

## ***Interactive comment on “Technical Note: Using wavelet analyses on water depth time series to detect glacial influence in high-mountain hydrosystems” by S. Cauvy-Fraunié et al.***

### **Anonymous Referee #3**

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#### General comments:

This paper presents an innovative, interesting and convenient way to assess to what degree streams are fed by meltwater from glaciers upstream. The approach is presented in a clear, comprehensible and concise way and is in any case worth to be published.

However, I would suggest some clarification right in the abstract and in the Introduction section of the paper. Readers that are not familiar with spectrum analysis will learn only in the Materials and Methods section that the wavelet approach is based on the diurnal

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variations of meltwater from the glacier. Thus it can be applied only during the ablation period which is restricted to the summer period at higher latitudes. In addition, diurnal variations of stream runoff might be generated by plant water uptake in the riparian zone, especially during low flow periods which has often been described in the literature. This should be checked, e.g., at sites 13 and 14 in this study. For example, using the Fourier transform instead of wavelets, phase lags can be checked for consistency with travel time in the streams from the glacier to the monitoring sites. Alternatively, plant water uptake will more strongly correlate with radiation and air humidity, whereas melting should be related to air temperature. Radiation and air temperature can be decoupled, e.g., during overcast or rainy days.

I do not agree that the 24 h peaks in the global wavelets should be tested against white noise. The catchment usually acts as a low-pass filter, which transforms the (approximately) white noise of the precipitation input (daily values) into the red noise of the hydrograph at the catchment outlet.

Fig. 2, Fig. 3: The minor peaks at 12 h period length obviously are harmonics to the diurnal cycle. This would suggest that the diurnal variations are not symmetric. Thus, this peak should be included when calculating the wavelet glacier signal.

Fig. 5: When all of the regression lines pass through the origin, the only information the figure provides is that about the different slopes. However, in the current form it is very cumbersome to compare slopes for different months. Instead, I would suggest to present the information about the slopes in a bar plot (which would nicely depict the seasonal pattern), and to give the confidence intervals for the determination of the slopes of the regression lines as error bars in addition.

Details: 1) P. 4372, l. 12: I suggest to replace “water security” by “flood risk”. 2) P. 4373, l. 13: Use plural “catchments”. 3) P. 4374, l. 22 and later on: Delete “superficial” in “superficial tributaries”. 4) P. 4375, l. 14: Replace “into” by “in”. 5) P. 4375, l. 25 and later on: Replace “water depth” by “water level”. 6) P. 4376, l. 9: “expresses” 7)

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P. 4377, l. 6 (eq. 2): Replace “6” in the exponent of the second factor by, e.g., “ $\omega$ ”. 8) P. 4380, l. 6: Use plural “contour lines”. 9) P. 4380, l. 28: Replace “which increases costs” by “with high costs”. 10) P. 4381, l. 12: Replace “daily glacial flood” by “diurnal variations”. 11) P. 4381, l. 23: Replace “glaciar” either by “glacier” or “glacial”. 12) P. 4382, l. 1: Use the adverb “seldomly” (or “rarely”). 13) P. 4382, l. 4: Don’t you mean “experienced” rather than “experimented”? 14) P. 4382, l. 16: Better insert “the”: “when compared to the upstream site”. 15) P. 4382, l. 22: Don’t you mean “lay” rather than “laid”? 16) P. 4382, l. 26: Does “this phenomenon” mean precisely at these two sites? 17) P. 4384, l. 2: Replace “were” by “have been” (they are still in use!). 18) P. 4384, l. 16: No plural “s” for “descriptor”. 19) P. 4384, l. 17: Replace “they” by “it”. 20) P. 4384, l. 19: Better “meltwater infiltration occurs” 21) P. 4384, l. 27: Omit “a” in “to much wider temporal scales”. 22) P. 4384, l. 28: “Glaciated” rather than “glacierized” 23) P. 4386, l. 9: Use plural for “scales”. 24) Fig.1: I would strongly recommend omitting the arrows in this graph. They suggest well known and clearly defined single flowpaths. However, this study gave only some first evidence that such flowpaths might exist, but did not allow any inferences about their location. 25) Fig. 3: The lines of the cone of influence and the lines of significance are hardly discernible. Moreover, please give a legend for the different colours. 26) The PhD thesis of Villacis (2008) is in French and thus might not be very helpful for most of the readers.

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