BIGF RINEX data usage notes – coordinates and antennas

Keywords: precise station coordinates; antenna reference point (ARP), antenna phase centre.

RINEX data are available from two classes of archive stations: *Ordnance Survey(OS) active network* and *Scientific*, as indicated at the website.

Q Are there any usage issues related to this classification?
A Yes:

1. The height offset from the station marker to the antenna's reference point (ARP).
2. The offset from the ARP to the antenna's phase centre
3. Where the station coordinates are to be found.

Issues (1) and (2) are now discussed in the context of the measurement of a baseline by GPS, and then summarised in a table, together with (3):

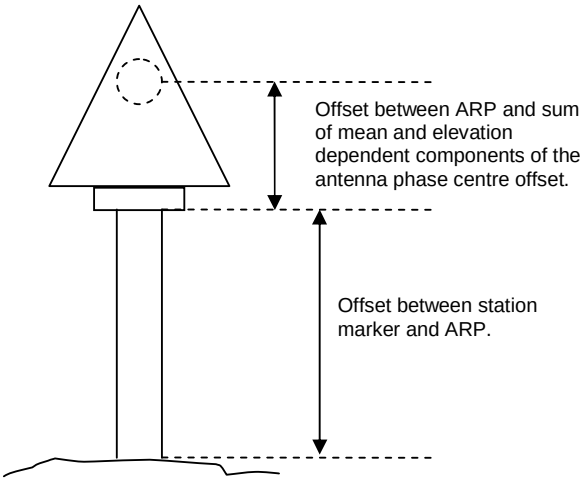
A GPS baseline is measured between the phase centres of the two antennas. To relate this baseline to the station markers, the vertical height from the station marker to the antenna phase centre must be known. The phase centre is not a physical point that can be measured to by conventional means (its position is derived at a calibration facility), so the offset of the phase centre from a physical point on the antenna must be accounted for during processing.

The antenna heights of all BIGF stations are measured vertically from the station marker to the ARP for each antenna, which is usually the base of the antenna mount.

The offset from the ARP to the phase centre is then added to the antenna height in the processing software to give the height of the phase centre above the station marker.

The main phase centre offset component is vertical (up) but there are also small horizontal offsets to north and east. There are actually two phase centres in a dual-frequency antenna – one for the L1 frequency and the other for L2, and each phase centre has a different offset.

The phase centre applicable at the time of observation of the satellite signal also varies depending on the elevation of the satellite. Hence, phase centre corrections must be applied in the processing to take this into account. These corrections usually take the form of a mean offset value and a look-up table with additional elevation dependent values quoted for every 5 degrees of elevation, with separate tables for L1 and L2 frequencies.



Where do I find …?	Ordnance Survey stations	Scientific stations
Precise station coordinates.	RINEX file header.	The coordinates in the RINEX file header are stand-alone positioning accumulations for the particular file only. Precise station coordinates are given at the BIGF website, but so far only a sub-set of these have been coordinated in ETRS89.
Offset of the ARP from the station marker.	The station marker is the ARP, so the offset (antenna height) is 0.000 m, except for former scientific stations now operated by the Ordnance Survey, where the antenna height is non-zero. From 2008-12-19 Ordnance Survey started to install a sub-network called GeoNet, where station monuments are connected to solid rock. The antenna height for these stations is recorded in the RINEX file header – it is NON-ZERO	The offset of the ARP from the station marker is given in the RINEX file header.
Mean antenna phase centre offset from the ARP?	Values for L1 and L2 are given as North, East and Up components, at the OS website.	Can be obtained from the GPS antenna calibration page at the US National Geodetic Survey at http://www.ngs.noaa.gov/ANTCAL/
Elevation dependent offsets from the mean antenna phase centre offset?	Can be obtained from the GPS antenna calibration page at the US National Geodetic Survey at http://www.ngs.noaa.gov/ANTCAL/	Can be obtained from the GPS antenna calibration page at the US National Geodetic Survey at http://www.ngs.noaa.gov/ANTCAL/

Related questions:

Q Do I need to consider azimuthal variation in the antenna phase centre offset?
A Offset variations with azimuth are currently assumed to be negligible from the view point of antenna manufacture.

See the discussion paper at http://www.ngs.noaa.gov/ANTCAL/Files/summary.html for more information.

Q When do I need to consider the elevation dependent offsets?
A If the same antenna types are used on a relatively short baseline (typically less than 100km), then the effect of the elevation dependent offsets will cancel out as the values are effectively the same for the same antenna types at both ends of the baseline.

If different antenna types are used, even on the shortest baselines, then the effect of the elevation dependent offsets will not cancel out as the values will not be the same due to the differences in the antenna types.

If the same antenna types are used on longer baselines (i.e. greater than 100 km), then the effect of the elevation dependent offsets will not cancel out as the values will not be the same due to the differences in elevation angle.

Q What happens if I do not consider the elevation dependent offsets during processing?
A The effect on the results will then depend on whether or not you are solving for tropospheric zenith delay parameters, in order to mitigate the tropospheric delay that is not accounted for by a model such as Hopfield or Saastamoinen. In some cases, when different antenna types are mixed and the data is processed with tropospheric zenith delay parameters solved for but elevation dependent offsets not accounted for, the effect can be an error in height of up to 10cm.