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Interactive comment on "Predicted ripple dimensions in relation to the precision of in situ measurements" *by* Knut Krämer and Christian Winter

Anonymous Referee #2

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Short summary of the MS

Krämer and Winter (KW) have carried out lander-based in situ measurements of ripples in a shelf environment. The two main objectives, as also highlighted in the title of the MS, are 1) to evaluate the precision of the in situ measurements, and 2) to compare the in situ measurements with ripple predictors. KW find that 1) ripple dimensions can be measured with a precision smaller than 10% of their absolute dimensions, and 2) the applied ripple predictors can predict the order of magnitude of ripple dimensions.

General comments

Overall the MS is well structured, well written and easy to read. KW outline that one

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of the objectives is to report, and overall this contribution is more of a technical report. Nevertheless, I find it relevant and useful for the community. High-resolution and high-precision in situ measurements of small scale bedforms, whether ripples or dunes, are still relatively scarce, especially in deeper waters like shelf environments which are logistically challenging.

Moreover, the methodology is sound, although it should be better imbedded in already published methods in order to better distinguish between existing methods as opposed to newly developed methods.

The MS lacks explanations of the measured ripple dimensions in relation to the measured hydrodynamics and it also lacks explanations of the deviations in trends between measured and predicted ripple dimensions. Including this would inevitable improve the MS; however, this may require even further revision and may also be beyond the intended scope of the MS. I find the MS to fit within the scope of OS and I recommend pursuing publication; however, the MS would improve by a revision.

Below a list of suggestions of more overall and general character, which KW may consider for improving the MS:

1) Consider revising aim and objectives: See section comments for more details (comment to page 3, lines 4-9).

2) Consider elaborating further on morphological adaptation in non-steady conditions: See section comments for more details (comment to page 2, lines 32-34).

3) Consider elaborating further on system interference in near-bed lander setups: See section comments for more details (comment to page 3, lines 25-27).

4) Consider elaborating further on sampling strategies in non-steady conditions: See section comments for more details (comment to page 4, line 16).

5) Consider including more predictors in the comparison: See section comments for more details (page 7, lines 20-29).

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6) Consider elaborating further on the observed and predicted ripple dynamics in relation to the observed hydrodynamics: See section comments for more details (comment to page 12, lines 20-22).

Comments and suggestions to each section of the MS are given below, including minor comments related to syntax and typos.

Section comments

Title

Consider including shelf environment in the title. Both because this is in essence a case study and because it qualifies the study to have determined ripple dimensions in a relatively deep water environment during both calm and wave conditions.

Abstract

The objectives listed in the abstract are not identical to the objectives outlined in the introduction. If listed in the abstract then they must be identical the objectives outlined in the introduction. In addition, the abstract must of course be updated in relation to a revised MS.

1 Introduction

Page 1, line 21: Consider changing "...as critical bed shear stress or dimensionless Shields parameter,..." to "...as the critical bed shear stress or the dimensionless Shields parameter,...".

Page 2, lines 3-5: Consider reformulating the sentence to something in the order of "In contrast to dunes, ripple dimensions are generally described as independent of the flow depth (see classification in Venditti, 2013); however, by applying a virtual boundary layer concept Bartholdy et al. (2015) recently demonstrated that water depth is actually a controlling factor along with grain size and flow velocity.".

Page 2, line 8: Consider also accrediting the seminal earlier works of Baas (1994)

demonstrating the time evolution of ripple dimensions in a flume study.

Page 2, line 16: Consider changing "..., assessment..." to "..., and assessment...".

Page 2, line 30: Consider changing "...unrelated..." to "...not related...".

Page 2, line 31: Consider changing "...bioturbation i.e., the..." to "...bioturbation, i.e. the...".

Page 2, lines 32-34: The time lag or duration of morphological adaptation in non-steady flow is a central issue. Consider elaborating on this by including earlier works on this topic as well as by including established and debated geomorphological concepts, e.g. process-materials-form, equilibrium, time-space scales, inheritance, and complexity and nonlinearity.

Page 3, line 1: Consider changing "...ripples i.e., bed..." to "...ripples, i.e. bed...".

Page 3, lines 4-9: The overall aim of the study is not specifically formulated, as opposed to the more specific objectives, which albeit are formulated slightly hidden within four sentences. From a taxonomy perspective the active verbs are describe, determine, derive, report, evaluate, compare and discuss. To some extent this outlines a stepwise development in the MS, which is clear and sound. Nevertheless, it could be improved in order to aid the reader. Consider outlining the overall aim of the study, and consider a more rigid and transparent formulation of the objectives. In order to raise the level of analysis consider adding an assessment in relation to the comparison (i.e. the comparison between measured and predicted dimensions); and also consider changing the discussion, which is a vague expression, to e.g. an evaluation or an assessment, or something in that line.

2 Methods

2.1 Study site

Page 3, line 12: Consider changing "...data was acquired..." to "...data were

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acquired. . .". There is a standing debate on whether data are (or is) plural or singular; however, in general data are plural. I only mentioned it in this case, as I believe it is the first in the MS.

Page 3, line 12-19: The description of the study site settings is very limited. Consider presenting a location map that shows the location of the study site.

As KW applies a morphodynamic approach it would seem appropriate to outline and if possible visualize the environmental conditions of the system under investigation, e.g. the static or quasi-static boundary conditions like the overall geology, morphology (bathymetry) and sedimentology as well as the dynamic boundary conditions like the winds, waves and tides driving the hydro- and morphodynamics.

2.2 Lander deployments

Page 3, lines 25-27: Potential interference with the system under investigation is a central issue in any in situ measurements. Consider elaborating on this by including earlier works on this topic as well as by estimating and assessing a potential impact, e.g. in relation to the energy input to the system under investigation.

Page 3, line 28: What do environmental conditions refer to in this context? The term, and also environmental parameters (page 4, line 17), appears again later in the MS.

2.3 Devices and data

Page 4, line 16: In non-steady environment the duration of the individual measurement is a central issue. It is unclear from the text whether the 12 minutes interval of a full bathymetry scan, i.e. 5 scans per hour, also refers to a duration of 12 minutes per scan. Consider elaborating on the duration of each scan in relation to the dynamics of the seabed.

2.4 Bed detection methods

Page 5, lines 3-5: Seem to be a syntax issue. Consider rephrasing.

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2.5 Coordinate conversion and gridding

Page 5, lines 23-33: This section is difficult to read due to the several symbols and numbers. In essence, however, it is simple trigonometry, so perhaps a schematic visualization could improve the readability. Hence, consider visualizing this section.

Page 5, line 33 to page 6, line 5: In general, approximations of higher elevations (like crests) can be determined quite good, whereas elevations of lower lying areas and small depressions (like troughs) are difficult to determine as the signal most likely gets reflected from the highest elevations within the ensonified area. However, here KW argue for the opposite. Please elaborate on this. As suggested above, it might also aid the reader to visualize this section.

Page 6, lines 6-7: Consider including the arguments for gridding the data at a cell size of 2.5 cm, i.e. arguing with the along and across track beam width as well as the overall point density.

2.6 Ripple geometry

Page 6, lines 19-20: In earlier works the relation between the stoss side length and the lee side length, to describe bedform asymmetry, has been termed symmetry index.

Page 6, lines 19-20: In earlier works the relation between the stoss side length and the lee side length, to describe bedform asymmetry, has been termed symmetry index.

Page 6, line 30 to page 7, line 18: The methods outlined for determining ripple dimensions display a mixture of continuous and discrete approaches. Similar methods and their advantages and disadvantages have been outlined and discussed in previous works by e.g. Robert (1988), Robert and Richards (1988), Nikora and Hicks (1997), Jerolmack and Mohrig (2005), Friedrich et al. (2007), Dijk et al. (2008), van der Mark and Blom (2007), van der Mark et al. (2008) (as also cited), Ernstsen et al. (2010). Consider elaborating on and discussing the apllied methods in relation to earlier works.

Page 7, line 8: Change "...(through)..." to "...(trough)...".

Page 7, line 8: Change “. . .transect. . .” to “. . .transects. . .”.

2.7 Predictors for ripple dimensions

Page 7, lines 20-29: One of the key objectives (and part of the title) refers to a comparison between measured and predicted ripple dimensions. However, relatively few predictors are included in the analysis. It seems as if there are periods where only currents are mobilising the seabed. Hence, consider including additional predictors, so that all the different types of predictors considering input parameters are covered.

2.7.1 Current ripples

Page 8, line 16: Change “. . .are a valid. . .” to “. . .are valid. . .”.

2.7.2 Wave ripples

2.8 Hydraulic roughness

Page 9, line 8: Change “. . .as is exceeds. . .” to “. . .as it exceeds. . .”.

3. Results

3.1 Bed detection

OK.

3.2 Hydrodynamics

Page 10, line 1: Consider changing the subtitle to 3.2 Hydrodynamics and sediment mobility.

Page 10, lines 9-11: Referring to supercritical conditions in a section entitled hydrodynamics may easily be misunderstood as referring to supercritical flow conditions. Hence, consider instead to refer to e.g. excess shear stress or something in that line in order to improve readability and to avoid misunderstandings.

3.3 Ripple dimensions

Page 10, lines 13-32: Ripple lengths shown in Fig. 8b are not described in the results section; however, Fig. 8b is being referred to in the discussion. Nevertheless, consider also describing the measured and predicted ripple lengths in the results section with reference to Fig. 8b.

Page 10, line 20: Change "...returns..." to "...return...".

3.4 Hydraulic roughness

OK.

4 Discussion

4.1 Methods for dimension measurement

OK.

4.2 Precision of measurement

Page 11, lines 23-24: Seem to be a syntax issue. Consider rephrasing.

Page 11, line 24: Change "..., i.e., the..." to "..., i.e. the...".

Page 11, line 31 to page 12, line 2: One of the main advantages of a discrete approach for determining bedform dimensions is that it enables subsequent statistics on the distributions of bedform dimensions. Hence, consider showing these distributions e.g. as histograms along with the descriptive statistics. If showing the histograms then these should be included in the results section.

Page 12, line 4: Change "...predicted Soulsby et al. (2012)..." to "...predicted by Soulsby et al. (2012)...".

4.3 Form roughness

OK.

5 Conclusions

Page 12, lines 20-22: KW state that the observed dynamics of the ripple dimensions can be linked to changes in the forcing hydrodynamics. The time series are visualized in Fig. 7, however I don't recall any analysis and explanation of the variations. In addition, it seems as if the trend of the measured ripple height dynamics, after the peak in wave-related shear stress, is different from the trend of the predicted ripple height dynamics. Consider elaborating on this.

Page 12, line 21: Change ". . ., i.e., the relative changes can. . ." to ". . ., i.e. the relative changes, can. . .".

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