

# SPICE Calibration and Configuration Recommendations for the GEONOR Precipitation Gauge

*Prepared by Jeffery Hoover. Developed from:*

- I. Roy Rasmussen's GEONOR site visit summary*
- II. GEONOR calibration demonstration by Ivar Fredriksen, Tuesday October 16, 2012, Brussels, Belgium*
- III. GEONOR T-200B user manual*

This document concerns the recommendations for the calibration and configuration of the GEONOR reference instrument including:

1. Laboratory calibration of the GEONOR vibrating wire transducers
2. Empty bucket field calibration of the GEONOR precipitation gauge
3. Field check of the GEONOR precipitation gauge
4. Recommended GEONOR mounting configuration

1. Laboratory calibration of the GEONOR vibrating wire transducers

SPICE Recommendation: The independent calibration of the individual GEONOR vibrating wire transducers is not recommended for site managers.

GEONOR's experience is that the factory calibration of the vibrating wire transducer does not change significantly over time. This is supported by DiBiagio<sup>i</sup>, Rasmussen<sup>ii</sup>, and previous studies within the CRN group. Vibrating wire transducers that are found to be out of calibration should be returned to GEONOR for factory recalibration.

2. Empty bucket field calibration of the GEONOR precipitation gauge

SPICE Recommendation: Field calibration of the GEONOR gauge should be performed using an empty bucket as per section 5.4 in the GEONOR user manual<sup>iii</sup>. Prior to the field calibration the gauge should be installed and leveled according to the GEONOR user manual. If any of the empty bucket transducer frequencies ( $f_0$ ) differ by more than 10 Hz

from the GEONOR calibration values, a new  $A'$  coefficient must be calculated using the equation provided in section 5.4. This field calibration is to be completed at the beginning of each SPICE measurement period with the old and new transducer coefficients documented.

### 3. Field check of the GEONOR precipitation gauge

SPICE Recommendation: A field check shall be performed after the empty bucket field calibration as a check of the gauge function and calibration values (wires hanging correctly, interference with bucket, calibration coefficients etc.). The field check is performed by adding a 1.5 kg of water to the bucket, corresponding to 75 mm of precipitation. Each observed transducer frequency must be within 0.5 % of the calibration frequency for acceptance. If the transducer frequency is outside this range it should be returned to GEONOR for recalibration. This field check is to be completed at the beginning and end of each SPICE measurement period with each transducer frequency recorded for reference. The water measurement procedure and scale features (make, model, resolution, repeatability, linearity, calibration identification, and calibration expiry date) should be recorded as well.

If possible, additional observations at 3.0 kg, 4.5 kg, 6.0 kg, 7.5 kg, 9.0 kg, 10.5 kg, and 12.0 kg masses are recommended for reference.

### 4. Recommended GEONOR mounting configuration

SPICE Recommendation: In order to minimize noise due to mechanical vibrations on the GEONOR gauge, a configuration with the Alter shield isolated from the gauge is recommended. In this configuration the GEONOR gauge is mounted to the GEONOR pedestal (see section 2 in the GEONOR manual), while the Alter shield is independently mounted to the ground or DFIR. Examples of these Alter shield configurations are shown in Figures 1 and 2 for reference.

**Figure 1: Single Alter Shield Mounting in DFIR, R2(G,SA) Reference, CARE, Canada**



**Figure 2: Single Alter Shield Mounting, R3(G,SA) Reference, CARE, Canada**



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<sup>i</sup> E. DiBiagio, "A case study of vibrating-wire sensors that have vibrated continuously for over 27 years," Norwegian Geotechnical Institute, 2003.

<sup>ii</sup> R. Rasmussen, *Summary of GEONOR site visit*, Oslo, 2012.

<sup>iii</sup> "GEONOR T-200B Precipitation Gauge User Manual," GEONOR, 2012.