The following appendices accompany the article

Wave exposure indices from digital coastlines and the prediction of rocky shore community structure

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Appendix 1. Wave fetch model and data

Model structure and operation: a description of the code and operation of the wave fetch model with details of the format of the input and output data, see Appendix 2.

Wave fetch data for UK: using a 200 m grid based on Global Self-consistent, Hierarchical, High-resolution Shoreline (GSHHS) data projected into British National Grid coordinates.

F200mEUndiagNLL.zip (2.7MB, uncompressed 13.1 MB).

UK 200 m landmass grid: 200 m grid used to generate wave fetch data.

eu200msb.zip (274 KB, uncompressed 82 MB)

Model code: Visual Basic 6 project code and user form WaveExposureSourceCode.zip (7 KB)

Model setup and installation files: Setup program and associated files. WaveFetch16v01.zip (1.7 MB)

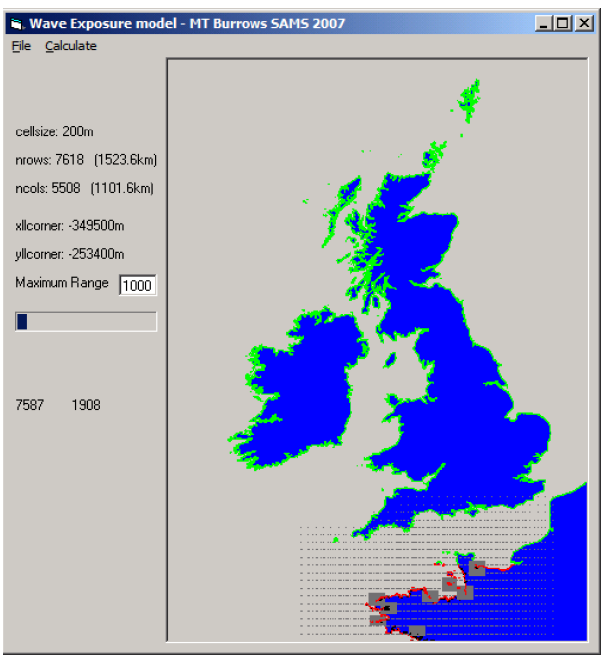
The ready availability of digital coastline data, such as the World Vector Shoreline and GSHHS, means that producing relatively high resolution (200 m scale) maps of wave fetch using our model is a relatively simple and straightforward process. The model is designed to be used in parallel with a GIS program capable of projecting geographical coordinates (latitude and longitude) into distance units (m) using projections such as Universal Transverse Mercator or national grids. Once calculated, wave fetch data may be best displayed and further manipulated using a GIS. Please note that the large grid supplied here (5508 × 7618) may take several minutes to load into the model, and that calculation of wave fetch for all the coastal cells in this grid (114 792 cells) may take over 20 min or longer.

Appendix 2. Wave fetch model design and use (November 2007)

This document describes the design and use of the wave fetch model as implemented in Microsoft Visual Basic 6.

Model interface

The model has a graphical user interface as shown below, with a number of menu-driven commands and a display of the currently loaded coastline grid (right) with details of the dimensions and location of the grid (left). A text box allows the user to input the maximum range (in grid cells) for searching for nearby land masses.



Basic model structure

Once the grid data has been loaded into the model (**`mnuFileLoadMap_Click`**), the program identifies the coastal cells as those adjacent to the sea (**`GenerateCoast`**) and plots these as green squares on the map graphic. The model grid is stored as a 2D array (**`HabitatMap(j&, i&)`**) with 0s for sea cells, 1 for land cells and 2 for coastal cells. Data for each individual coastal cell are stored as another array (**`CoastCell(k&, 20)`**) to hold grid coordinates, calculated wave fetch in different angular sectors, summed fetch and neighbourhood average fetch values.

Initiating the calculation of fetch for coastal cells (**`CalculateFetch`**) starts the model running. Three scales of searching are repeated for each coastal cell. If the cell searched is a land cell (checked using **`IsItCoast`**), then the distance to that cell is compared to the last recorded distance to the nearest land in that angular sector. If this distance is closer than the last, this new distance becomes the distance to the nearest land. The screen grab above shows the model running. Grey dots are plotted for each searched cell for one coastal cell in every 1000.

When complete, the wave fetch data can be saved as a comma-separated value file (`*`.csv or `*`.dat; **`mnuFileSaveFetch_Click`**) or as an ArcGIS ASCII raster file (`*`.asc; **`mnuFileSaveTGrid_Click`**).

File formats: comma-separated files

Comma-separated wave fetch files have a single header row with the names of 22 fields for each coastal cell. The first 4 specify cell ID and location, followed by fetch values for each sector, then 2 summary values.

Field	Description
CellNo	Cell ID number
OSEast	x-coordinate of the coastal cell in original distance units
OSNorth	y-coordinate of the coastal cell in original distance units
Col	Grid column
Row	Grid row
d1-d16	Fetch values (see below) in multiples of the grid cell size
fetchsum	Sum of the fetch values in d1-d16
f3avg	Average of the summed fetch values for the cell and its immediate neighbours

Fetch values for each angular sector are given in grid cell units in fields d1-d16.

Fetch	Sector	Mean angle (°)	from	to
d13	13	0	−11.25	11.25
d12	12	22.5	11.25	33.75
d11	11	45	33.75	56.25
d10	10	66.5	55.25	77.75
d9	9	90	78.75	101.25
d8	8	112.5	101.25	123.75
d7	7	135	123.75	146.25
d6	6	157.5	146.25	168.75
d5	5	180	168.75	191.25
d4	4	202.5	191.25	213.75
d3	3	225	213.75	236.25
d2	2	247.5	236.25	258.75
d1	1	270	258.75	281.25
d16	16	292.5	281.25	303.75
d15	15	315	303.75	326.25
d14	14	337.5	326.25	348.75

File formats: ESRI ASCII raster file format

Full details of the ArcGIS ASCII raster file format are available from a large number of online sources (e.g. http://en.wikipedia.org/wiki/ESRI_grid).

The first 6 lines of the file contain the specifications of the grid. For example:

```
ncols      5508
nrows      7618
xllcorner   -349500
yllcorner   -253400
cellsize   200
NODATA_value -9999
```

where ncols and nrows specify the number of rows and columns as integers; xllcorner and yllcorner are the x- and y-coordinates of the lower left corner of the grid, usually the easting and northing in metres; cellsize is the length of one side of a grid cell and nodata_value is the value representing missing data.

Data values follow these lines, either in rows with as many elements as there are columns in the grid, or as single values for each grid cell.

Input format

The input file (see below) must have the above header rows as appropriate for the area of the coastal grid. The data must consist of 0s for all sea cells and 1s for all land cells.

Output format

For output, the model puts the summed fetch values in the file for all coastal cells.

Program operation

Three steps are needed to generate wave fetch data using the model.

(1) Load the coastal grid file (*.asc). Select 'File > Load Map' then locate and select the file. The file needs to be in ArcGIS ASCII raster format. Successful completion of this step results in a plot of the map of grid area, with land shown in blue, coast in green and sea in grey.

(2) Start the fetch calculations. Select 'Calculate > Fetch'. The calculation begins. Progress can be seen on the left hand progress bar and in the progressive plotting of fetch values from south to north.

(3) Save the fetch data. Select either 'File > Save Fetch Data as XYZ to File' or 'File > Save Fetch Data as &Grid' as required.

Example data

Two files are provided with the model:

`eu200msb.zip`, 0.27 MB containing **`eu200msb.dat`**, 81.9 MB. This input file has a 200 m scale coastal grid for the UK and near continent produced from the GSHHS digital coastline dataset projected on the British National Grid.

`F200mEUndiagNLL.zip`, 2.7 MB containing **`F200mEUndiagNLL.dat`**, 13.1 MB. This comma-separated output file has the wave fetch data used in the paper.

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