Geomagnetic noise analysis and suppression from next generation autonomous systems 2009 sea trials

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Abstract: A prominent area of research promoted by naval groups throughout the world involves the advancement of wireless, acoustically-linked, total-field magnetic sensors. In 2009, a Next Generation Autonomous Systems (NGAS) sea trial took place which tested the capabilites of a field of such sensors. During this trial, ambient geomagnetic noise was recorded in an effort to provide an improved understanding of the noise induced on these magnetic sensing systems. Results from the analysis of the NGAS noise data set are presented in this paper. Four categories of magnetic noise are presented including: acoustic-modem induced noise, clock-drift induced noise, geomagnetic background fluctuations, and geomagnetic ULF pulsations. A robust method for eliminating clock-drift induced noise is presented, which yields over 20 dB improvement in noise suppression. The statistical and diurnal properties of the geomagnetic background fluctuations are shown. Interestingly, the hourly noise variance was found to reach minimums at around 1 AM UTC each day that were 15 dB lower than the rest of the day. Additionally, the results of applying two noise-suppression techniques are presented. Finally, the effects of ULF pulsations on a single-sensor detection system are discussed.

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