

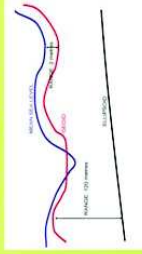
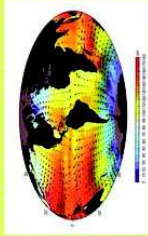
# A COMPARATIVE STUDY OF METHODOLOGIES TO INTERPOLATE SEA LEVELS ALONG DOÑANA COAST AND THE BAY OF ALGECIRAS (SW SPAIN)

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## THE PROBLEM

The mean sea level *changes* along a coast. In the world, it means a variability of only 2 metres, if measured from the geoid. It is not a very big range, compared with the one of the geoid (160 m), although this creates much bigger problems for map-making.

Crucially, this creates a very important cartographic problem when maps about sea level hazards have to be made. Some variables (such a sea level rise) have a smaller range than the variability of mean sea level over the geoid.



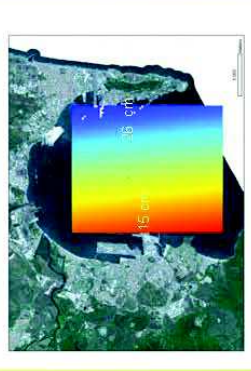
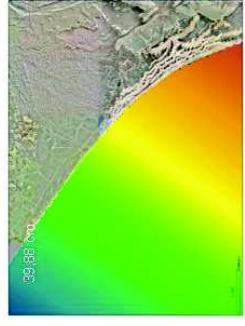
In the andalusian coast, the range of mean sea level is 40 cm, measured from the datum of Alicante (a arbitrary reference of the geoid, and zero for all the topographic maps).



We have chosen two different locations to test methodologies for interpolating mean sea levels along a coast. The first example is a very smooth coast in the National Park of Doñana. A 10 cm difference has to be solved. The second one is the Bay of Algeciras, a very complicated location where there is another 10 cm difference between Algeciras and Gibraltar

## TREND SURFACES WITH FIRST GRADE POLYNOMIALS

A trend surface is a grid that is built up by an equation, provided by a regression model. If this polynomial is made by a first grade equation, the resultant trend surface is a plane.



This method seems to be a good solution in flat/open coasts, such as Doñana coast. However this is not the case in the crescent Bay of Algeciras, where values are interpolated in a short segment in the north of the bay.

## INTERPOLATING ALONG THE COASTLINE



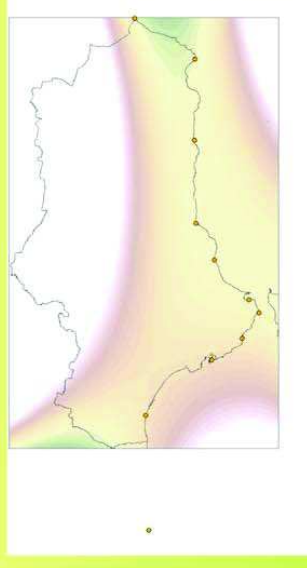
The vertexes of each segment of the shoreline have been converted into points. Then, we have calculated the length of each point from the beginning of the line.

Having found the relative distance of each point from the beginning to the end of the line, it is possible to calculate the interpolated value for each point through a simple equation.

There are not many big differences between the obtained data following this method or following the first one in Doñana. However the changes between this way and the first are huge in the Bay of Algeciras: it has completely changed the shape of the surface that we can imagine defined by those points.

## A REGIONAL TREND SURFACE FOR MORE THAN TWO TIDE GAUGES

It is also possible to interpolate all the andalusian tide gauges in only one grid by using a trend surface with a multiple grade polynomial. The polynomial should have the lowest grade as possible.



Although it is possible to identify some mistakes, this method can be used as a very general way to make regional interpolations.

## CONCLUSIONS

The second method, interpolating along the coastline, seems to be the most accurate one of the three analyzed on this poster. The main problem that can be identified for this method is related with its hard work. But we think that it

The first one, using first grade equations, is only accurate in open and flat coasts, as the one from Doñana to Bonanza. When the coast turns too rough, the obtained results make no sense.

The third method is just a good way to make very regional models not necessarily with high accuracy.