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Elephant Seal Migration Pattern

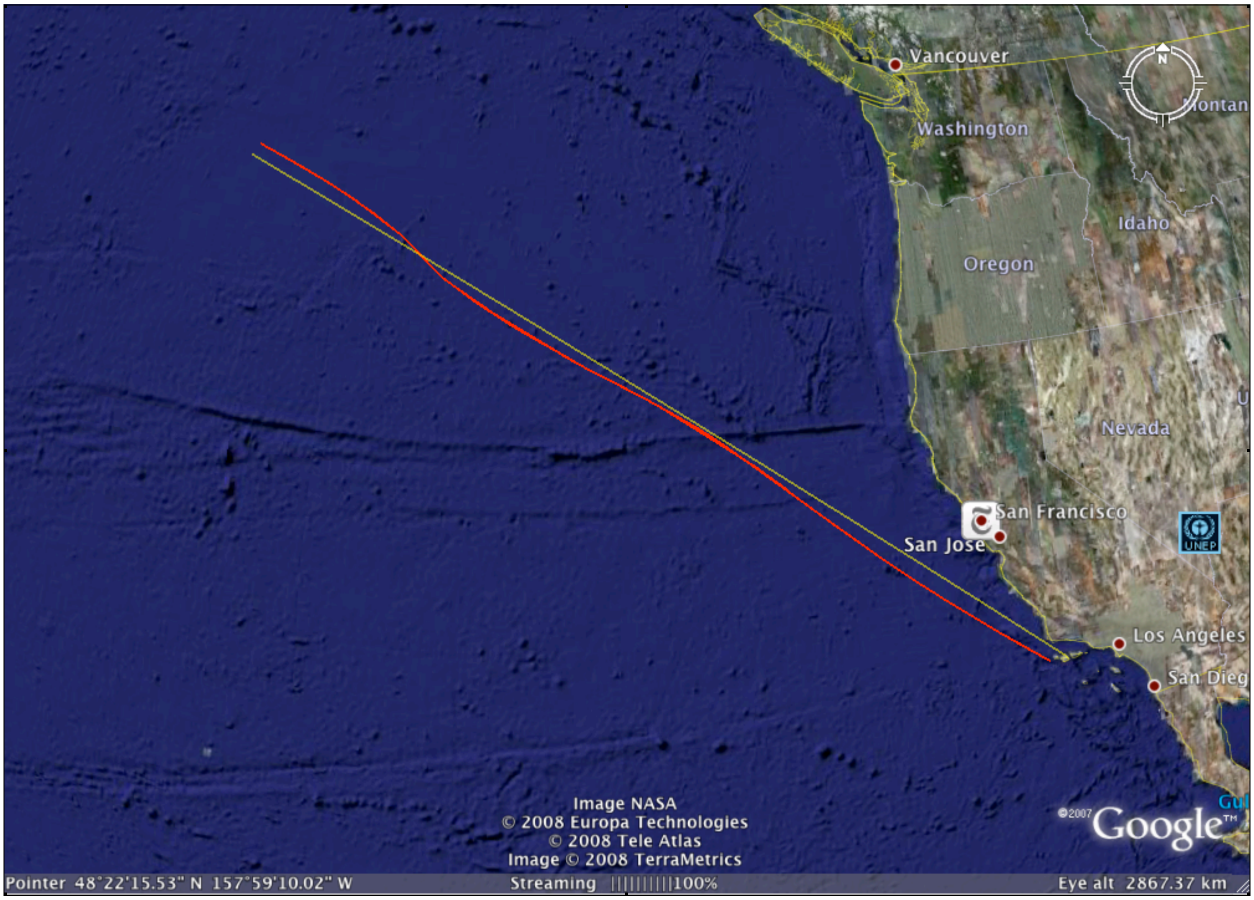
Every year, elephant seals migrate between the coast of Southern California where they mate and give birth to their pups and the Pacific Ocean just south of Alaska on the quest for food. In the 1980s, scientists began tracking elephant seals to learn more about the migratory patterns and life cycles of these large marine mammals. What they discovered is that they may be able to innately follow a great circle, the most direct path between two points on the globe.

To determine whether or not elephant seals follow a great circle, trackers were placed on them and recorded the position daily. From this set of data, the information for one elephant seal was provided for statistical analysis.

First, the graph of the great circle path that connects the initial point and the farthest point before the seal returns was animated onto Google Earth (GE). This provided the control against which all the other paths were compared. Next, the path of the elephant seal was smoothed and animated onto GE to provide an initial comparison. If the simplified path of the seal looked like it was similar to the great circle, it was plausible that the path truly did follow it. After this, the path traveled by the seal was animated onto the same GE image as was the true great circle. The data from both the great circle and the seal's actual path were used to create a residual plot that shows how similar the two paths are to one another. Next, random walks along the great circle were generated and animated onto the image of the great circle and the seal's true path. The random walk by definition follows the great circle but is made to have deviations that are similar to those of the original path. Finally, a graph of the residuals between the great circle and the random walk was plotted on top of the residual plot of the original path. Thus a comparison could be made between the deviations the original data and the randomly generated walk had from the great circle. If the residual patterns are both similar in scale and spread, then the seal is likely to have traversed along a great circle.

The images from GE show that there seems to be a similarity between the path of the seal and the great circle. The first step, the smoothed path of the seal, showed two lines that were very close to one another, at times even overlapping. This showed that in its simplified form, the seal closely followed the great circle. Furthermore, the GE image depicting the great circle (beige), the original path of the seal (green), and the random walk (purple) shows that they are all quite closely related to one another. Neither path follows the circle exactly, but that is to be expected since it is not ideal but rather the path and approximation of a living animal. As confirmation, the graph of the residuals shows that the seal stays mostly within one degree of latitude in either direction from the great circle.

The elephant seal seems to have an innate ability to follow the path of a great circle. Naturally, it deviates from its ideal course somewhat, but this is probably due to currents and the need to follow food supply. This is an amazing feat.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Pointer 48°22'15.53" N 157°59'10.02" W
Streaming 100%
Eye alt 2867.37 km

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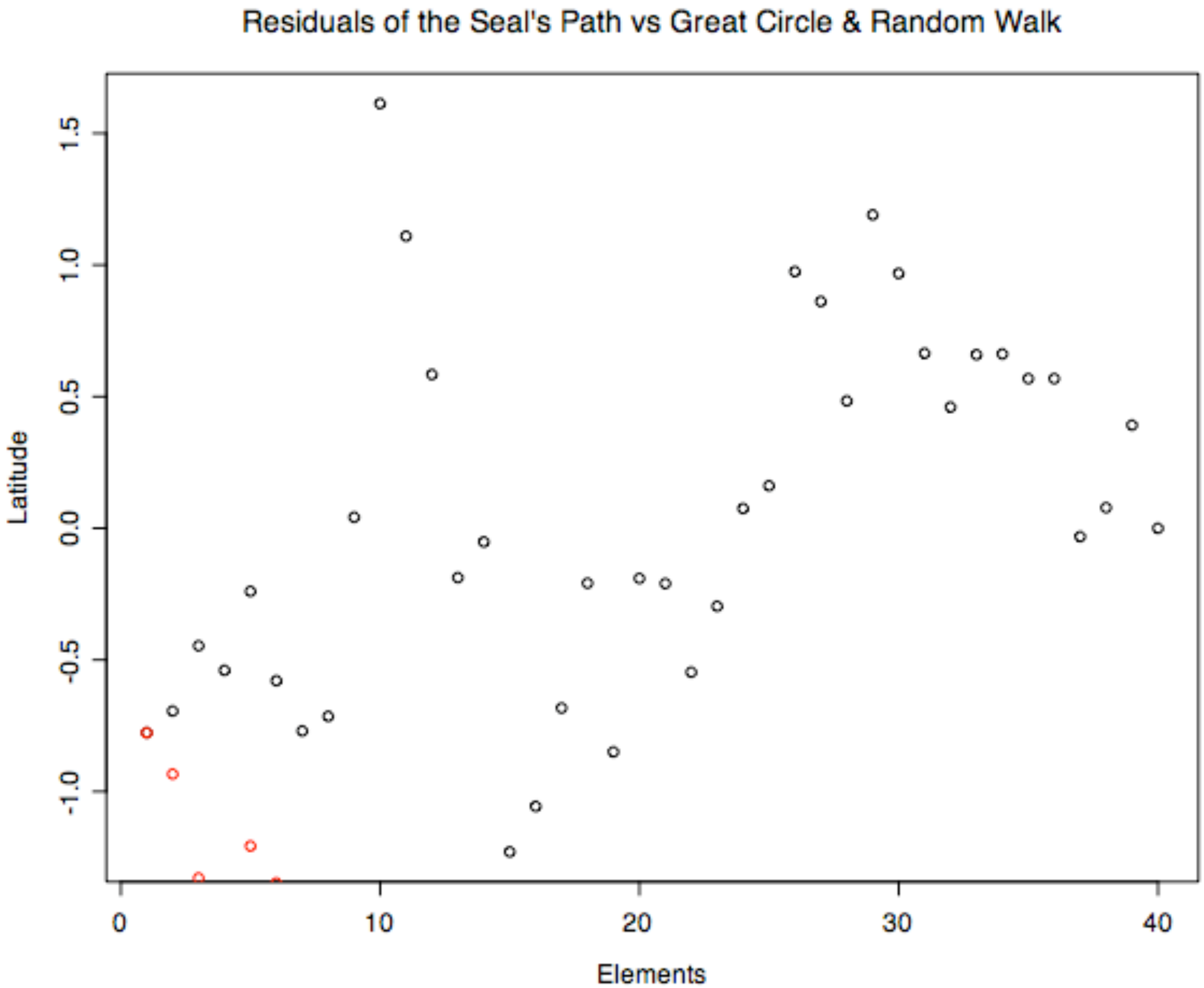
Residuals of the Seal's Path vs Great Circle & Random Walk
Latitude
Elements
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1.0
0.5
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-0.5
-1.0
0
10
20
30
40