This exercise poses the question *“How long is the length of Britain’s coastline?”* to demonstrate that the uncertainty associated with any measurement or estimation is a function of the spatial scale at which that measurement or estimation was generated. The imagery basemap supplied by ArcGIS can used as a back drop against which the coastline of Britain can be digitised across at a series of different geographical scales in order to measure, or estimate, its length.

A table is supplied below to illustrate estimates of the coastline length, alongside the scale at which the coastline was digitised in order to generate the overall length estimate.

|  |  |  |  |
| --- | --- | --- | --- |
| Scale | Scale factor | Coastline length/ km | Ln Coastline length |
| 1:25000000 | 0.00000004 | 7219 | 8.884472 |
| 1:30000000 | 3.33333E-08 | 6011 | 8.701346 |
| 1:50000000 | 0.00000002 | 5779 | 8.661986 |
| 1:100000000 | 0.000000001 | 5430 | 8.599694 |

The natural log of the perimeter estimations for the UK coastline are plotted against the scaling factor (area on the map divided by the areas on the ground) for a series of estimation values derived across a range of geographical scales to explore the influence of scale on measurement.

This question can be answered by digitising the coastline as a vector dataset composed of many lines. The overall length can then be calculated by adding together the lengths of all the individual lines. If several digitisations are carried out across a range of scales, it becomes apparent that the greater the scale at which the coastline is viewed during the digitization procedure (i.e. the more ‘zoomed in’ the analyst is to the coastline), the longer the overall length that is estimated. This is because the more you zoom in on the coastline, the more detail is apparent. Thus, a line digitised at a larger scale more closely follows the intricate meandering shape of the coastline. As a consequence, the estimated length increased as a function of scale. Figure 8.2 illustrates the lines digitised to estimate the length of the mainland UK coastline at a scale of 1:1,000,000 (the largest scale), 1:10,000,000 and 1:30,000,000 (the smallest scale). It can be seen that a greater degree of error is associated with the line digitised at the smallest scale. This is because it is not possible to see the detailed meanderings of the coastline. Indeed, the lines digitised at this smaller scale often miss the coastline altogether. Such an error can be quantified through repeat digitisations of the coastline and statistical analysis of the distribution spread associated with the resulting coordinates belonging to the vertices of the digitised lines (see section 8.5.1). To get a more accurate measure, it is necessary to increase the scale. The estimate of length will continue to increase as the scale is increased. Even if the length is measured of every boulder, rock, pebble or grain of sand, this estimate will continue to increase as the scale or precision increases, approaching infinity. This phenomenon makes it very difficult to provide a definitive answer to the question of how long the coast of Britain is!