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Interactive comment on "Note on the directional properties of meter-scale gravity waves" *by* Charles Peureux et al.

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The authors would like to thank the reviewers for their comments, which helped improving this manuscript. The questions asked by the reviewers are rewritten in bold and answers follow.

The abstract is a bit technical and should be rewritten to emphasize the key finding of the note. The first sentence of the abstract is not very clear, in particular the expression "is bimodal for frequencies above twice the peak frequency". Maybe the definition of bimodality should be given, since it seems that not everybody uses the same definition in the literature.

We have now included a definition of bimodality in the abstract :

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"their directional distribution exhibits two peaks in different directions and a minimum between."

The key finding of the note is summarized by the last sentence of the abstract:

"These observations extend to shorter components previous measurements, and have important consequences for wave properties sensitive to the directional distribution, such as surface slopes, Stokes drift or microseism sources."

The main question of the reviewer is: what is the point of removing bound harmonics? For example, Romero Melville studied bimodality without removing any bound harmonics. Consequently, the second part of the first sentence of the abstract is a bit misleading.

Please refer to the reply to reviewer 1, question 1.

Overall, I know that it is obvious for the authors but I am not sure that I always see exactly where the bimodality is present in the figures. For example, could the authors add some arrows in Figures 2 and 3, that match the text on Page 6, line 2 (". . . detach from a main direction . . .")

Arrows have been added on figure 3 (page 5) to locate the directions of the two lobes and of the "main direction".

Page 1, last line: the bimodality is caused by the nonlinear cascade of wave energy from dominant to high frequencies. So not by free waves?

In a weakly turbulent framework, the nonlinear energy cascade involves waves from the first and the third (and higher) order of nonlinearity. Bound waves also result from nonlinearities, but it is known from Hasselmann (1962) that non stationary energy transfer occurs among free waves (Snl source term). This same term has been confirmed to be a source of bimodality by the references cited in the introduction.

Page 2, sentence lines 1,2,3: I do not understand the sentence.

This has been corrected in the manuscript :

"The model results of Gagnaire-Renou et al. (2010, their figure 18) show that bimodality is followed at smaller scales by a return to a unimodal directional distribution, somewhere below $f/f_p = 10$, depending on the parameterizations of wave generation and dissipation."

Page 2, last line: "increasing away from the cameras . . ." – to the left or to the right?

The sentence is probably misleading. For clarity, the camera look direction has been added to figure 1 (page 4), so that the readers can easily figure the way cameras are looking.

Page 4, line 11: there is a mixture of vectors and scalars (at least in the notation). Same in equation (6).

Notations have been changed in equation (4).

Page 7, line 23 and Page 8, second line of Caption of Figure 4: α seems to have two different meanings. Please change the notation.

This has been corrected in the definition of the fitting function, equation (17) and (18).

Page 8, Figure 4(a): Should there be a subscript "free" instead of "bound"?

This has been corrected in the manuscript. The caption of this figure has been modified as well in order to make this thing clear : the spectrum of free waves is located between the 2 black solid lines.

Page 8, lines 6 7: circles and disks should be reversed.

This has been corrected in the manuscript :

"Full markers (triangles, disks and stars) correspond to estimates from constant wavenumber snapshots while empty markers (circles, diamonds and upside down tri-

angles) correspond to estimates from constant frequency snapshots."

Page 9, line 1: I do not understand where the $k/k_p = 4$ comes from.

The authors wanted to provide a lower bound for the appearance of bimodality. This value actually results from a mistake in the computations. Looking at the directional distributions as a function of frequency, bimodality appears between f=0.410 and f=0.425 Hz. Concerning the directional distributions as a function of wave number, they appear between k=0.52 and 0.70 rad/m. The peak frequency being fp = 0.189 Hz, the corresponding wave number is kp = 0.146 rad/m (with a water depth of 17 m). In other words, the bounds for bimodality correspond to : 2.2<f/fp<2.3 or in terms of wave number 4.7<k/kp<5 3.6<k/kp<4.8 As the accuracy of these results is quite unknown, the value k/kp=5 could be retained as representative, rather than 4. In the previous estimate, the finite water depth had not been taken into account. This has been corrected on the parametrization of figure 5 and in the manuscript :

"Bimodal profiles are first detected at $f = 0.43$ Hz and $k = 0.7$ rad $\cdot$ m^{-1}, corresponding approximately to $k/k_p = 5$."

The parameter a=0.039 has not been affected by this change.

Page 10, equation (23): Should the integral be from $-\infty$ to 0 ?

The integral in equation (23) is performed over the wave number domain in order to account for the effect of waves of all scales. As a consequence, the Stokes drift has to be integrated across all wave scales, from 0 to infinity.

Page 11, Figure 6: the caption refers to equations (30) and (31), but these equations come after the reference to figure 6 in the text.

Figure 6 shows variables referenced in the text at successive locations. For convenience, they have been plotted on the same figure. Figure 6 has been shifted to the end of section 4.

Page 12, line 5: using repeated twice

This has been corrected in the manuscript accordingly.

Page 12, line 18: I could be wrong but I am not sure that "occasion" is a verb in English

This verb has been replaced by "caused" in the text,.

Page 13, line 11: What are these three main points? (I am lost)

A description has been added in the text :

"Bimodality has been characterized by extracting the positions of the two bimodal peaks and the central minimum from directional distributions of the free waves, either at constant frequency or constant wavenumber (see Fig. 4)."

Page 13, line 13: waves

This has been corrected in the text accordingly.

Appendix page 14, equation (A1): why is the dispersion relation that of deep water? Is factor 1/N missing?

The more general dispersion relation could be used as well, but its use only introduces insignificant differences for the domain of waves (typically above 1-2 times the peak frequency) which are analyzed by this algorithm. For example, at 0.189 Hz, the inversion of the dispersion relation in deep water only introduces errors of about 1The cost function has been adapted from Senet et al. (2001), equation (7), with the introduction of weights. The factor 1/N could be added but does not change the set of (Ux,Uy) which minimizes the cost function. However, the authors realized that the definition of factor σ (renamed χ) was missing. This has been added in the text, equation (A2).

Figure A1 page 15: clearly say that the difference between the two figures is f (left) vs k (right). (a) and (b) do not even appear in the caption.

This has been corrected in the caption of figure A1.

Page 15, line 2: "points checking" ???

This has been corrected in the manuscript :

"Only the points with coordinates (k_j, θ_j) *are kept if they fall in the interval [. . .] "*

Page 15, line 12 and caption of figure A1: use the same units for the velocity u_b

This has been corrected in the manuscript, caption of figure A1.

References

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