Geometrics Knowledgebase

Difference between our standard Cesium Magnetometer and the SX model

Clarification regarding Geometrics standard magnetometers,

SX versions and the US Govt. export regulations

In this brief review magnetometer specifications are given in terms of both nT/sq-rt-Hz RMS and in Peak-to-Peak (P-P) noise values as both forms are often used to describe instrument performance. For clarification on this point see M-TR120 Magnetometer Specifications and What they Mean available from our website under Literature.
The US Government specifies that an export license is required for magnetometers that have a sensitivity of better than (noise level less than) 0.02nT/sq-rt-Hz RMS. Obtaining an export license is not difficult but it does require approximately 6 weeks. Not all geophysical applications require export license sensitivity and so we offer SX models that have a noise floor of 0.02nT/sq-rt-Hz RMS. Compare this with our standard portable model G-858 at 0.008nT/sq-rt-Hz RMS and our standard marine model G-882 at 0.004nT/sq-rt-Hz RMS.
What does SX performance mean in the survey results? When the sensor is deployed at some distance from the source such as in above the shoulder mounting for geological surveys (G-859SX) or at some distance (several meters) from the seafloor for 882SX surveys, the distance from the source provides some natural filtering of the near surface response. This means that surveys not focused on small target detection (20mm ordnance rounds) where the sensor is deployed very close to the ground (<1m), SX performance is more than adequate.

Let us consider the G-858 man-portable model. Under low noise laboratory conditions at a sample rate of 10 samples per second, the 858SX will show approximately 0.125 nT of noise (peak-to-peak) compared to a standard 858 of about 0.05nT P-P. To understand the significance of this, the natural earth background noise due to geomagnetic micro-pulsations is about 0.02nT/sq-rt-Hz (about 0.125 nT peak-to-peak) at the quietest of times. Micro-pulsation amplitudes of 1 or 2 nT are common and, during active periods, they may be larger than 10 nT.
Any magnetometer will produce a record of the combination of the background noise (micro-pulsations, diurnal drifts, etc) and its own internal noise. If the various noise components are not correlated with each other they will add as the square root of the sum of their squared amplitudes. In the case of the G-858SX, the combination of instrument noise and background micro-pulsations will be

(0.125nT^2 + 0.125^2) = 0.18nT.

For the standard G-858, this combination will be

(0.05nT^2 + 0.125^2) = 0.13nT.

That is, the SX model will exhibit about 30% more noise amplitude compared to the standard model if the atmospheric noise is typical. Unless the survey measurements are referenced to a high performance base station magnetometer equipped with a very accurate clock, the user will not be able to detect any difference between SX and standard performance. If such base station data were available, the greatest difference that would be seen should be no greater than about 0.05nT P-P in the average peak-to-peak amplitude. Such small differences cannot be seen or even detected in the total field contour maps made for exploration surveys which are typically contoured at 1nT or more.
It should be remembered that the amplitude of the geomagnetic micro-pulsations in the frequency range from 5hz to 10hz is not constant; i.e., at most times they will be greater than 0.125nT and occasionally less than this value. Their intensity is governed by the average intensity of the instantaneous global thunderstorm

activity and sunspot activity. While their levels are generally lower in the w

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