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The Cryosphere
Discussions

Interactive comment on "Quantifying ice loss in the eastern Himalayas since 1974 using declassified spy satellite imagery" *by* Joshua M. Maurer et al.

J.M. Shea (Referee)

joseph.shea@icimod.org

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Review - Maurer and Rupper, TCD

Using declassified spy satellite imagery (Hexagon and Corona) and recent ASTER imagery, Maurer et al calculate glacier mass changes for 21 glaciers in eastern Bhutan, from the 1974 to 2006. The methods and assumptions appear to be sufficient, errors in the analysis are well-documented, and the results are interesting and highly relevant. The paper is also well-referenced, very well-written, and essentially free from grammatical/structural/organizational errors.

Aside from the comments by the other reviewers (Pieczonka and Nuimura), I can only

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Discussion paper

add a few general points that the authors might wish to address:

1) A very brief outline of the Hexagon/Corona pipeline (Maurer and Rupper, 2015) would be helpful

2) Why are only 21 glaciers studied? And what are the impacts of the 30% coverage threshold? Previous geodetic studies (e.g. Gardelle et al., 2013, Bolch et al., 2011) consider the entire glacierized area that is covered within a region. Using only 21 glaciers (and only those larger than 3 km2) and replacing potentially large missing areas with the regional mean for a specific glacier type and elevation band could result in biased regional estimates of glacier mass change that are not comparable to previous studies.

3) How is the ELA defined in this study (it first appears on P10L29)? Strictly speaking, this is typically taken from surface mass balance measurements. While the elevation that divides geodetic mass gain and loss would be related to the ELA, I am not sure that it can be used as an ELA substitute (though I would be interested to hear otherwise).

Specific comments: P2L20: are these annual or seasonal streamflow contributions?

P4L20: Define DN.

P10L25: What data support the conclusion that debris-covered glaciers melt at the same rate as clean-ice glaciers? If this is overall mass balance rates than it should be specified. Figure 4 clearly shows that melt rates at debris-covered glaciers are lower than those observed on clean ice glaciers for the same elevation band, and this is later referenced by the authors on P10L28.

P11L15: Debris cover will almost always get thinner moving up-glacier. The greater thinning rates observed at the transition between debris-covered and debris-free zones is due in part to enhanced melt rates under thin debris cover but also due to the simple fact that bare ice will melt at a faster rate than debris-covered ice at the same elevation. Modelling studies in the Khumbu region (Shea et al., 2015; Rowan et al., 2015) both indicate that debris-covered tongues will detach from their accumulation areas in the future, leading to greater future melt rates.

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