Background. The effect of water temperature on the reported NO$_3^-$ concentration from the ISUS NO$_3^-$ analyzer (Satlantic, Halifax, Nova Scotia) was evaluated as part of this study to assess nitrate variation observed at Sleepers River, Vermont during the 2009 snowmelt period. In our study, sensors were turned on for only 2 minutes during a 30 minute interval as is customary in moored deployments to conserve power, reduce data storage, and minimize lamp degradation during the deployment. Therefore, the potential impact of lower temperature relative to the temperature at which the sensor was calibrated for NO$_3^-$ (18.5 °C) was evaluated. However, the manufacturer recommends a warm up period of 15 to 30 minutes to allow the internal temperature to reach relative stability (Operation Manual for MBARI-ISUS V3, Document Number SAT-DN-425, Revision A-5). We characterized the performance of the ISUS under the operational conditions used in the field to permit correction of the data.

Methods. In order to characterize the effect of temperature on the reported NO$_3^-$ concentration from the ISUS NO$_3^-$ analyzer, we submersed both the sensor and a sealed glass beaker containing 20 μmol L$^{-1}$ NO$_3^-$ (as KNO$_3$) standard in an ice bath. The nitrate standard was circulated continuously to the ISUS using the flow cell, acid-rinsed inert Tygon 3603 tubing and a Seabird Electronics 5T in-line pump controlled by a solid state relay equipped datalogger. ISUS data were logged through the study period at 30 minute intervals following a 2 minute instrument warm up period to replicate the sampling frequency and duration used in the field study. The ice bath was allowed to warm from < 1 to ~20 °C (measured and logged with a YSI 6920 sonde, YSI
Inc, Yellow Springs, OH). The last $T_{\text{int}}$ measured during each 2 minute interval (1 Hz data) was used as the temperature for data correction. Lowest $T_{\text{int}}$ measured during the lab test was 2.97 °C, corresponding to a measured water temperature in the bath of 1.01 °C. The ISUS internal temperature ($T_{\text{int}}$) did not reach the factory calibration temperature for this sensor (18.5 °C, S/N 0159) for approximately 51 hours.

Results: A temperature effect of approximately 0.23 μmol L$^{-1}$ N per °C on the instrument (ISUS V3) over the course of the test. While not directly evaluated in the present study, the calibration and experimental data suggest that the thermal influence on the measured NO$_3^-$ value is mostly caused by variation in the lamp spectral output as temperature changes (Geoff McIntyre, Satlantic, pers. comm.). Therefore, a correction was made to the data using the instrument-specific internal temperature during manufacturer calibration (18.5 °C) and internal temperature ($T_{\text{int}}$, °C) logged during the field deployment to calculate a temperature-corrected NO3-concentration using equation 1 as reported in the paper:

$$\text{NO}_3^{-\text{tempcorrected}} (\mu\text{mol L}^{-1}) = \text{NO}_3^{-\text{raw}} - (0.23 \times (18.5 - T_{\text{int}}))$$

(1)
Figure S1. Relationship between the internal temperature of the ISUS (T\_int, °C) and the NO$_3^-$ concentration (μmol L$^{-1}$) calculated from the sensor. Concentrations have been corrected for a blank offset of -6.2 μmol L$^{-1}$. 

\[ y = -0.2317x + 24.4 \]

\[ R^2 = 0.9987 \]