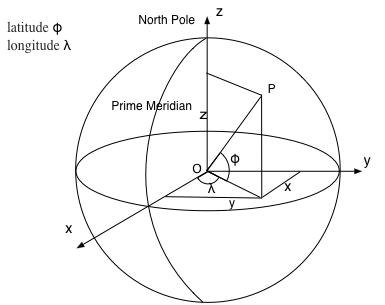
The algorithm for calculating the center point of a series of coordinates through combining geographical coordinate system with a cartesian coordinate systems that regards the Earth as a sphere (Fig.1). In Cartesian coordinates, Earth is a sphere centered at the origin [1]. The z axis points to the north pole. The x, y axis are on the equatorial plane that the x-axis passes through the equator and the prime meridian and the y-axis points to the equator at 90 degrees east [2]. Point P in Fig. 1 represents a geographical coordinate with latitude and longitude .



latitude

longitude

for i=1,…,n

Cartesian coordinates

The spherical coordinates of a point in the ISO convention (i.e. for physics: radius r, inclination θ, azimuth φ) can be obtained from its Cartesian coordinates (x, y, z) by the formulae

where *r* ∈ [0, ∞), *θ* ∈ [0, π], *φ* ∈ [0, 2π), by:

Consider a Cartesian coordinate system in which the Earth is a sphere centered at the origin, with z pointing to the North pole and x crossing the Equator at the λ=0 meridian. The 3D coordinates of the given points are:

= r,

= r,

= r,

The centroid of these points is the average of the sum of

() = ,

Calculate the radian coordination of the centroid:

= ,

= ,

1. Clynch, J. R. (2006). Earth coordinates. *Electronic Documentation, February*.
2. Montenbruck, O., Gill, E., & Terzibaschian, T. (2000). Note on the BIRD ACS Reference Frames.