Evaluation of Different GPS Signal Corrections to Improve Field Accuracy of the Autopilot System

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Summary

GPS positioning is the foundation of the precision farming or rather site-specific plant production technology. Positioning accuracy plays a key function both from technical and economic aspects, since certain agricultural operations require different precision levels. In the case of fertilization the decimeter accuracy is needed, but in case of seeding the accuracy should be a centimeter or smaller. We have investigated the different GPS correction sources, such as without correction, EGNOS, OmniStar VBS, OmniStar HP, and RTK corrections both from own base and GNSS network, in the four cardinal directions. The effect of driving direction on accuracy with regard to the given correction signals was analyzed.

In the course of experiment, we have investigated the steering accuracy of a New Holland T 6030 tractor installed with Trimble Autopilot hydraulic robot pilot system controlled by a Trimble FmX display. Test swats were marked out ensuring 200 m long straight sections in each direction. Autopilot was used following the same test AB lines in 10 repetitions in North – South, South – North, East – West and West – East directions. Repetitions were done in each direction using different GPS correction sources.

The processed data shown that the most accurate measurement were the GNSS network and the own base RTK corrections (*Figure 1*).

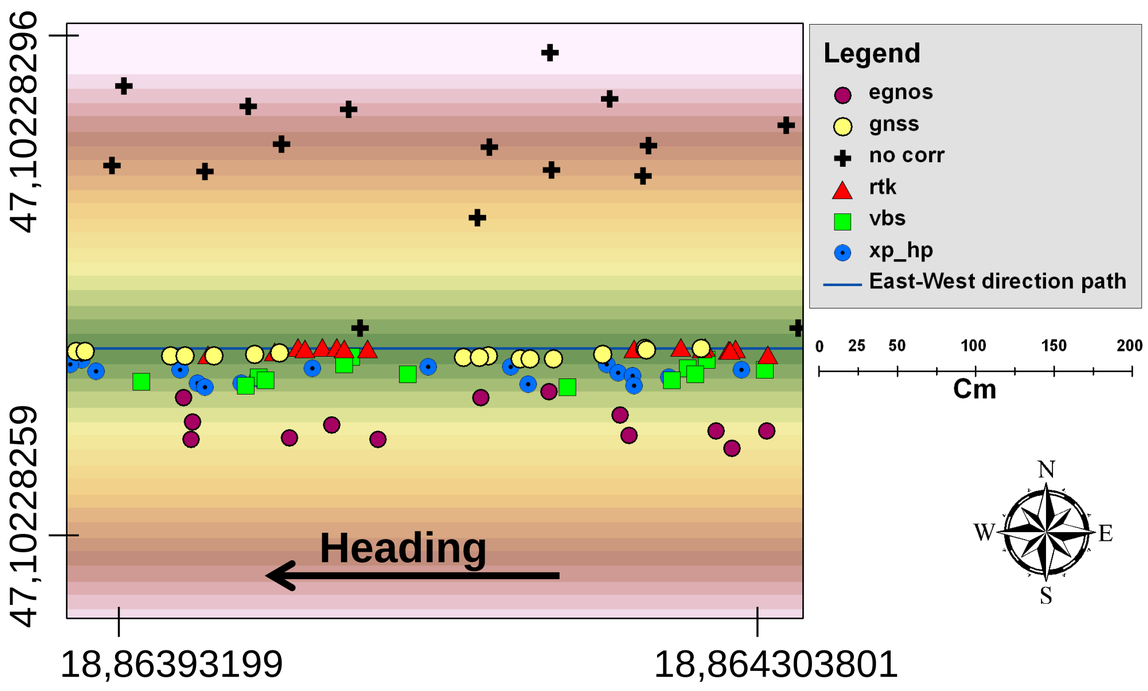

Figure 1. Navigation divergences in East – West direction.

Conclusions

Choose and adjust to a given operation of the appropriate correction source is necessary for precision agricultural practice. To use the inadequate correction signal could saddle surplus costs on the farmer, which could reduce the profitability of crop production.

We have implemented further tests to determine the accuracy of measurements. The offline distance values by the FmX job computer had collected the data, which were the momentary errors of actual A-B line. The standard deviation of the offline distance is shown the navigation of tractor on the A-B line. The data were classified into tenth of millimeter of intervals to determine how many points of GPS measurements were included in the given intervals. The more accurate steering was the less class intervals were resulted. According to this investigation the best performances were achieved using GNSS and base station RTK or rather OmniStar HP corrections (*Figure 2*).

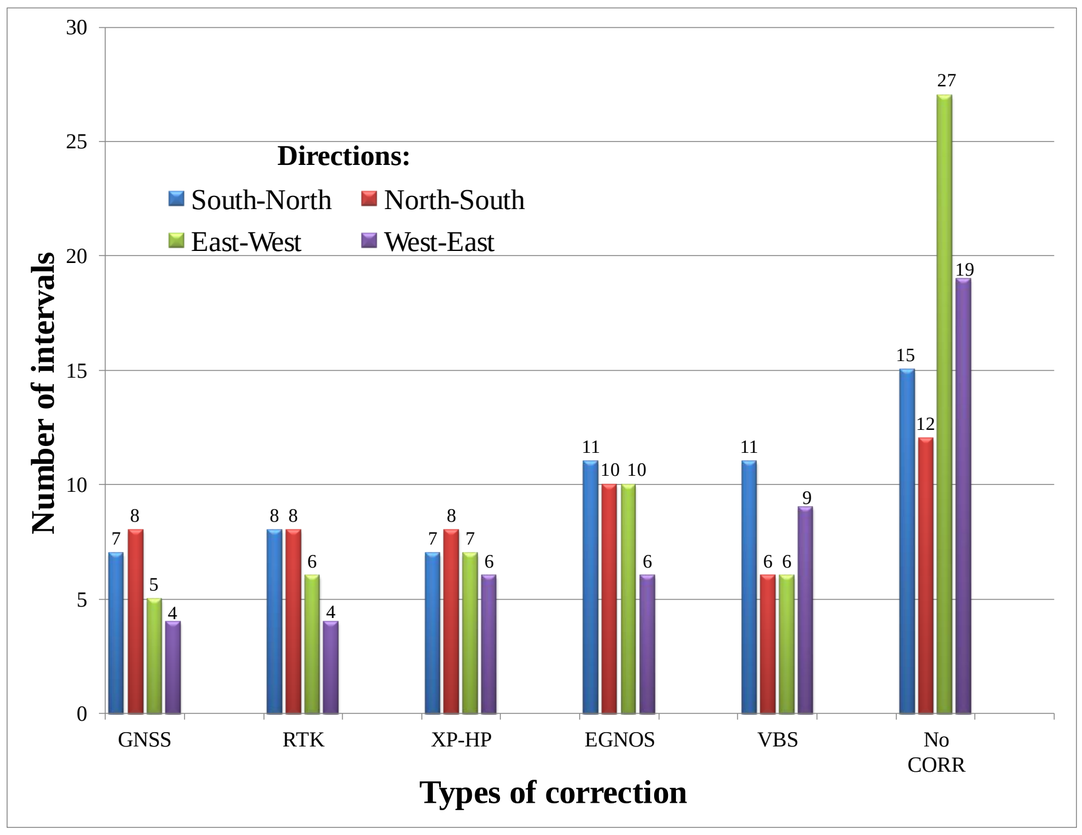

Figure 2. The number of class intervals in case of different correction sources.

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