Interactive comment on "Universal multifractal Martian topography" by F. Landais et al.

Anonymous Referee #2

The paper is technically sound and the results are convincing. My main objection is instrumental. If MOLA samples are separated 300 m and the accuracy is 1.8 m (some authors say worse), appreciating the right scaling for differences at the scale of few kilometres sounds as challenging to me. How can we be sure that the effect below 10 Km is not merely an artifact (especially when the changes in slope do not seem so big in Figure 2)? One possible way to analyse this could be to rebin the series, for instance getting a series with half samples and each sample being the average of two adjacent original samples; this way the error is reduced by a factor square root of two, although the resolution is decreased by a factor of 2. If the crossover is not modified after this change this would imply that it is an actual geophysical limit; however, if it is decreased this would mean that the effect is an artifact. As this is an important point of the paper, I would like to see this question clarified prior to my acceptance of the paper, which is otherwise of great quality

Answer :

We thank the referee for his positive evaluation. As mentionned in your comment, using simple differences to appreciate the scalings at small scales may be misleading due to the limit in instrumental accuracy. For this reason precisely, we have not used simple differences to define fluctuations. As specified in part 3, we choosed the Haar fluctuations that have the advantage of reducing the uncertainty at small scales. Indeed, due to the definition of this wavelet, the smallest scale avalaible is 600m (twice the MOLA resolution as you suggested) and the corresponding fluctuation is obtained from the data of 4 along-track points by taking the difference beetween the mean elevation of the first two points and the mean elevation of the last two points. This being equivalent to the procedure you suggested, we can not use your idea to test the accuracy of our results. However, It is clear to us that a bias at small scale is possible and should be carefully examined. To make sure that the accuracy of MOLA is not responsible for the transition around 10 km, we performed numerous fractal simulations artificially polluted by a random white noise to imitate the uncertainty of MOLA's measurement. Our results indicated that this kind of error is very unlikely to produce the observed transition.