Coastal Flooding Methodology

# **Summary**

Timeline

Description automatically generated

# **Detailed methodology**

## Part 1: Preparation of data sources into compatible formats

1. *Discrete blocks showing SWRL at each block:* ***SWRL***

Surge data – Three years of data to represent the short, medium and long term scenario (2025, 2055, 2100) converted from raster to vector using polygonise, created centroids from polygons.

1. *Line showing SLR along coast:* ***SLR***

Sea Level Data (SLR) comprising of a series of raster grids joined together to form a complete coastline. Similarly data was converted from raster to vector using polygonise, centroids were created from polygons and Voronoi’s were created out of the centroids. This ensured that the data covered the entirety of the coastline data.

Similarly to surge, the same three years of data were used – 2025, 2055, 2100. However, three different confidence levels were also taken (5, 50, 95)

1. *Map of slope along the coast:* ***G***

Slope data calculated based on elevation data published by the Ordinance survey. Data is downloadable and coded according to the British National Grid.

1. *Existing coastline:* ***ECL***

UK & Ireland Coastline downloaded from government website – this is the line which all the flooding variables will be added onto and which will form the base of the end product buffers.

## Part 2: Calculating sea level rise

1. *Discrete blocks showing SLR at each block:* ***SLRb***

SLRb was calculated by using the ‘Join attributes by location’ tool to join the sea level rise voronois (SLR) onto the surge block centroids layer (SWRL) where the Voronoi intersects with the centroid. This joins only the value of sea level rise assigned to the precise location of the surge block. Step 5 was only completed for the 50th percentile as only one value is required.

1. *Discrete blocks showing additional storm surge SWRL-SLR at each block:* ***(SWRL – SLRb)***

Once SLRb was added to the SWRL blocks, a new calculated column was added subtracting the SWRL value from SLRb value. Another set of voronois was then created from this layer. Steps 5 – 7 were repeated 3 times, once for each time period.

1. *Smoothed line showing sea level rise + storm surge along coast:* ***SLR + (SWRL – SLRb)***

Sea level rise Voronoi’s created in (2) were joined to the ECL (4) using the ‘join attributes by layer’ tool, this was repeated for each year and confidence interval creating 9 layers in total.

The surge (5) and additional surge (6) voronois were also added to the ECL data.

Added a new calculated field adding together SLR and additional surge (SWRL – SLRb) which represents the storm surge value at the local level along the coast. Repeated for each confidence interval and each time period.

## Part 3: Calculating coastal flooding

1. Smoothed line showing inward shore movement **[SLR + (SWRL – SLRb)] x 1/G**

The output of Part 2 is 3 a coastline layers containing sea level flooding and additional surge, plus the calculated columns required to reach this point for each different time period. Please see the table below for a breakdown of the fields.

The slope data (G) needs to be joined onto this output of the coastline. This can either be done in a GIS programme or with code, its up to you whichever is most efficient.

Next add a calculated field multiplying the sea level rise by 1/G. This needs to be repeated for the following columns:

* ST\_05\_Local
* ST\_50\_Local
* ST\_95\_Local
* Finalsurge50

The output should be 4 new columns added to the coastline layer. Repeat for each time period.

1. Buffered zone showing inward shore extent: **ECL – {[SLR + (SWRL – SLRb)] x 1/G}**

Using single sided buffer tool, buffer the 6 columns to achieve a visual representation of the project distance inland a coastal flood may reach (mm). Repeat for each time period.

# **Table of fields**

|  |  |  |
| --- | --- | --- |
| Field name | Description | Comments |
| Cat | Background fields – these may vary slightly between the three files but can all be ignored as they’re not used in the analysis. Not all fields are populated for all rows because the Isle of Man and the Isle of Wight were joined to the mainland for the purposes of the map aesthetic from separate sources | These fields have been greyed out because they’re not required within the analysis. |
| ID\_0 |
| ISO |
| NAME\_0 |
| OBJECTID\_1 |
| ISO3 |
| NAME\_ENGLI |
| objectid |
| ctry18cd |
| ctry18nm |
| ctry18nmw |
| bng\_e | British National Grid Easting |
| bng\_n | British National Grid Northing |
| long | Longitude |
| lat | Latitude |
| st\_areasha | Area |
| st\_lengths | Length |
| layer |  |
| ST\_05\_local | Sea level rise  ST = short term (2025)  **05 = 5th Percentile**  Local = sea level rise for that specific section of coastline | These three columns relate to the short term sea level rise at different confidence levels.  These will appear in the 2055 file as medium term (MT) and 2095 as long term (LT) |
| ST\_50\_local | Sea level rise  ST = short term (2025)  **05 = 50th Percentile**  Local = sea level rise for that specific section of coastline |
| ST\_95\_local | Sea level rise  ST = short term (2025)  **05 = 95th Percentile**  Local = sea level rise for that specific section of coastline |
| swrlb\_ST | Surge level  ST = short term | Only one value per time period for surge data. Spatially, surge data is comprised of approximately 50 blocks spread along the UK coastline |
| slrb\_ST\_50 | SLR = Sea level rise  **b = sea level rise value directly underneath the closest surge block**  ST = short term (2025)  50 = 50th Percentile | Step 5 |
| swrl-slrb50 | Surge level minus SLRb at the 50th Percentile | Step 6 |
| Add\_surge50 | Additional surge value combining ST\_50\_local with swrl-slrb50 | Step 7:  *SLR + (SWRL – SLRb)* |

# **Additional task if time permits**

The other variable that has been mapped is coastal erosion. The dataset is finished and the ‘single sided buffer’ tool was used to visually represent the area of land which may be affected by coastal erosion within the given time period. However having some trouble formatting the buffer to look neat on the map.

The screenshot below is an example of where the 3 confidence interval buffers looks untidy and I believe its because of the underlying dataset.

Any thoughts you have on how to fix this would be much appreciated! Let me know if you have time and I can explain in greater detail and show you the underlying data.

Diagram

Description automatically generated with low confidence