

Hydroacoustics Update – Use of Filters in DGPS

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July 12, 2005

Background

This document describes a problem that has been identified regarding the use of differential global positioning systems (DGPS) receivers with ADCPs, and provides information about how to correct this problem.

USGS users (and others) often use DGPS receivers in conjunction with ADCPs. DGPS receivers may be used with ADCPs when the boat velocity measured using bottom tracking is not accurate (moving bed condition) or when mapping velocity vectors in a river, lake, or estuary.

Many of the DGPS receivers used in the USGS are Trimble AgGPS 132¹ receivers, although other models and manufacturers are also in use. During the past 6-9 months, OSW personnel have found numerous instances in which the PV Filter in AgGPS 132's was not disabled. Based on information available to the OSW at present, it appears that discharges measured using DGPS receivers with the PV filter enabled were not significantly compromised. Nevertheless, position data for individual velocity measurements obtained using DGPS receivers with the PV filter enabled are likely to be in error.

Problem

Many, if not all, DGPS receivers incorporate filters of various kinds. Trimble AgGPS 132's receivers have a filter called the PV Filter. According to the AgGPS 124/132 Operation Manual (Trimble Navigation Limited, 1999), the PV Filter "smooths position data when the antenna is moving and attempts to reduce the effects of position disturbances, which include reflected signals and small outages of DGPS corrections". It appears that when the AgGPS 132's (and perhaps other Trimble models) are shipped, the PV Filter is set to "D+S", or dynamic and static applications. Similarly, it appears that the PV Filter may be set to "D+S" after a firmware upgrade to the DGPS. The PV Filter should be set to "Off" if the DGPS receiver is being used with an ADCP.

A relatively quick and fool-proof way to know if your PV Filter is set to something other than "Off", is to review boat speed time-series plots, if they are available. A sample plot of boat speed time series using an AgGPS 132 receiver with the PV Filter set to "D+S" is shown in figure 1. A boat speed time series plot using bottom tracking as the velocity reference for the same data set is shown in figure 2.

¹ The use of trade, product, or firm names in this document is for descriptive purposes only and does not imply endorsement by the U.S. Government.

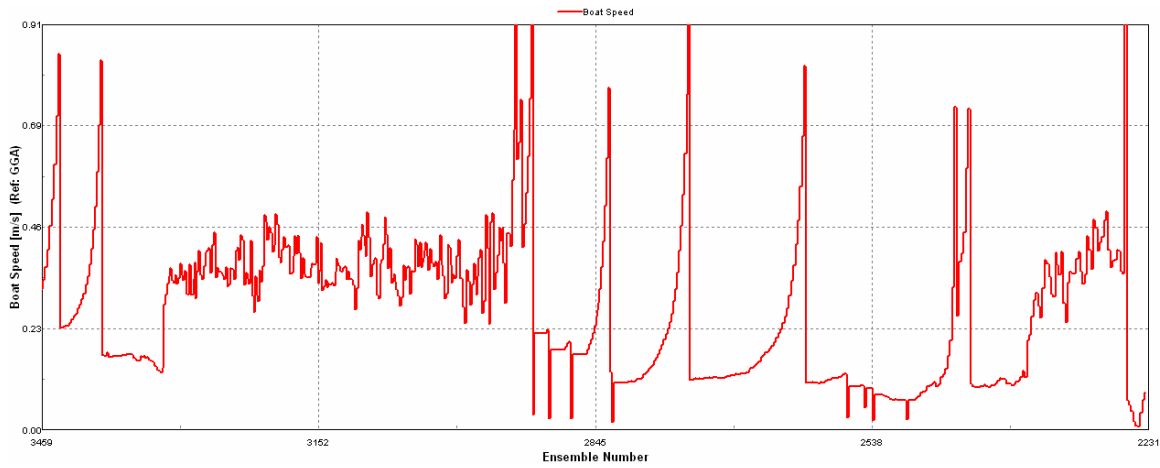


Figure 1.--Boat speed time series from a Trimble AgGPS 132 receiver and with using the GPS as the velocity reference.

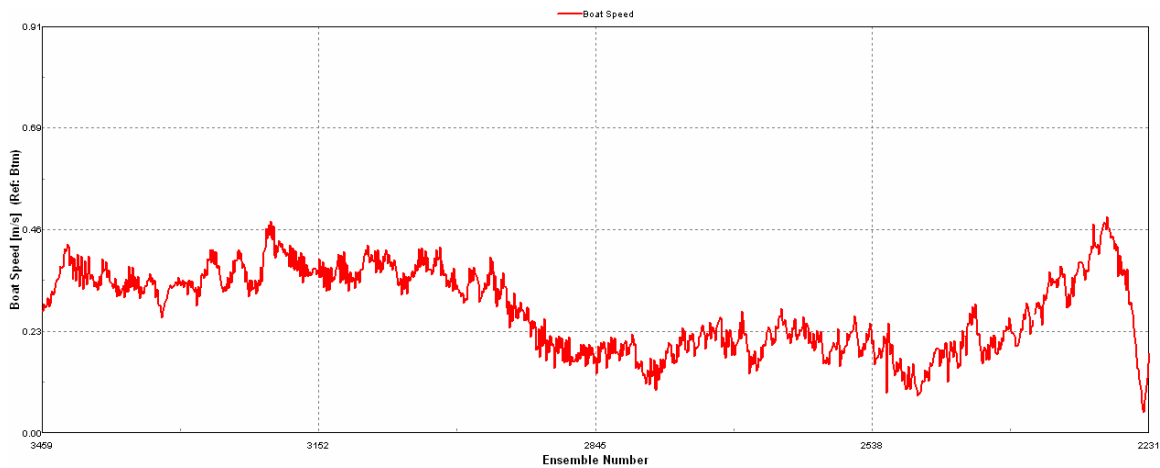


Figure 2.--Boat speed time series using bottom tracking as the velocity reference.

Setting the PV Filter to “Off”

Every USGS office using a Trimble AgGPS 132 or 124 model receiver for discharge measurements and velocity mapping should make sure that the PV Filter is set to “Off”. For AgGPS 132’s, this is done by powering up the receiver and using the menu buttons (fig. 3) to perform the following steps.

1. Click “>” three times to display the Configuration menu, and click “v” to display the first Config menu.
2. Click “>” several times until the GPS Config menu appears, and click “v” to display the first GPS Config screen.
3. Click “>” or “<” to navigate through the GPS Config screens.
4. When the PV Filter screen appears, click “v” to select the field. The cursor flashes when the field is selected.
5. Click “>” or “<” to set the PV Filter to “Off”.
6. Save your changes by clicking the Enter key.

7. Return to Home screen.

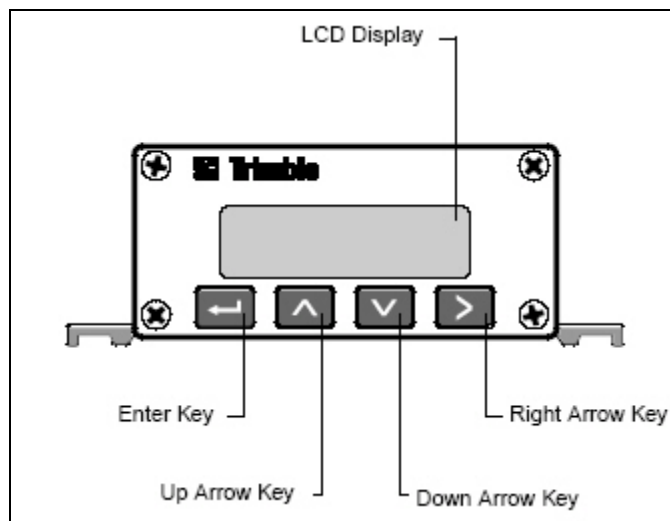


Figure 3.--Trimble AgGPS 132 display and menu buttons (from Trimble Navigation Limited, 1999)

Other DGPS Receivers

If other DGPS receivers are used by USGS for discharge or velocity measurements, it is strongly recommended that any built-in filters be turned off. Some receivers, especially handheld receivers, do not allow the user to turn the filter(s) off. These receivers should not be used for discharge and velocity measurements due to the position errors that are possible.

The OSW, supported by funding from ICOM and Environment Canada, is currently evaluating some WAAS-enabled receivers for use with ADCPs. The project is not yet complete, but initial results indicate that WAAS-enabled receivers show promise for use in ADCP measurements. However, at present, it seems that handheld receivers often do not provide sufficient resolution in the positions output, and struggle in handling situations where there is multi-path interference. Also, several handheld, WAAS-enabled receivers do not allow the user to turn off all filters.

Summary

This Hydroacoustic Update includes information regarding potential errors caused by the PV Filter being turned on in Trimble AgGPS 132 and similar receivers. Users should check their DGPS receivers and make sure that all filters are turned off. Instructions are provided for changing the setting of the PV Filter for Trimble AgGPS 132 receivers. If you have any questions, please contact Kevin Oberg (kaoberg@usgs.gov or 217-344-0037 x3004) or email the USGS Hydroacoustics Work Group, hawg@simon.er.usgs.gov.

References Cited

Trimble Navigation Limited, 1999, Ag GPS 124/132 Operation Manual, Sunnyvale, CA, 194 p.