

The Cryosphere Discuss., referee comment RC1
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Review of “Review article: Performance assessment of electromagnetic wave-based field sensors for SWE monitoring” by Royer et al.

Craig Smith (Referee)

Referee comment on "Review article: Performance assessment of radiation-based field sensors for monitoring the water equivalent of snow cover (SWE)" by Alain Royer et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-163-RC1>, 2021

The review article by Royer et al. provides some insight into the measurement principles, accuracy, and advantages/disadvantages of four instruments that employ electromagnetic waves to measure in situ snow water equivalent (SWE). Instruments reviewed are the Cosmic Ray Neutron Probe (CRNP) (deployed in two configurations: above and below the snowpack), Gamma Ray Monitoring (GMON) sensor, Frequency Modulated Continuous-Wave Radar (FMCW-Radar), and Global Navigation Satellite System (GNSS) receivers. The paper is a combination of reporting results from previous evaluation and intercomparison studies and the reporting of results from intercomparisons at two Canadian research sites: Foret Montmorency and the Site Interdisciplinaire de Recherche en ENvironnement Extérieur (SIRENE). The purpose is to inform the reader of the relative advantages and disadvantages of each of these systems in the context of employing them in operational monitoring networks.

I thought that the paper offered a complementing balance of previous assessment results and associated measurement issues with fresh results to build on the experience. SWE sensor evaluation is complex because advantages and disadvantages are only realized in differing measurement (snowpack) conditions which are impossible to assess at one, or even several, concurrent intercomparison sites. In this way, the paper is both interesting and contributes to the body of knowledge related to automated in situ SWE measurements. Having said that, there are several deficiencies in the paper that require revision before the paper can be published in TC. These are incorporated into the attached annotated manuscript, but the major issues are as follow:

1) There are general wording and grammar issues and some terminology inconsistencies that need to be fixed. These are noted in the annotated manuscript.

2)The abstract is quite vague. It would benefit from some additional detail about each of the sensors assessed and perhaps a short overview of the offered recommendations.

3)There are some redundancies and therefore readability to be gained in Sections 3/4/5. For example, by the time we get to Section 4 (in particular, lines 700-702), we shouldn't be reading more about instrument description, such as the field of view of the CRNP, as this should be outlined already in Section 3. I think that Section 4 can be organized a bit better to improve readability, perhaps by converting the bulleted list starting at line 637 to paragraphs using heading names organized by instrument.

4)Similar to point #2, the Conclusions section contains redundant details, such as the bulleted list starting on line 740, that should only be briefly summarized at this point. Since your pros and cons are a bulleted list in Section 4, summarize these in a short paragraph in Section 5, followed by some brief recommendations to potential users.

Please also note the supplement to this comment:

<https://tc.copernicus.org/preprints/tc-2021-163/tc-2021-163-RC1-supplement.pdf>