Conversion of Geodetic coordinates into ECEF-r, LTP into ECEF-r and vice versa

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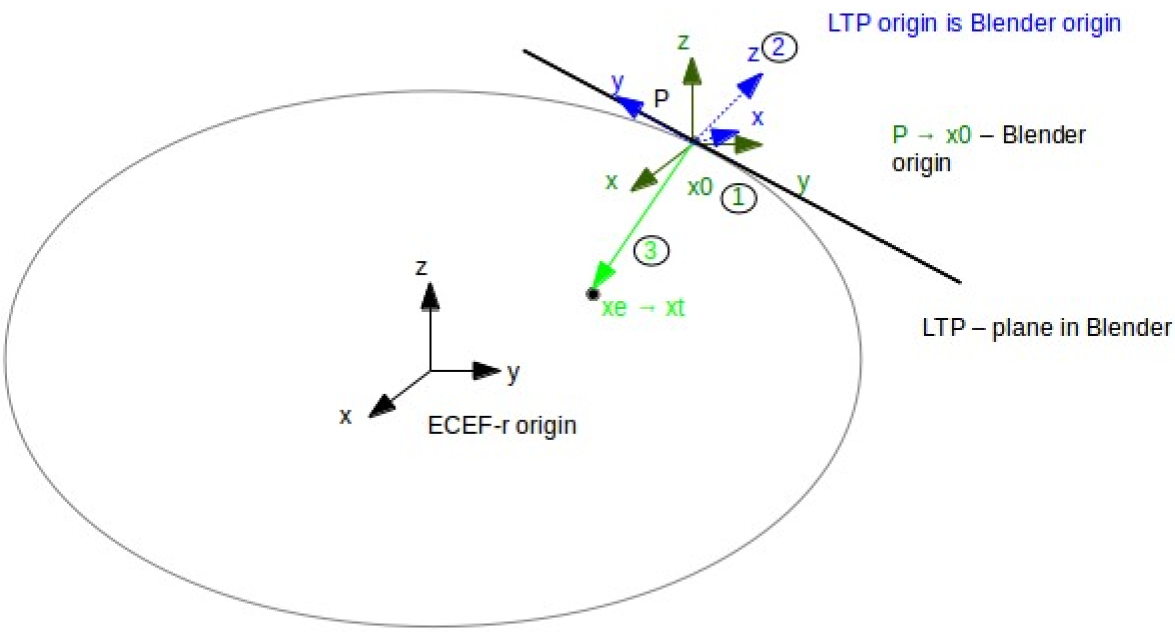
Conversion of Geodetic coordinates into ECEF-r

To be able to simulate a GPS-sensor P (the Blender origin) must be defined in the properties in Geodetic coordinates (longitude, latitude, altitude). For the transformation[1] the coordinates must be in decimal degrees (no North, minutes, etc.). The result is a point x0 in the ECEF-r coordinates.

Conversion of ECEF-r into LTP[1]

For this conversion x0 is the base. A point xe is given in the ECEF-r coordinates and the goal is to get xt (= xe in the LTP-coordinates).



Step 1: Transform P (Blender origin, geodetic coordinates (stored in the properties)) into x0 (geocentric (ECEF-r) coordinates)
Step 2: calculate Rte[1] with longitude, latitude and altitude; matrix is the rotation part of the transformation
Step 3: transform xe into xt with xt = Rte * (xe-x0)

Conversion of LTP into ECEF-r[1]

Known: P in Geodetic coordinates (→ x0 in ECEF-r) and xt in LTP-coordinates

Goal: xe (= xt in ECEF-r coordinates)

Based on the transformation described above the transformation is calculated with the transposed matrix Rte:

xe = x0 + (Rte)' * xt

Conversion of ECEF-r into Geodetic coordinates

The last transformation is from ECEF-r coordinates into Geodetic coordinates. This transformation is calculated with the Vermeille's method[2]. The result is the point xe in „GPS-coordinates“ in radians.

[1] „Conversion of Geodetic coordinates to the Local Tangent Plane“, Version 2.01 (http://psas.pdx.edu/CoordinateSystem/Latitude_to_LocalTangent.pdf)
[2]„3.4 Vermeille's Method(2002)“ in „Comparative Analysis of the Performance of Iterative and Non-iterative Solutions to the Cartesian to Geodetic Coordinate Transformation“, Hok Sum Fok and H. Bâki Iz, (http://www.lsgi.polyu.edu.hk/staff/zl.li/Vol_5_2/09-baki-3.pdf)