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Interactive comment on "Medium-term dynamics of a Middle Adriatic barred beach" *by* Matteo Postacchini et al.

Anonymous Referee #2

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General Comments

Summary: This submission investigates medium-term morphodynamics of a barred beach along the Middle Adriatic coast of Italy using annual bathymetric surveys and offshore wave buoy data. Previous studies of similar beaches have focused on short- and long-term dynamics, leaving medium-term behavior relatively unstudied. A better understanding of the connections between wave climate and changes in nearshore morphology is needed to improve models that predict storm effects (flooding), beach erosion, or how shoreline protection structures will affect a beach. The authors utilize well-tested data sources (bathymetric surveys and wave buoy from Italian wave measurement network) to examine dynamics on a neglected timescale, medium-term. However, the bathymetric data was collected only once per experimental year, and in my opinion, this limited data set imposes restrictions on the authors' interpretation of

the results. Namely, there is insufficient data to separate the possible effects of short-term changes due to winter storms from medium-term changes due to medium-term wave climate. See Specific Comments section for further comment.

Abstract and Title: Abstract explains context and main findings clearly and concisely. The title is appropriate, although upon first reading, the phrase "medium-term dynamics" was unfamiliar. After reading the abstract, I learned that medium-term is a timescale that is longer than short-term (days) and shorter than long-term (years/decades), on the order of seasons or annual. If there is a way to be more clear in the title that medium-term is a timescale, that would be encouraged, but this change is not essential.

Organization: This paper is generally well organized. One recommendation- Explain Dean-type beach stability analysis earlier. It is not addressed until the discussion, but it is first mentioned in the "Description of the Site" and then used to explain longshore variability in the "Results". It would be helpful to present the equation with its explanation earlier, so the reader knows where this stable beach shape characterization comes from and why it is relevant for understanding other changes to the beach morphology.

Specific Scientific Comments

Assessment of Medium-term dynamics: Wave climate and nearshore morphology are strongly linked and it is valuable to reveal this relationship over various time scales and environments. The authors focus on a sandy barred beach, chosen for its similarity to many other beaches worldwide, over medium-term time scales. The wave data presented here is sufficient for medium-term analysis. However, a description of the original form of the wave buoy data (time series, hourly product, wave spectra?) and the methods used to further process this data should be specified for the sake of reproducibility.

The authors acknowledge that beach morphology is "dynamic throughout the year, especially during sea storms driven by NNE winds" (p. 3, line 30). Given this variability, it is necessary to be able to distinguish short-term variability from medium-term variability in order to assess the connection between medium-term wave climate and beach morphology. The bathymetric surveys were collected in different months/seasons each year: June/Summer 2006, February/Winter 2010, February/Winter 2011, April/Spring 2012, March/Spring 2013. The authors explain that the two types of winds (ESE and NNE) can happen during the same season, and that in the study region, winters are stormy and summers are calm. The winter surveys would therefore be more susceptible to short-term variability due to storms, which is not distinguishable given the limited bathymetric data set. The summer bathymetric surveys are perhaps more representative of medium-term dynamics, because the beach is not subjected to the magnitude or frequency of short-term, high impact events during that season. Since the literature shows and the authors admit that significant bathymetric changes can occur over the course of a single storm, and there is no information given to put each survey in this short-term context, it is not correct to assume that the "snapshot" of bathymetry seen in the data is representative of the medium-term dynamics. The authors should pursue supplementary data (perhaps short-term wave data analysis) to provide context for the bathymetry surveys used in this study.

The authors present current theory, based on peer-reviewed and published field and laboratory measurements, for predicting bar migration based on wave conditions. This theory states that steeper, larger waves promote a seaward shift of the bar and less steep, smaller waves promote a shoreward shift of the bar. The bar migration pattern results presented in this study agree with previous findings. However, agreement with the theory is limited due to insufficient bathymetric data to definitively ascribe morphological changes over a particular year to medium-term wave climate alone (i.e., lacking evidence that short-term wave climate is not contaminating the bathymetric surveys).

Tables: Table 1& 2: The authors claim it is best to use wave statistics based on the maximum percentage of energy flux over the time interval of interest. This is a fair decision. However, based on the Figure 3 wave roses and Table 1 statistics, there

is not always a single band where the energy flux is concentrated. For 2010-2011 especially, the energy flux seems evenly split between H_m0=1.5-2.0 m (energy flux distribution % of 16.56) and H_m0=3.0-3.5 m (energy flux distribution % of 16.02). The authors decide that the dominant waves were about Hm0=1.75 m. Looking at the wave rose for 2010-2011 there are strong peaks in both the ESE (∼25%) and NNE (∼20%) directions. Yet, when summarizing the 2010-2011 period, the authors choose ESE for this time interval. The 2011-2012 and 2012-2013 conditions were truly dominated by one type of wind event over the other, so the assumptions made by the authors for those time intervals are justified. Perhaps a more nuanced bimodal analysis of 2010-2011 is warranted, especially if these bulk wave climate characteristics are used to explain changes in beach morphology.

Figures: Figure 6a shows normalized bar height versus normalized bar width with fits for outer and inner bar (essentially steepness curves (H_bar/W_bar) showing how bar geometry changes from outer to intermediate bars). The fits are presented for 2010 and 2013, but not for the other three years of data, leaving the reader questioning whether these trends are consistent. Furthermore, if the goal is to show that medium-term bar dynamics are strongly linked to medium-term wave climate, it is important to present plots that relate bar features (or changes in bar features) to wave climate metrics (like Table 3, but is visual plot form). Figure 6b shows that the cross-shore area of the bar increases southward. A shift in the grain size distribution is the explanation given for the alongshore trend in the equilibrium beach profile. Since grain size distribution is a consideration throughout the authors' analysis of the results, plotting cross-shore bar area versus some grain size distribution metric would be more useful.

Technical Comments

Fluency: Although it is apparent that English is the second language of the authors, this does not inhibit the reader's ability to understand this research and its conclusions. There are only a few places where grammar issues impede the authors' message. Listed below are the sentences where a second pass at phrasing would be beneficial.

p. 7, line 10 - p. 8, line 3 p. 16, lines 1-7 p. 18, lines 15-20

Equations: Mathematical formulae, symbols, abbreviations, and units are correctly defined and used.

References: The number and quality of references is appropriate.

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