



Computing Datum Offset values for Eos Tools Pro

Eos Tools Pro (iOS starting with version 1.64.7 and Android version 1.46.25 and up) offers an Offset feature that can be used for datum shifts. Note that the new position computed will populate the Core Location (iOS) and Location Service (Android) and will also be passed on to 3rd party data collection app. Therefore, care must be taken not to duplicate the datum shift. For example, if using Collector for ArcGIS, it is preferable to use the built-in on-the-fly (OTF) datum transformation of Collector instead of this feature. If your app does not support OTF datum transformations, then this tool is for you.

The principle for computing datum offset values is simple: Destination/target datum coordinates **minus** Origin/current datum coordinates and you enter these values in the Offset menu of Eos Tools Pro.

$$\text{Destination} - \text{Origin} = \text{Offset}$$

Example for the United States: from NAD83 2011 to WGS84 (G1674)

This transformation is typical when using the Arrow receiving corrections from an RTK network (most likely referenced to Nad83 2011) and the maps used are in Web Mercator (WGS84 G1674 or G1762; 5mm difference between these two)

- a) Get a coordinate from Google Map for the area in which you are working. Let's say

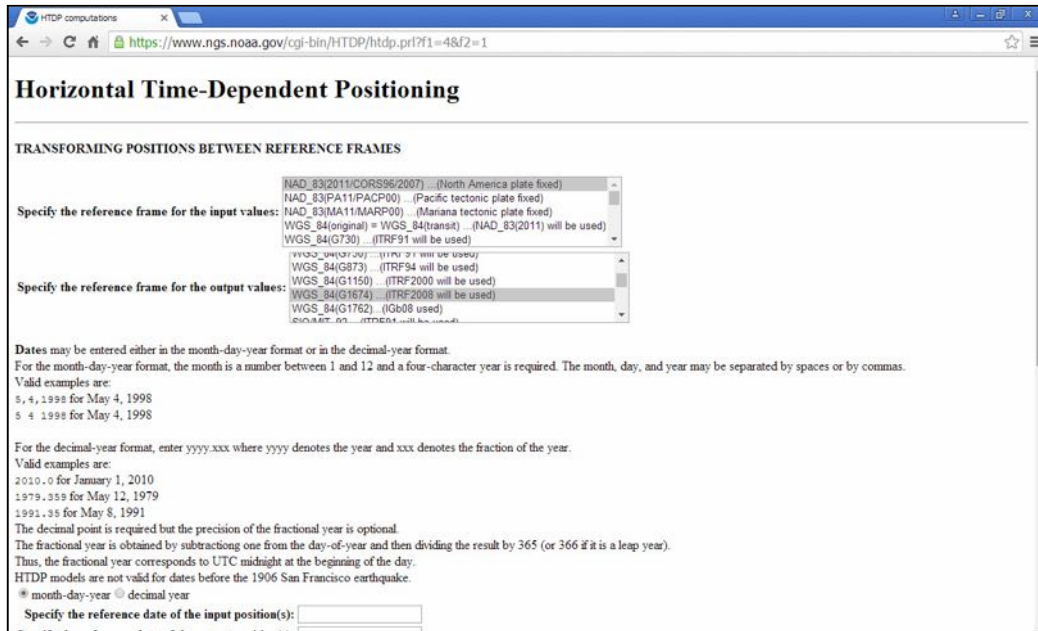
Latitude: 38° 20' 15.000"
Longitude: -80° 50' 20.000"
Height: 0.000 meters

We'll call this point Origin and we'll assume it is in Nad83 2011.

- b) Next we need to compute the Destination coordinates in WGS85 G1674. For this, we go to the NGS NOAA web site for the HTDP (Horizontal Time-Dependent Positioning) online tools to transform positions between reference frames:

<https://www.ngs.noaa.gov/cgi-bin/HTDP/htdp.prl?f1=4&f2=1>

- We first select the “Reference Frame for the Input Values” to be Nad83 2011 and the “Reference Frame for the Output Values” to be WGS84 (G1674)



Horizontal Time-Dependent Positioning

TRANSFORMING POSITIONS BETWEEN REFERENCE FRAMES

Specify the reference frame for the input values: NAD_83(2011)(CORS96/2007) (North America plate fixed)

Specify the reference frame for the output values: WGS_84(G1674) (ITRF2008 will be used)

Dates may be entered either in the month-day-year format or in the decimal-year format.

Valid examples are:
 5, 4, 1998 for May 4, 1998
 5 4 1998 for May 4, 1998

For the decimal-year format, enter yyyy.xxx where yyyy denotes the year and xxx denotes the fraction of the year.
 Valid examples are:
 2010.0 for January 1, 2010
 1979.359 for May 12, 1979
 1991.35 for May 8, 1991

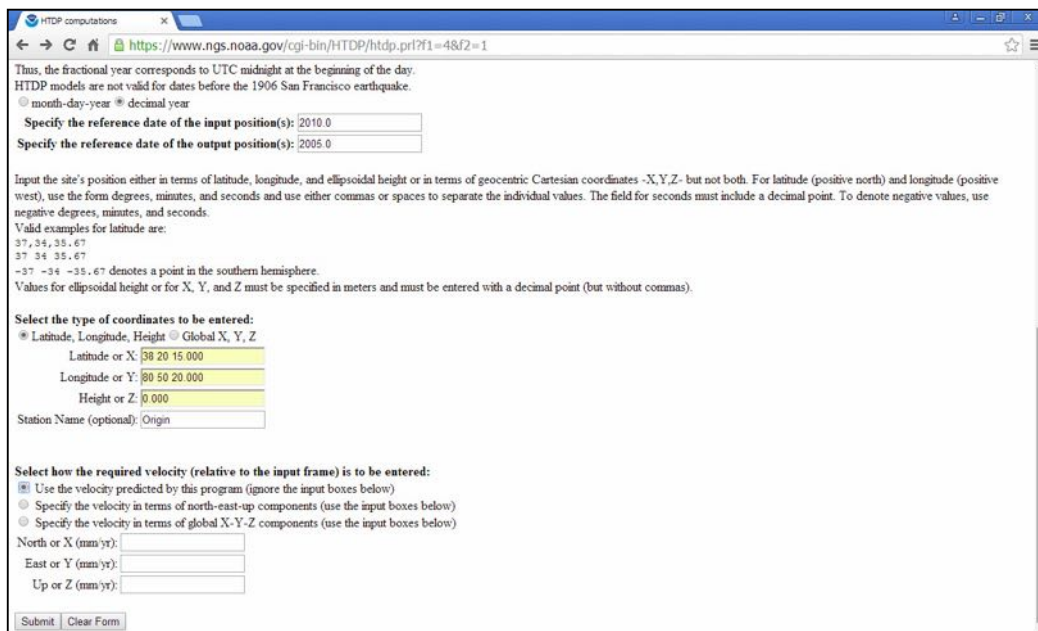
The fractional year is obtained by subtracting one from the day-of-year and then dividing the result by 365 (or 366 if it is a leap year). Thus, the fractional year corresponds to UTC midnight at the beginning of the day.

HTDP models are not valid for dates before the 1906 San Francisco earthquake.

month-day-year decimal year

Specify the reference date of the input position(s):

- Next, select “decimal year” for the dates and enter “input position” date/epoch 2010.0 (for Nad83 2011) and output epoch 2005.0 (for WGS84 G1674).
- Select the “type of coordinates” to be Latitude, Longitude, Height and enter the values as specified (space between the numbers and no “-” sign for longitude)
- Click on “Use the velocity predicted by this program” and click on “Submit”



Thus, the fractional year corresponds to UTC midnight at the beginning of the day.
 HTDP models are not valid for dates before the 1906 San Francisco earthquake.

month-day-year decimal year

Specify the reference date of the input position(s): 2010.0

Specify the reference date of the output position(s): 2005.0

Input the site's position either in terms of latitude, longitude, and ellipsoidal height or in terms of geocentric Cartesian coordinates -X,Y,Z- but not both. For latitude (positive north) and longitude (positive west), use the form degrees, minutes, and seconds and use either commas or spaces to separate the individual values. The field for seconds must include a decimal point. To denote negative values, use negative degrees, minutes, and seconds.

Valid examples for latitude are:
 37, 34, 35.67
 37 34 35.67
 -37 -34 -35.67 denotes a point in the southern hemisphere.

Values for ellipsoidal height or for X, Y, and Z must be specified in meters and must be entered with a decimal point (but without commas).

Select the type of coordinates to be entered:
 Latitude, Longitude, Height Global X, Y, Z

Latitude or X: 38 20 15.000
 Longitude or Y: 80 50 20.000
 Height or Z: 0.000

Station Name (optional): Origin

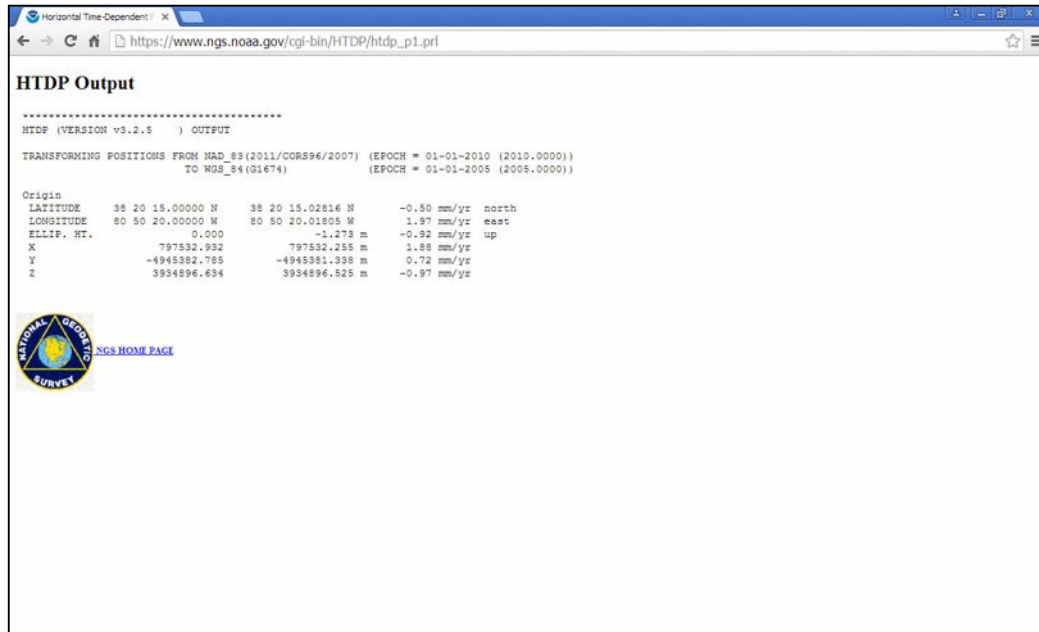
Select how the required velocity (relative to the input frame) is to be entered:
 Use the velocity predicted by this program (ignore the input boxes below)
 Specify the velocity in terms of north-east-up components (use the input boxes below)
 Specify the velocity in terms of global X-Y-Z components (use the input boxes below)

North or X (mm/yr):
 East or Y (mm/yr):
 Up or Z (mm/yr):

Submit Clear Form

The destination coordinate in WGS84 (G1674) is then:

Latitude: 38° 20' 15.02816"
 Longitude: -80° 50' 20.01805"
 Height: -1.273 meters



- c) We now convert these coordinates to degrees decimal (with a minimum of 8 decimal digits):

$$(((\text{Seconds}/60) + \text{minutes})/60) + \text{Degrees}$$

$$\text{Example for Latitude: } (((15.000/60)+20)/60)+38 = 38.33750000$$

The two sets of coordinates are now:

Origin - Lat: 38.33750000
 Lon: -80.83888889
 Height: 0.000

Destination - Lat: 38.33750782
 Lon: -80.83889390
 Height: -1.273

- d) And we compute the shift with (Destination – Origin) with at least 8 decimal digits. This gives us the following values:

Offset = Destination – Origin

Δ Lat: 0.00000782 (degrees)

Δ Lon: -0.00000501 (degrees) *(-80.83889390 – (-80.83888889))

Δ Height: -1.273 (meters)

(Since the shifts are small we could have simply computed the difference for the seconds only and then divide by 3600 to get decimal degrees).

- e) The last step is to enter these values in Eos Tools Pro.
 - For the iOS version, go to Config menu and enter the offset values, then hit "Save". Turn the "Offset Mode" tab to the ON position to activate.



- For Android, go to the Settings menu and turn on the Offset tab to enter the values, then click on "OK".

