DATUM MATTERS

Department of Natural Resources, Mines and Energy

Understanding Ellipsoid Heights vs AHD Heights

This information may assist in understanding ellipsoid heights from GNSS versus AHD heights in the context of GDA94 and GDA2020 when transforming a dataset from a current datum to GDA2020.

AHD and ellipsoidal heights

Heights in Australia are often referenced to the Australian Height Datum (AHD) because it gives a standard way of expressing heights above Mean Sea Level, which is important for issues such as drainage and flooding.

However, Global Navigation Satellite Systems (GNSS) heights are measured relative to a purely mathematical surface known as the ellipsoid. It is therefore often necessary to convert ellipsoidal heights to AHD heights (or vice versa) using a so-called geoid model.

The relationship between these various types of heights are shown in the Figure 1.

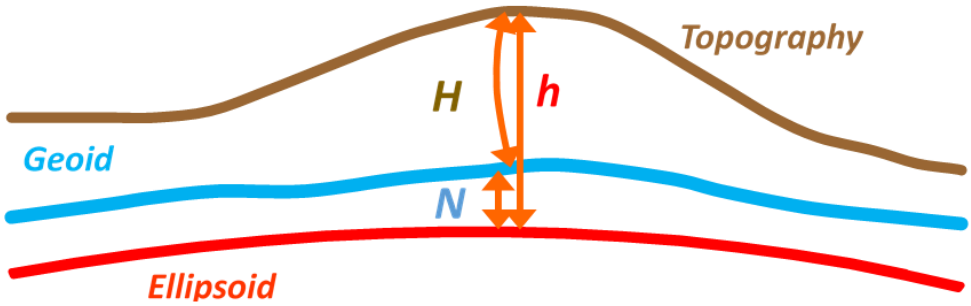

Figure 1: Ellipsoid vs AHD Heights (H = AHD, h = ellipsoidal height and N = geoid ellipsoid separation)

Which Geoid model?

In Australia, the geoid model used to convert a GDA94 ellipsoidal height to an AHD height is AUSGeoid09. It is also important to note that GDA94 was established using the International Terrestrial Reference Frame 1992 (ITRF92).

With the introduction of GDA2020, there are changes to the way ellipsoidal and AHD heights should be related. GDA2020 is based on a new version of the International Terrestrial Reference Frame, ITRF2014. Improvements in our knowledge of the centre of mass of the earth, between ITRF92 and

ITRF2014, means that an ellipsoidal height based on GDA2020 is approximately 9cm lower than one based on GDA94 (Figure 2).

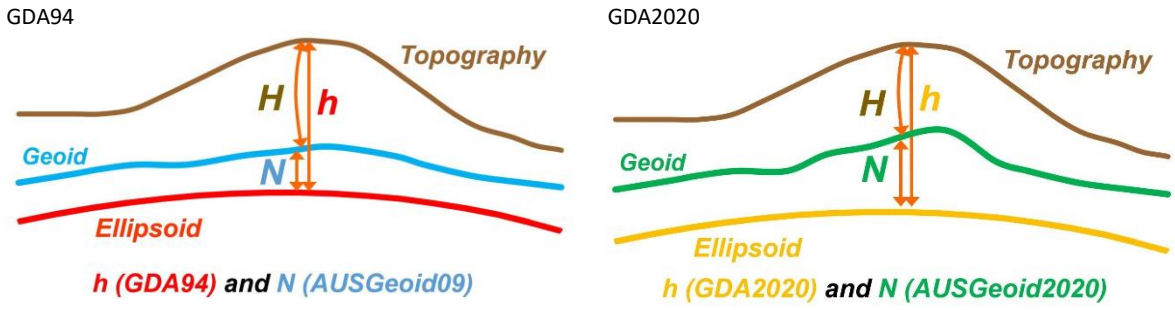

Figure 2: A difference between an ellipsoidal height based on GDA2020 and GDA94 is approximately 9 cm.

This also means that GDA2020 ellipsoidal heights need to be converted to AHD using a new geoid model known as AUSGeoid2020. As well as accounting for the ITRF difference, AUSGeoid2020 has an improved fit to AHD compared to GDA94.

Which datum transformation method?

These differences also have additional implications when transforming data between GDA94 and GDA2020 and users need to be careful when using the 7 parameter transformation (3D) vs the transformation grid (2D).

If the height in the 3D data is an ellipsoidal height (e.g. geodetic data or raw LiDAR) use the 7 parameter transformation to transform all 3 dimensions. Also note if AHD heights are then to be calculated from that data, the correct AUSGeoid model needs to be applied according to the datum of the ellipsoidal heights (i.e. AUSGeoid09 for GDA94 and AUSGeoid2020 for GDA2020).

If the height in the 3D data is an AHD height (e.g. a Digital Elevation Model) a 2D transformation should be used, i.e. the coordinates of each height needs to change but the actual AHD value needs to stay the same. This 2D process is achieved using the transformation grid.

For more information on implementing GDA2020 in Queensland please contact
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Published: December 2019