

Dear Editor and Referees

The authors would like to thank all referees for the positive and constructive comments regarding the submitted manuscript and dataset, which helped to improve the work. In general, all small changes suggested by the referees were accepted. A complete reply addressing each referee comments is presented next, where all modifications are reported as well.

Referee #1 Comments	Authors Reply
<p>http://www.earth-syst-sci-data-discuss.net/essd-2016-5/essd-2016-5-RC1-supplement.pdf</p>	<p>Minor changes were all accepted by the authors.</p> <p>Cell numbers were removed from abstract. Longshore drift directions information along the study area was added to section 2.</p> <p>Figure 7 and 8, changed numbering.</p> <p>To further assist the discussion of rate of change results in each cell, the % of transects in erosion, with values within uncertainty and in accretion were added to Table 1, for each cell and for all cells.</p> <p>Although a thorough review of the many Portuguese coastline (and shoreline) evolution studies is beyond the scope of this study, some results reported by other authors for areas most prone to erosion is now briefly summarized in discussion section. Thus, the discussion section was extended as suggested by the referee.</p>

Referee #2 Comments	Authors Reply
<p>Abstract: How can the authors affirm that erosion trends dominate the Portuguese beach-dune systems if the result is as low as -0.24m/yr? Indeed, the authors after affirming this call the reader attention to the exceptions to the rule. I would recommend the authors to split the coast into two major areas: the north (which is indeed the one that shows a clear erosive trend) and the south, with a rather stable trend.</p> <p>As you are referring to the littoral cells that you define at the methods section within the abstract, I would recommend to at least say something about these cells in the abstract (e.g. total number of cells).</p>	<p>Comments were added regarding the mean average value obtained for all sandy coast in relation with number of transects in erosion. This now give a better perspective of the spatially incidence of the erosion.</p> <p>Authors consider that splitting the coast at north and south sector is not needed because a complete description for each sediment cell is already provided.</p> <p>Cell information was removed from the abstract, also suggested by referee #1.</p> <p>The EMODNET link to dataset containing part the data presented in this study was added to section 4.</p>

Regarding your dataset, the layer file (the one linked to EMODnet project) cannot be visualized, when is this going to be available?	
Line 7: what do you mean by global?	Changed to “national-scale”
Line 8: please include “coasts” at the end of the sentence.	added
Line 15: I would delete the end of the sentence: . . .for all mainland Portuguese beachdune systems. . .	The study was conducted only in sandy beach-dune systems. This information is to reinforce that the -0.24 m/years result does not include other geomorphological types of coast (e.g. cliffs).
Introduction: I would recommend the authors to explain how representative is the analysis of only two shoreline positions over fifty years in order to further support their dataset; would not be possible to add an intermediate point to better represent the long term trend?	<p>This work targets coastal evolution at long-term time scales and data exploitation should take into account this circumstance. Results are only representative of the average evolution in the last 50 years. Obviously it would be very interesting to do some intermediate points to assess if the erosion is increasing or decreasing, but this will be the object of future works.</p> <p>At this stage, authors do not have a complete dataset for Portuguese mainland coast surveyed in another year. Author aim, in the near future, to acquire such dataset for other years and supplement this study with short-term analysis, as stated in future work (Conclusions section).</p>
Page 1, Line 25: please rephrase: . . . As human demands. . .	Changed to “human activities”
Page 2, Line 30: again, what do you mean by global?	Changed to “national-scale”
Study area:	
Page 4, Line 22: please change mounth by mouth	corrected
Results and Discussion:	
Page 7, Line 11: please give some details about the timing when these will be available	The EMODNET link to dataset containing part of our data was added to section 4.
Page 8, Line 19: please check: . . . globally, this sector presents a slight erosive trend with a +0.04m/yr	Changed to -0.04 m/year.
Page 8, Line 32: after checking within the dataset, I was not able to find rates of +3.11 within this cell, could you please check this?	There was in fact an error: values were corrected for Min. (-0.95), Max. (1.32), both in Table 1 and in the text.
Page 9, Line 10: as I have stated at the abstract, I would recommend the authors to rewrite this as looking at the overall coast it is not so clear that erosion dominates, and indeed the resultant value is too low.	Explained in the first comment.

Referee #3 Comments	Authors Reply
<p>(1) more discussion is needed with regard to the coastline definition;</p> <p>(2) the differences in the geomorphological settings (foredune, incipient dunes, sand dykes, washovers terraces and frontal revetments) should be pointed out clearly;</p> <p>(3) overwashing areas or incipient dunes (with or without vegetation) observed in extensive areas may be discussed regarding the methodology procedures;</p> <p>(4) some discussion that relates the results and its future use to coastal management might be useful.</p>	<ol style="list-style-type: none"> 1) Coastline definition section was rewritten to justify the use of the foredune indicator. 2) This methodology is capable of analyzing coastline evolution of sandy beach-dune systems, which are the areas capable of expressing a rapid coastline retreat due to the soft nature of sandy backshore. Besides, coastal stretch sand dykes, washovers terraces and frontal revetments were not considered, as clearly stated in the manuscript. 3) Percentage of sandy beach not mapped with this method was added in the coastline indicator section. When the indicator is not discernible it constitutes a limitation to the methodology, therefore other approaches have to be considered in such cases. Discussion on such approaches will be the object of future works, as mentioned in Conclusions section. 4) The discussion of the results was slightly extended and, although the point raised by the reviewer is appealing, the thorough discussion of the implications on coastal management is beyond the study scope.
<p>Technical corrections Abstract Page 1, lines 18 and 19: Some names that identify coastal stretches are not correct. Please change “. . . Costa Nova - Praia da Mira. . .”to Praia de Mira, and “. . .Cova Gala – Leirosa. . .” to Cova da Gala. Please, change also the names in Results and Discussion section.</p>	<p>Names changed both in the figures and text.</p>
<p>3 Methods 3.1 Beach coastline indicator Page 5, line 6-12: Taking into account others studies in the near future, you need to specify how to proceed when the shoreline indicator (foredune toe) is not present. You must have this problem in a lot of situations,</p>	<p>When the indicator is not visible it constitutes a limitation to the methodology, therefore other approaches have to be considered in this case. Discussion on such approaches will be the object of future works, as mentioned in Conclusions.</p>

in particular, on the digital orthophotomaps of the year 2010, both in northwest coast (namely sub-cells 1b and 1c), where the geomorphological features are quite diverse, and in south coast (cell 8).	Percentage of sandy beach not mapped was added in the coastline indicator section, to quantify such situations.
4 Results and Discussion Page 8, line 19: please check: "... globally, this sector presents a slight erosive trend with a +0.04m/yr". Page 8, line 32: after checking within the dataset, I cannot find And rates of +3.11 in cell 6; please verify this. Page 9, line 10: according with the low value of the medium erosion rate, it is not clear that erosion processes have been to dominate the Portuguese coast; could you rewrite this and check the abstract?	<p>Changed to -0.04 m/year.</p> <p>There was in fact an error: values were corrected for Min. (-0.95), Max. (1.32), both in Table 1 and in the text.</p> <p>Comments were added regarding the mean average value obtained for all the coast in relation with number of transects in erosion (discussions section – last paragraph). Authors consider that this gives a good perspective on the meaning of the result - 0.24m/year for all mainland Portuguese sandy coastline.</p>

Referee #4 Comments	Authors Reply
Abstract	
Line 8: add "coast" at the end of sentence.	added
Line 17: change to "coastal sediment cells"	changed
Details such as cell numbers should not appear in the Abstract.	changed
Introduction	
Page 2, line 21: change to "are not expected"	changed
Page 2, line 23: delete the question mark after "Bettencourt and Angelo, 1992". Study area:	corrected, missing a reference
Some general information on wave approach directions is necessary. Moreover, the approximate length of each cell should be indicated in this section	Information on general wave approach and littoral drift added to this section.
Page 3, lines 23-24: the cliffs at the south of sub-cell 1b and the rocky coast at the north of sub-cell 1c are not represented in Figure 1.	Figure changed
Page 3, lines 24-26: references are needed here to support this information.	Reference added
Page 3, line 30: change to "presenting numerous pocket beaches".	changed
Page 4, line 5: why is there information on dominant wave approaching direction only in cell 4 and not in the other cells?	Information on sheltered coastlines from the dominant wave directions was only characterized for cells 4 and 5, which present this characteristic. Cells 6 and 7 wave directions was already characterized in

	section 2, the newly added lines about wave climate and littoral drift.
Page 4, line 9: the sector between Cape Espichel and Sado inlet seems to be part of cell 4 in Figure 1.	corrected
Methods	
Page 5, line 6: change to “which focuses”.	changed
Page 5, line 8: change to “Del Rio and Gracia, 2013” (change also in the References section).	changed
Page 5, line 11: change to “could not be mapped”. This is an important issue: the authors could provide some comments on possible alternatives for shoreline mapping in these cases. What percentage of the total length of sandy beaches could not be mapped?	Percentage of sandy beach not mapped was added in this section
Page 5, line 15: how many photos were used in total?	Information added
Page 5, line 24: The authors should explain how could they generate the mosaics without first georeferencing the photos. This is a very uncommon procedure, as the distortions of non-georeferenced (uncorrected) aerial photographs usually hinder the generation of mosaics. How did the authors match the edges of each image to the neighbour one without having them corrected first?	An explanation about this procedure was added
Page 5, line 26: change to GCPs. Information should be added on how many GCPs were used per image (on average), and also on what was the average RMSE of the georeferencing process.	Information added
Page 6, line 3: change to digitization.	changed
Page 6, lines 4-5: Why did the authors reduce the detail of the shorelines from the original digitization scale (1:5000-1:8000) to 1:50.000 or smaller? This should be justified.	The 1:50 000 scale of the final coastlines was derived using a commonly accepted drawing error of 1/5 of the line with (+/- 0.2 mm). Both coastlines presented different uncertainty values (8.4 m and 5 m, for 1958 and 2010 respectively). For final coastlines scale assessment, the uncertainty was maximized to 10 m, which is 0.2 mm at the 1:50 000 scale.
Page 6, line 7: change to Digital Shoreline Analysis System.	changed
Page 6, line 21: change to “Del Rio and Gracia, 2013”.	changed
Page 6, line 22: Why were only three mosaics used for evaluating georeferencing	This information was added to section 3.2.2

uncertainty? Which ones? Were they representative? How many mosaics were used in total? This should be clearly explained and justified.	
Page 6, line 25: How was vectorization uncertainty estimated to be 7 m in the 1958 photos and 5 m in the 2010 orthophotos? This procedure should be clearly explained and justified.	Information added to section 3.3.1
Page 6, lines 28-30: This expression for the calculation of uncertainty in coastline change rate should include at least the citation of Fletcher et al. (2003).	Citation included
Page 7, lines 1-5: It is not clear why the authors are calculating an average uncertainty, when every transect has the same uncertainty (0.2 m/yr).	Fletcher et a. (2003) suggests calculating the uncertainty of the average transects evolution, as it may depend upon number of transects used. We have follow uncertainty methodology assessment proposed by these authors in average transects.
Discussion	
In general, there is a clear lack of citations of (and comparisons with) previous works in which rates of shoreline change are calculated for different sections of the Portuguese sandy coast. These works (some of which are cited in the Introduction section) should be accounted for.	Although a thorough review of the many Portuguese coastline and shoreline evolution studies is beyond the scope of this study, some results reported by other authors and for areas prone to erosion were briefly summarized in the discussion section.
A description of the type of coast and general geomorphological characteristics of each cell is included for cells 1 to 5, but not for cells 6 to 8. Why? It should be added for the latter too.	A complete description of the general geomorphological characteristics of each cell is conducted in section 2.1. References are made to these geomorphological settings when they are relevant to the study.
Page 7, lines 1-2: Total length of digitized coastlines is included in Table 1, but it would be convenient to mention it in the text as well.	Mention to text added to section 2.1
Page 7, line18: The erosive trend is more related to the high percentage of eroding transects, rather than to the average rate of shoreline change.	To further assist the discussion of rate of change in each cell, the % of transects in erosion, with values within uncertainty and in accretion were added to Table 1 for each cell and for all cells.
Page 8, line 5: is this really a whole sediment cell? From the description it looks more like a series of minor cells without any transport between them.	A complete discussion of these sediment cell sediment budget is present in Duarte Santos et al. (2014).
Page 8, line 12: change to "From Cova do Vapor to Bicas"	changed
Page 8, line 19: A rate of shoreline change of 0.04 m/yr is not significant at all, so it	To further assist the discussion of rate of change in each cell, the % of transects in erosion, with values within uncertainty and

should not be described as an erosive trend. The percentage of eroding or accreting transects should rather be considered for this.	in accretion were added to Table 1 for each cell and for all cells.
Page 8, line 25: change to “are broadly homogeneous”.	changed
Page 8, line 30: Some comments would be needed about the type of coast and the extremely short length of beach-dune coastline in this cell.	Type of coast is presented in section 2.1.
Page 8, line 32: change to “Figure 5”.	changed
Page 8, line 35: please add “an overall accretional trend in the few stretches of sandy coastline”.	added
Page 9, lines 1-7: As stated above, citations of previous works are needed here, so for instance a comparison with results of studies published by the research group of the Universidade do Algarve should be included in this cell.	Some results reported by other authors for areas prone to erosion were briefly summarized in the penult paragraph – discussion section.
Page 9, line 3: Figure 8 should not appear in the text before Figure 7.	changed
Page 9, line 7: remove “evolution”.	removed
Page 9, line 10: Highlighting an average value (-0.24 m/yr) where such contrasting trends exist is not significant at all.	Comments were added regarding the mean average value obtained for all the coast in relation with number of transects erosion (discussions section – last paragraph).
Conclusions	
Page 9, line 26: Again, this average value is not significant. Please add “display extremely variable evolution”.	Replied above
Page 9, lines 30-32: These three lines are identical to the final lines of the Discussion section. Please remove them from one of the sections.	Removed from the discussion section
Page 10, lines 4-5: Some comments could be included about possible improvements or changes that would be necessary to apply the methodology described to rocky or mixed coasts.	This cannot be done without the devolvement of another methodology that accounts for these type of coasts characteristics. This will be the subject of future work.
Tables	
Table 1: considering the amount of transects included on each cell, and the extremely variable rates of shoreline change, I recommend to include standard deviation instead of uncertainty in the column of mean evolution rate.	Although pertinent, due to the extremely variable nature of rates of change, authors believe that Fletcher et al. (2003) methodology is preferable.
Figures	
Figure 1: Scale is missing in this figure. The fact that cells are not displayed in	changed

geographic N-S order is a bit confusing.	
Figure 7: For consistency, the rate of change ranges for representation must be <-1.0 (red), from -1.0 to 1.0 (white), and >1.0 (green). Again here and as suggested for Table 1, the uncertainty of 0.02 m/yr is not meaningful at all, so I recommend to substitute it by SD of the different transects (accounting for spatial variability of shoreline changes along the cell).	This figure was altered to have the same range as the others: < -0.2 m/year for erosion; -0.2 – 0.2 for stable or within uncertainty and > 0.2 m/year for accretion.
Figure 8: The location of these areas should be indicated in Figure 6.	This figure was updated with the addition of area A and B locations.
Data review	
The shapefiles of coastlines are correct, but some useful additional information could be included in the attribute tables. I suggest dividing each shapefile into different features (one for each cell), and including a column in the attribute table with the cell number	Because coastlines shape files can be used for any other studies, authors think they should remain on single line. Each user can use these lines as they want, depending upon studies particularities.
The shapefile of the rate of change is clearly subject to improvement due to several reasons: a) The columns Date_XXXX (distance to baseline) are useless without the baseline shapefiles, so they should be removed to avoid confusion. b) The transects are not consecutively numbered, so it is difficult to identify each rate from the table. In fact, the numbering is chaotic, with transects from North to South being 1855-1865, then 1812-1851, then 1682-1807 etc. Many transect numbers are missing (I presume that due to removal of useless or not-included transects) and this is confusing. I recommend to re-number all transects in a new column, where transect 1 will be the northernmost one and transect 1241 will be the last one before the Guadiana river.	Nevertheless: - the shapefile of rate of change, cell ID was added to each transect. - Unnecessary columns were deleted. - Transects were consecutively numbered from north to south
The layer file should include the versions of the software that can open it, as e.g. it cannot be accessed with ArcGIS 9.	Information sent to Pangaea repository.

Referee #5 Comments	Authors Reply
Specific comments	
1) Several times the authors refer that human interventions interfere	Authors are referring to all human interventions (sediment river discharge

<p>with the coastal system, originating and maintaining a sediment deficit (page 1, line 20; page 9, lines 13 and 30). It is not clear to what kind of human interventions the authors are referring to. This should be clarified and some references to literature should be presented.</p>	<p>reduction, sand extractions, heavy engineering works on the coast, etc). Although the scope of this article was not to address this causes in an exhaustive way, authors felt that these causes should be mentioned in a general way, as all them have effectively and collectively contribute to a sediment deficit.</p>
<p>2) Related with point 1), are the authors considering that the coastal defense interventions are included in the causes of sediment deficit? Or were the coastal defense structures a response to the high rates of coastal erosion? In some coastal stretches the authors should identify the date of construction of coastal defense interventions and the shoreline evolution before and after these coastal works. It is not completely clear how the shoreline position is identified when a longitudinal coastal revetment (or groin) is present.</p>	<p>A thorough examination of the coastal defenses impact/mitigation in/of coastal erosion certainly is a very interest discussion; such discussion is beyond the scope of this study. This discussion is thoroughly address in Duarte at al. 2014.</p> <p>The coastline position is identified by the dune foot by either the presence of vegetation or a slope break. If groins are present seaward of these features, they will not substantially affect the indicator position. If groins are present, but no beach-dune system exist then the coastline could not be mapped. Coastal revetments will not allow the coast to retreat, so they were not used as indicators of coastline evolution in this study.</p>
<p>3) The authors can include a section where the temporal scale of analysis should be discussed. There are no reference of eventual storm waves attack to the dunes (and post storm recovery) and the impact that this may have on seasonal beach profile behavior. In several Portuguese coastal stretches it is presently difficult to identify the dune toe, where dunes are under erosion or were destroyed by man-made constructions.</p>	<p>The chosen coastline indicator is as independent as possible from short-term (tidal) and medium-term (seasonal) changes. In what regards storms, they are in fact capable of affecting the coastline position (dune toe position) and they will represent actual coastline retreats. If such episodes are not cumulative, coastline might recover, and in a long-term study its effects will be concealed.</p> <p>Percentage of sandy coasts analyzed by the methodology was added to section 3.1</p>
<p>4) At chapter 2, section 2.1 exists without a section 2.2. At the end of this chapter, it is suggested to be included a brief identification of the low-lying sandy coasts that are being analyzed by the authors.</p>	<p>Percentage of sandy coasts analyzed by the methodology was added to section 3.1</p>
<p>5) At page 8 (line 23) there are references to artificial nourishments at only one Portuguese coastal stretch. References to other coastal stretches with beach nourishments should be added.</p>	<p>Information on artificial nourishments was added to cell 8 as well. For other cells such information was not available to the authors.</p>
<p>Technical corrections</p>	

<p>Page 2 (line 23): delete “?” Page 2 (line 24): Baptista et al (2014) can be added to the references: Beach Morphology and Shoreline Evolution: Monitoring and Modeling Medium-Term Responses (Portuguese NW Coast Study Site); Coastal Engineering Journal, Elsevier, 84: 23-37. Page 8 (line 19): clarify “. . .erosive trend with a +0.04. . .” Figure 1: What is the scale of each cell representation? Is it the same for all the cells?</p>	<p>? is a missing reference, which was added.</p> <p>Authors have added references from the same study area analyzed in Baptista et al (2014), with a time-frame near the time interval used in this study. The number of works based on shorter time intervals for Portugal are so numerous that is impossible in a work of this nature to include them all.</p> <p>Changed to -0.04 m/year.</p> <p>Figure 1 changed. Scale added to each cell.</p>
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Furthermore, the dataset DOIs were also updated in the new manuscript version. Comments explicitly related to the dataset were directed to PANGAEA data repository, for dataset update.

As a conclusion, the new version of the manuscript, which includes all changes, is in attachment.