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Configuring HYPACK Geodesy for Specific Datums (and where all the values come from)

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We often get support calls from users trying to get bathy data corrections to specific datums and are not sure how they should configure their HYPACK® correctly. What does this mean? When we collect bathy data, we need to reference the vertical heights back to something specific. For years, surveyors installed tide gauges or used data from pre-established tide gauges and corrected their soundings to a specific chart datum. Real Time Kinematic (RTK) Tides came into play, which allowed users to use the data collected from the GPS in real time. With the use of a Geoid Model and/or a known vertical separation file, it is easy to reference all the bathy data to a specific datum.

The following examples show proper set up to get corrections to NAVD88, Ellipsoid, VDATUM (multiple datum options) and the use of a KTD file.

This GGA string, an output from the GPS, is used in all of the following examples:

```
$GPGGA,040007.00,4115.807643
9,N,07240.3416446,W,4,24,0.5
,10.497,M,-33.869,M,11.0,471
5*72
```

What is in the GGA string?

NOTE: If a user-defined geoid model, or inclicned plane is loaded into the receiver, the height output in the NMEA GGA string is always the orthomethric height (height above geoid). The orthometric height is output even if no user-defined geoid is loaded (there is a simplified default geoid in the reciever), or if an inclined plane is used.

GGA message fields

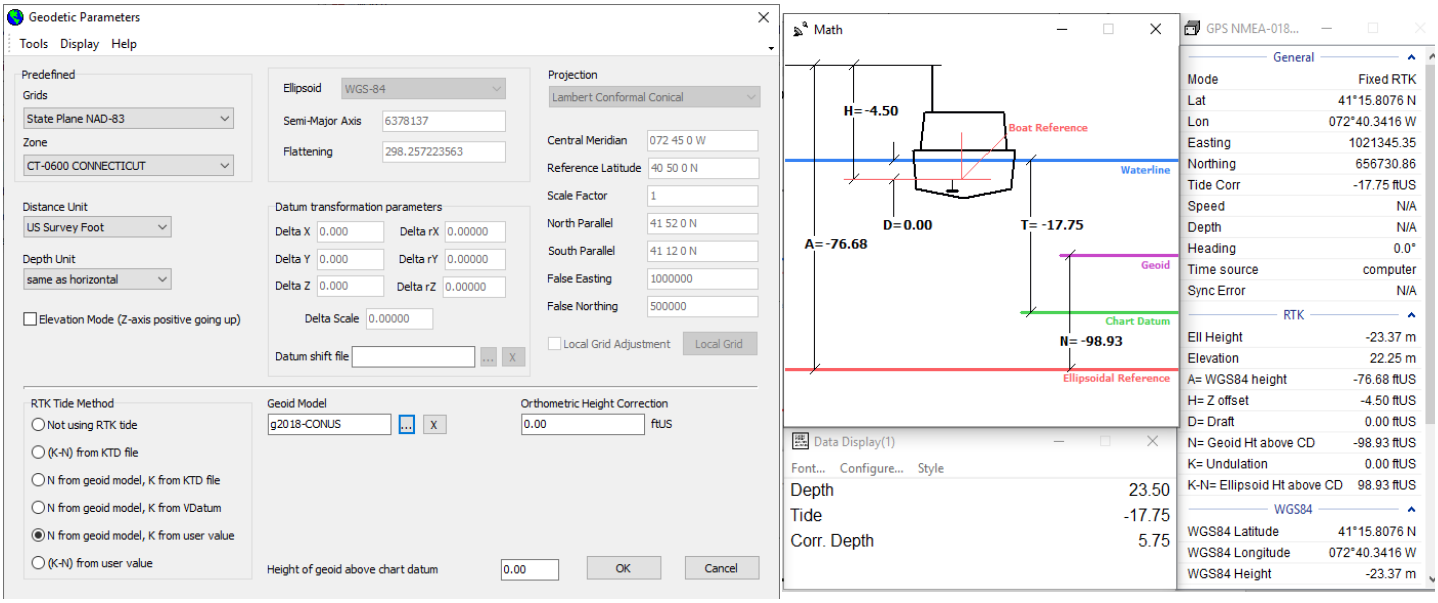
Field	Meaning
0	Message ID $GPGGA
1	UTC of position fix
2	Latitude
3	Direction of latitude: N: North S: South
4	Longitude
5	Direction of longitude: E: East W: West
6	GPS Quality indicator: 0: Fix not valid 1: GPS fix 2: Differential GPS fix, OmniSTAR VBS 4: Real-Time Kinematic, fixed integers 5: Real-Time Kinematic, float integers, OmniSTAR XP/HP or Location RTK
7	Number of SVs in use, range from 00 through to 24+
8	HDOP
9	Orthometric height (MSL reference)
10	M: unit of measure for orthometric height is meters
11	Geoid separation
12	M: geoid separation measured in meters
13	Age of differential GPS data record, Type 1 or Type 9. Null field when DGPS is not used.
14	Reference station ID, range 0000-4095. A null field when any reference station ID is selected and no corrections are received[1].
15	The checksum data, always begins with *

SETTING HYPACK GEODESY TO NAVD88 (NORTH AMERICA VERTICAL DATUM OF 1988): REQUIRES A GEOID MODEL ONLY

1. **Set the correct Grid and Zone for your project.**
2. **Under the RTK Tide Method, enable 'N from geoid model, K from user value'.**
3. **Select the Geoid Model.**

IMPORTANT: Do not enter a Height of geoid above chart datum.

The set up in HYPACK® GEODETIC PARAMETERS (Left). Math window, Data Display and GPS Window in HYPACK Survey (right).



How the Tide correction is calculated:

Tide = N –K – A- H –D

N	**-98.93**	Height of the Geoid Above the Ellipsoid Reference
K	**0**	Height of the Geoid Above the Chart Datum (Undulation)
A	**-76.68**	Height of the RTK Antenna Above the Ellipsoid Reference (Ellipsoid Height) (A = Geoid Separation – Orthometric height) Using the GGA string A = -33.869(m) – 10.497(m) = -23.372 (m) or -76.679(ft)
H	**-4.5**	Height of the RTK Antenna Above the Boat Origin Point (Z offset)
D	**0**	Dynamic Draft Measurement

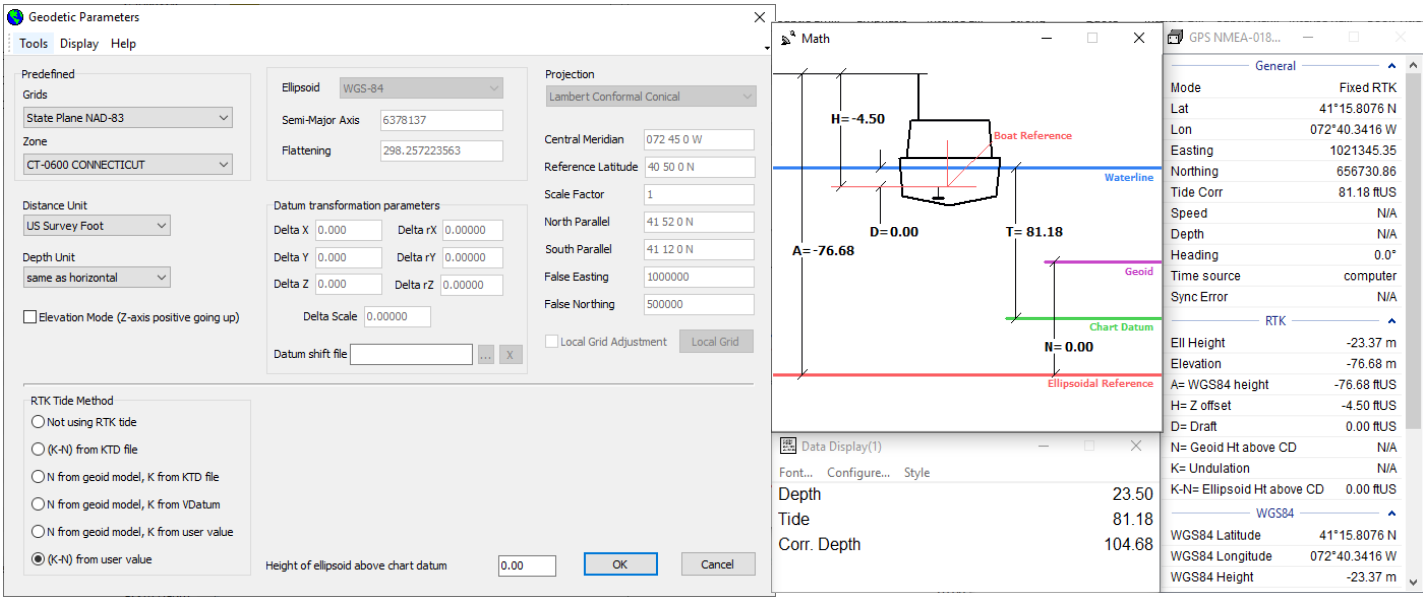
Tide = -98.93 – 0 – (-76.68) – (-4.5) – 0

Tide = **-17.75**

SETTING HYPACK GEODESY TO ELLIPSOID: NO GEOID OR K VALUES ARE USED

1. **Set the correct Grid and Zone for you project.**
2. **Under the RTK Tide Method: Enable '(K-N) from user value'.**

IMPORTANT: Do not enter a height of ellipsoid above chart datum.



Tide = N –K – A- H –D

N	**0**	Height of the Geoid Above the Ellipsoid Reference
K	**0**	Height of the Geoid Above the Chart Datum (Undulation)
A	**-76.68**	Height of the RTK Antenna Above the Ellipsoid Reference (Ellipsoid Height) (A = Geoid Separation – Orthometric height) Using the GGA string A = -33.869(m) – 10.497(m) = -23.372 (m) or -76.679(ft)
H	**-4.5**	Height of the RTK Antenna Above the Boat Origin Point (Z offset)
D	**0**	Dynamic Draft Measurement

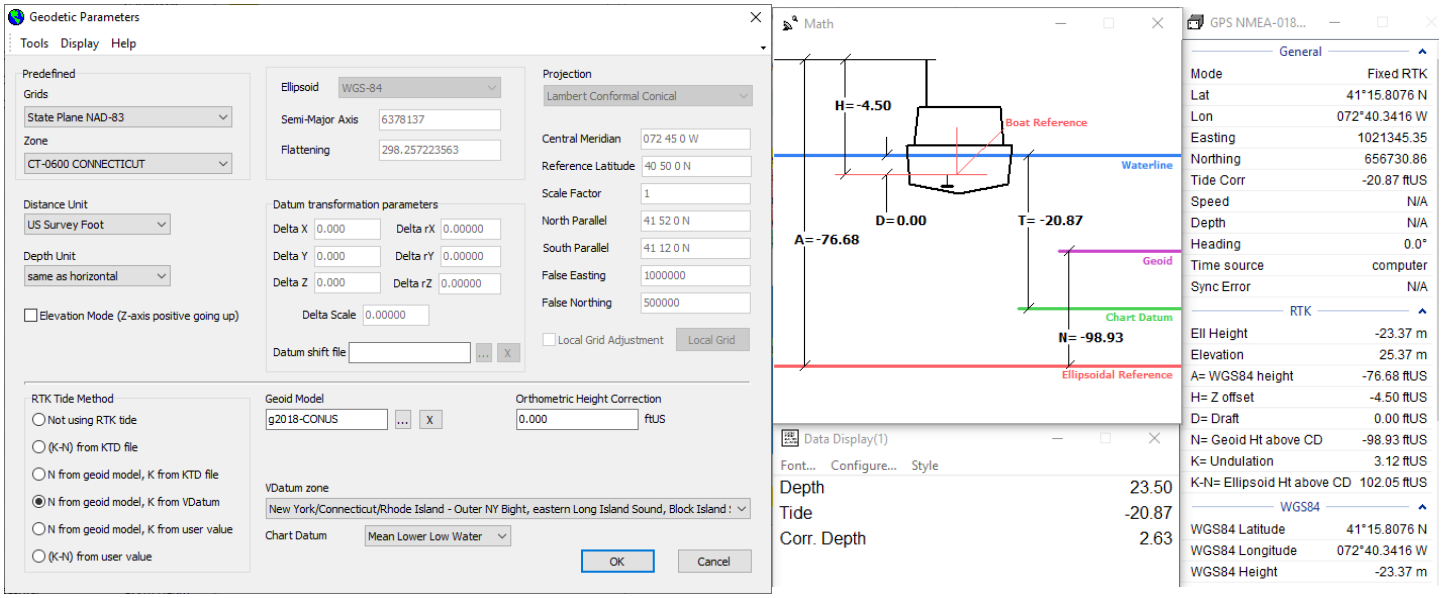
Tide = 0 – 0 – (-76.68) – (-4.5) – 0

Tide = **81.18**

SETTING HYPACK GEODESY USING A VDATUM MODEL TO A SPECIFIC CHART DATUM

1. **Set the correct Grid and Zone for your project.**
2. **Under the RTK Tide Method: Enable 'N from geoid model, K from Vdatum'.**
3. **Select the Geoid Model.**
4. **Choose the VDatum Model**. (Ensure the VDatum model files have been downloaded and placed in the C:\HYPACK 2020\datum\vdatum folder).

5. **Select the Chart Datum required.** (The following example uses Mean Lower Low Water (MLLW)).



Tide = N –K – A- H –D

N	**-98.93**	Height of the Geoid Above the Ellipsoid Reference
K	**3.12**	Height of the Geoid Above the Chart Datum (Undulation)
A	**-76.68**	Height of the RTK Antenna Above the Ellipsoid Reference (Ellipsoid Height) (A = Geoid Separation – Orthometric height) Using the GGA string A = -33.869(m) – 10.497(m) = -23.372 (m) or -76.679(ft)
H	**-4.5**	Height of the RTK Antenna Above the Boat Origin Point (Z offset)
D	**0**	Dynamic Draft Measurement

Tide = (-98.93) – 3.12 – (-76.68) – (-4.5) – 0

Tide = **-20.87**

SETTING HYPACK GEODESY USING A KTD FILE

1. **Set the correct Grid and Zone for your project.**
2. **Choose the RTK Tide Method:**

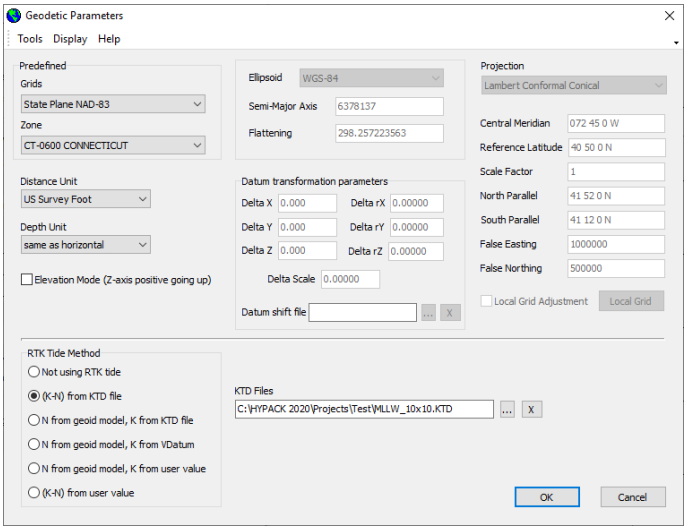
IMPORTANT: Vdatum KTD files are user-created files. You might have created one or been provided one. *Ensure you know what is in the file*.

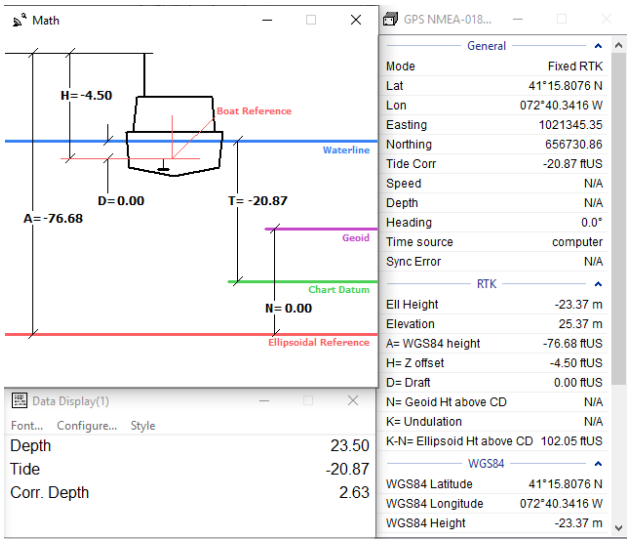
There are 2 options to choose when using a KTD file: does the KTD file include the Geoid Model or not?

> **Enable '(K-N) from KTD file': Use this option if the geoid is included.**
> **Enable 'N from geoid model, K from KTD file'.**

A. Enable '(K-N) from KTD file'

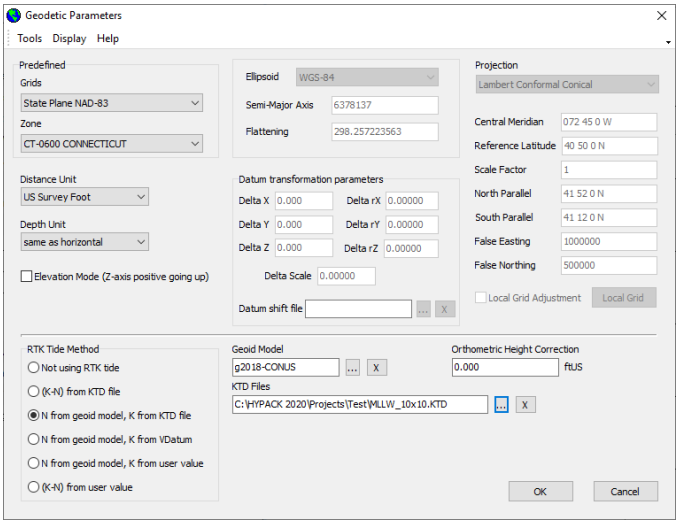
3. **Choose the KTD File.**

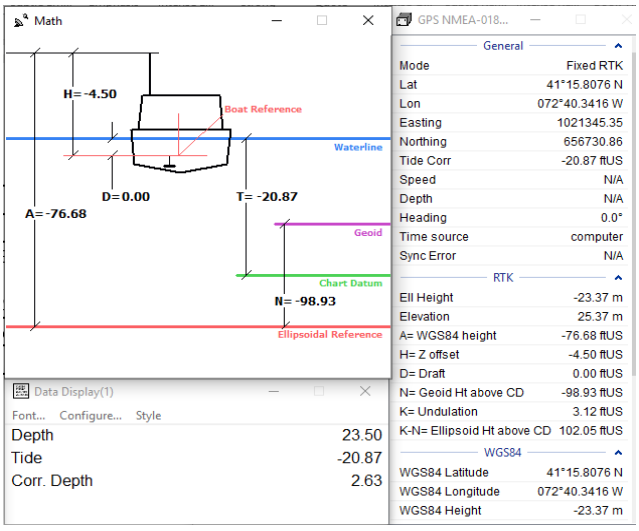




B. Enable 'N from geoid model, K from KTD file

- 3. **Select the Geoid Model.**
- 4. **Choose the KTD File.**





Tide = N –K – A- H –D

N	**0**	**-98.93**	Height of the Geoid Above the Ellipsoid Reference
K	**102.05**	**3.12**	Height of the Geoid Above the Chart Datum (Undulation)
A	**-76.68**	**-76.68**	Height of the RTK Antenna Above the Ellipsoid Reference (Ellipsoid Height) (A = Geoid Separation – Orthometric height) Using the GGA string A = -33.869(m) – 10.497(m) = -23.372 (m) or -76.679(ft)
H	**-4.5**	**-4.5**	Height of the RTK Antenna Above the Boat Origin Point (Z offset)
D	**0**	**0**	Dynamic Draft Measurement

Tide = 0 – 102.05 – (-76.68) – (-4.5) – 0 Tide = **-20.87**	Tide = (-98.93) – 3.12 – (-76.68) – (-4.5) – 0 Tide = **-20.87**

The following table lists all of the values used to get the tide correction based on the Datum selected.

	NAVD88	ELLIPSOID	Vdatum (NY/CT/RI-MLLW)	KTD File only	KTD File with Geoid
N (From Geoid)	-98.93	0	-98.93	0	-98.93
K (KTD, Vdatum, User value)	0	0	3.12	102.05	3.12
A (From the GPS: GGA or GGK string)	-76.68	-76.68	-76.68	-76.68	-76.68
H (GPS Antenna Height)	-4.5	-4.5	-4.5	-4.5	-4.5
D (Draft)	0	0	0	0	0
TIDE CORRECTION	**-17.75**	**81.18**	**-20.87**	**-20.87**	**-20.87**

NOTE: The Vdatum and the KTD tide corrections are all the same. I used the Vdatum NY/CT/RI MLLW corrections to create the KTD files. Two files were created: one with only the Vdatum vertical separation and the other includes the Vdatum vertical separation and the geoid value of 98.93.

Hopefully this article helps you determine where all the values are coming from for RTK tide correction. Please contact HYPACK Technical Support at help@hypack.com if you have any other questions.