivation and this simple example allowed us to get started. In that respect we now have a way of calculating potential evaporation using, for example, monthly means, that will be rigorous. The more complex real world example would be calculating actual evapotranspiration. This is a challenge because there are numerous thresholds, e.g.

runoff occurs when soil saturates, or, actual evapotranspiration is less than the potential rate because of water supply restrictions. We accept that the presence of thresholds, as noted above, presents challenges. However, it is important to be able to get the basc correct before we begin to tackle more complex (and therefore realistic) examples.

We plan to discuss this issue extensively in the Discussion and Summary section of the revised manuscript.

4. *Despite the rather negative review above, there is the potential here for an original, good and interesting paper on upscaling. Major revisions are required.*

Thank you. We will put up a revised manuscript soon.