Re: errors in GPS reported height

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Hi all,

Some interesting assertions here and I couldn't quite see how the mathematical transformation of three SV x, y and z ECI−centric coordinates to obtain one set of ECEF coordinates would contain any bias towards the z vector. If positional errors mainly arise from atmospheric refraction, ephemeris, or orbital errors, these should apply to latitude, longitude and height equally. As I couldn't work it out, I checked a reference book (Introduction to The Global Positioning System, Ahmed El−Rabbany, Artech House).

"The positioning accuracy . . . is 16m for the horizontal component and 23m for the vertical component (95% probability level)." Note that this refers to basic trilateration with three SVs − the key point is the HDOP / VDOP ratio.

"Because a GPS user can track only those satellites above the horizon, VDOP will always be larger than HDOP. As a result, the GPS height solution is expected to be less precise than the horizontal solution."

This makes sense when you think about it and I should have twigged myself. Look at the $GPGSV NMEA sentence structure. For each satellite in view, elevation is reported to a maximum of 90 degrees (ie 180 viewable) whereas azimuth range is 0 to 359 degrees. This allows latitude and longitude to be corrected, under ideal conditions, literally from all angles.

Incidentally, the author discusses solar flares extensively so I don't think their effect on a relatively weak radio signal is an eye opener to the GPS community.

For those who think that GPS height is "more accurate these days", I suspect it is more likely a consequence of newer receivers taking the GPS reported height (ie height above the centre of the sphere of reference) and calibrating it against the WGS−84 ellipsoid. Within the standard margin of error, this should align the GPS height with the satellite sub point. You can check the 'Geoid separation' value in the $GPGGA sentence to see if this is done, then if you are truly obsessive, visit an online geoid calculator and triple check. My GPS

reports my height as 613 metres while my location's geoid correction is 19.3 metres, according to http://earth−info.nga.mil/GandG/wgs84/gravitymod/wgs84_180/intptW.html. This concurs pretty closely with the height reported by my altimeter.

Cheers,

Bill

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