Isothermal points on equator

Show that there is at least one set of diametrically opposite points on the equator that at a given moment have the same temperature. (It doesn't necessarily have to be the equator, it can be any circle slice of the Earth.)

A more general topology theorem says that at each moment on the surface of the Earth there are always two antipodal points that have the same temperatures and pressures! (2 degrees of freedom – 2 independent parameters, and so on.)

Answer of problem **Isothermal points on equator**

Let's find point A on the equator with maximal temperature. Assume some profile for temperature $T(\phi)$ - importantly it should be smooth and single valued, i.e. after going around the equator it should get back to the same number.

Consider the diametrically opposite point, B. We'll now move around the equator comparing the temperatures at opposite points. This corresponds to shifting the temperature profile by π and finding a point where shifted and original curves cross.

At least one such point always exists as is obvious from the plot.