

# Performance of consumer GPSRs at high latitudes

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This is an update of my report back in June 1998.

Back in June 1998, there was a hot debate on sci.geo.satellite-nav about how a GPS receiver would perform at high latitudes, say, in the Arctic. Since the orbital inclination of the SVs is about 55 degrees, it might appear at first blush that getting north of N55 deg or south of S55 deg you might see only satellites in the sky to the south (or north for the Southern Hemisphere) of your location, hence your accuracy would deteriorate or maybe the GPSR would not even work. This worry was exacerbated by some models of consumer receivers having UTM coordinates without the Polar overlays (users of traditional latitude and longitude have no such worries).

In June of 1998, I had been climbing on Denali (Mt. McKinley to mountaineers and non-Alaskans, known as Chechacos) with two receivers in our group. I wrote a report for sci.geo.satellite-nav that is preserved in Joe and Jack's website. I got the same type of results in my subsequent climbs in the Arctic Range, including on my successful summit of Denali in 2002. But those observations were only to a latitude of 63 deg, not even to the Arctic Circle. Since, as Joe and Sam often say, an experiment is worth a thousand speculations, I carried two more receivers with me when my spouse and I went on her Grand Adventure to Alaska in May and June of 2005, a Garmin 60CS and a beta version of a Magellan eXplorist 400.

We went first to Anchorage, staying at the B&B that a dear friend ran (she has moved back to Europe, making a European sojourn a requirement for the near future). Then we headed south on the Kenai Peninsula to Homer, tracking our progress on the maps on both GPSRs. (Bit of trivia - did you know that there is no Motel 6 in Homer? This is interesting because Homer is the home town of Tom Bodette, spokesperson in the ads for Motel 6). We flew across to Katmai National Park to get up close and personal with the big brown furry guys and got lots of photos, plus getting a number of waypoints around Hallo Bay. We got weathered in at Hallo Bay. I rode right seat in the Cessna 207 on the return in murky weather (I am a licensed commercial pilot), and got the chance to compare the aircraft's GPSR with the ones I had - the coastline in the basemaps was surprisingly good, though not good enough for flight operations.

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Our next destination was the Kahiltna Glacier and climbers basecamp on Denali, thwarted by the weather. So we headed northward, crossing the Yukon River and following the Alaska Pipeline to Marion Creek campground, a short distance north of Coldfoot, some 65 miles north of the Arctic Circle. There is a big sign at a turnout at what purports to be the location of the Arctic Circle. HmMMMM - ever used your GPSR or a calibrated altimeter to check the altitude of those signs along the highway telling you your altitude? Not very accurate, are they?

Well, it says on the sign that the Arctic Circle is at 66d33m. Using the standard value (updated for current date) of the obliquity of the ecliptic (23d26.357m), the correct value should be 66d33.643m, which is closer to 66d34m than 66d33m. However, the sign was at 66d33.353m (NAD83) on the Magellan and 66d33.343m on the Garmin. Both units were tracking 9 satellites, though without WAAS (too far north for the two WAAS satellites, which are in geosynchronous orbits, hence directly over the equator). These positions are about 60 feet apart, which is ok, since I actually took one at the car and the other next to the sign, maybe 40 ft apart. But note that the sign is roughly 0.3 arcminutes south of where it should be, or some 1800 feet. How can this be, you ask? Well, I am glad you asked. The more accurate location would have been at a blind spot where the Dalton Hwy is cresting a hill and making a bend, both of which make it blind for the large trucks which travel the road.

We still had the problem of disorientation, only worse, since at Marion Creek, the sun was above the horizon 24 hours a day (just barely far enough north on that date for the Midnight Sun). It is hard to keep oriented when you are used to the sun rising in the east and setting in the west, but here just kept going around the sky at a low elevation angle.

We then headed back down to Talkeetna to take an air taxi onto the Kahiltna Glacier (got good enough weather this time) and spend a night at the climbers basecamp, visiting with old friends who happened to be there doing a bit of climbing.

So how did the consumer-grade GPSRs do? They performed very well indeed, being within the accuracy of the USGS topo maps we had available (using National Geographic s Topo! and downloading the collected waypoints onto their Alaska state series). But there is a small problem, common to both receivers and to computerized map programs like Topo! and Delorme s Street Atlas. Street-level data (including highways) are very poor in Alaska. So the Topo! overlays, Delorme, and the basemaps and uploaded map files in both Garmin and Magellan have serious errors in the locations of, for example, the Dalton Highway from Fairbanks north to Prudhoe Bay (not in Street Atlas at all), and on the Sterling Highway, which goes to Homer. The overlays, basemaps, and Delorme agree with one another, indicating that they all come from similar databases. I have noticed this same problem with Google Maps, and in fact, discussed it with Google representatives at a conference I attended. In places, the positions of the roads are over a mile off, and not just because of coarse

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vectorization. In Topo!, the position of the old Haul Road, which is essentially the Dalton Highway, is correct on the topographic map, but the overlay is significantly off (solution, just turn off the street and highway overlay). The overlays do not use USGS topographic map data.

The conclusion here is - you can depend on the positions given by your consumer GPSR in the Arctic, all the way to the North Pole (or South Pole in the Antarctic). But you better take your traditional paper topographic maps and obtain your navigational waypoints ahead of time from dependable sources.

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