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Interactive comment on "Evidence for spring mountain snowpack retreat from a Landsat-derived snow cover climate data record" *by* C. J. Crawford

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The author appreciates Anonymous Reviewer #3's time and effort to review this manuscript. The review was helpful for clarifying specific details in the SCA reconstruction including a more focused discussion on potential error. Please find the author's responses to specific reviewer comments below including changes to the manuscript where appropriate.

Reviewer: The SCA was reconstructed by using the CRU surface temperature. The quality of the temperature data is important for the SCA estimation. In Fig.4 of the paper, the author did not show equations of the linear fits. According to the scatterplots,

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it seems that an error of 1°C in the surface temperature would cause deviation of 5% in the estimated SCA. If the error of the surface temperature is large, the result of decrease of 36.2% in spring SCA since 1901 would be unreliable. Therefore, it is necessary to show the quality of the CRU temperature data and an error analysis on the SCA-temperature model. In addition, it would be better to show the linear equations in Fig.4.

Author: The CRU gridded temperature data has been widely used in many studies on temperature variability and change since its initial production. The meteorological stations used to construct the CRU grid points and subsequent regional temperature field in this paper have been checked for inhomogeneities and undergone extensive quality control. Mitchell and Jones (2005) provide a detailed description on how CRU grid points are constructed. Error is an inevitable component of observational data, and the reviewer is correct to raise this concern. That said, the author is comfortable with the quality of the CRU temperature data, as the procedures have been well documented. The author agrees that showing the linear equations in the Fig. 4 scatterplots would provide more information on the statistical relationships. Equations have been included in the revised manuscript. On this point though, its important to note that a 1°C mean temperature change should not be taken lightly, as this degree of change over time could result in significant SCA loss during the spring melt season. Much more observational analysis is needed to identify sensitive temperature-SCA thresholds. In response to the reviewer's concern over SCA reconstruction error and estimated SCA losses since 1901, author has decided to remove this calculation from the revised manuscript. The reviewer raises a strong point on model error and the potential for deriving an unreliable estimate of spring SCA loss. The author recomputed estimated SCA losses for a range of confidence limits and arrived at the conclusion that SCA on or near June 1 may not have enough spatial coverage to calculate SCA loss. The main issue here is that the lower confidence limits on reconstructed SCA estimates approached zero in certain years, and given model error, this may in fact produce unreliable loss estimates. More work is required to derive a reliable spring SCA loss

estimate.

Interactive comment on The Cryosphere Discuss., 7, 2089, 2013.

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