

## ***Interactive comment on “Variability of light transmission through Arctic land-fast sea ice during spring” by M. Nicolaus et al.***

**Anonymous Referee #2**

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Overarching general review/comments The topic of study is highly relevant to the present day environmental concerns and dynamics related to the energy and mass balance of Arctic sea ice. That said- the data and study does contribute to the large body of work regarding the variability of the transfer of energy through sea ice. However, given that the body of literature and data on the topic is very extensive (as nicely reviewed in the introduction of the current submission) the manuscript, in its present form, does not yet make an overly compelling case that the findings or analyses of the findings are particularly novel. Rather- the findings and analysis, as presented/analyzed, seems to indicate that these measurements are very consistent and repeat what others have found for the past several decades (Namely that snow cover is a major determinant of the transmittance of solar radiation that passes into and through sea ice, the annual dynamics of solar radiation passing through sea ice is very dependent on the

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season and, in the absence of significant amounts of algal material or colored material, the spectral composition of the under ice irradiances is fairly predictable or known). The manuscript and data however, likely has greater potential beyond what has been presented. Specifically, the manuscript has at its foundation a good series of measurements collected in a sound manner (for which the authors should be commended) that can quantitatively address spatial variability issues. As presented thus far, the ms presents a rather mundane analysis of the summary statistics (e.g. mean, mode, variance etc..) regarding light transmission along transects and show the transect data. Although this level of analysis does quantify the variation along a small scale (meters) it does not attempt to quantitatively correlate or relate the variability and the spectral (numerically speaking) characteristics of the along-track or horizontal variation. Looking at the data this type of analysis might not be statistically achievable given that the transects did not over many (e.g. 5 or more) wave forms in the along track variations). However, we really don't know if this is the case based in the data as presented because the data is only presented on a log-transformed scale. After presenting on a different scale and conducting an analysis of spatial variance- they may or may not find spectral (spatial) characteristics that may not be readily evident from their analysis presented thus far. It may turn out they do not have enough data to derive statistics such as autocorrelation lengths etc.. . However, any data that seeks to explain spatial or temporal variations and dynamics should be subject to that type of analyses. Even in the instances where the data may be insufficient to derive such information- the explanation as to why the information could not be obtained could be presented. Then, once this information (on distance variability etc..) is gathered or summarized... the data should be placed in context of the previous studies- in such a manner that comparisons can be made. For instance, a fundamental attribute that can allow a more readily comparison of information on transmittance and under ice irradiances, is the attenuation coefficient which – although it is apparent optical property- id does allow some comparisons to be made when thicknesses of the overlying snow and or ice become confounding factors in comparing the properties of the ice.

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The above discussion and comments are provided in hopes that some of the information and data analysis from this study can be integrated into a revision that will help progress the concepts which will be more useful to include in analyses – of not only current or past data- but data and studies of the future, and thus look forward to seeing the ms in a revised version.

Technical comments:

The presentation of the abbreviations for different irradiance values is not consistent with the standards for hydrologic optics. Specifically  $E_d(z, \lambda)$  is downwelling irradiance (the  $d$  should be subscripted and it denotes a cosine geometry of the collector) and  $z$  and  $\lambda$  denote the depth and the wavelength respectively.

The references are not consistent and the reference for Nicolaus 2012 is not presented.

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Interactive comment on The Cryosphere Discuss., 6, 4363, 2012.