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Interactive comment on "Modelling glacier change in the Everest region, Nepal Himalaya" *by* J. M. Shea et al.

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The modeling efforts carried out in this paper to forecast the glaciers behavior are in my opinion very important in the actual scientific debate. Therefore the paper face an interesting topic.

In general I think that from one side the paper shows real high modeling potentiality, but from another side the methodological aspects presented here are not easy to follow. I think the paper needs a review focused to increase the readability of the method section in order to 1) the scientific rigor can be assured and 2) the followed approach can be replicable to other regions.

I fully agree with one of the comment posted by B. Marzeion (Referee), that model

outputs depends on the input parameters. The authors should make it clear how model initialization works.

It is not clear which part of the model is based on methods presented in previous papers and which parts are news.

The authors refer to the ICIMOD report for calibrate/validate glacier parameters that is not a peer-reviewed dataset. Why not the authors use the recently published dataset on terminus, surface changes from Thakuri et al (2014; Supplement) that provides a complete dataset from 1960s to 2011 for the Sagarmatha National Park?? In particular for the initialization of the 1960s (as required by the reviewers) this study could be useful if the model runs are for each glacier separately (if I understood the method followed). In their paper Thakuri et al,2014 analyze about 400 km2 of glacier surfaces.

Concerning the meteorological forcing,

1) the authors carried out the downscaling of APHRODITE through the EVK2CNR data. In this way they got good performance on mean values (mean bias and root mean square error). However I am not sure that the adopted procedure can be considered as an independent validation (as declared) due to the fact the same stations were used to calibrate the mean bias correction.

2) the author do not have the availability of long series for discerning adequately the different gridded reanalysis existing climatic data set. However Yatagai et al., 2012 developping APHRODITE, underlined some discrepancies with GPCC in Nepal during the last decades. Furthermore Yao et al, 2012 underlined the monsoon weakening in the Himalayan region, confirmed by Salerno et al. (on TCD) and inferred by Wagnon et al., 2013. How do the non–stationarity of GPCC precipitation affect the results of this study??

3) Finally, the 500 m elevation bins used to estimate daily precipitation vs elevation might be too rough. As highlighted in the discussion this is a major source of uncer-

tainty for the glacier mass balance. The precipitation gradient estimated on the base of the observations in Salerno et al. 2014 may help to resolve some of the miss-fit (for example at Pheriche (fig. 6)), and better constrain the overall calibration process.

Furthermore I provide some suggestions and comments considering the recent paper of Thakury et al., 2014 analysing changes for different glacier parameters since 1962 in the same regions and considering the paper of Salerno et al (on TCD) analysing temperature and precipitation trends for the last twenty years.

p5377 (23-25)Salerno et al (on TCD) report that nearly 90% of the annual precipitation falling in the months of June to September. Considering that the mean daily temperature during these months is above 0 °C. On a yearly basis, this probability reaches 20% of the annual cumulated precipitation.

p5377 (26) Salerno et al (on TCD) report that the precipitation sensors at these locations are tipping buckets usually used for rainfall measurements and may not fully capture the solid prec. Therefore, prec is probably underestimated, especially in winter.

p5378 (1-3) Salerno et al (on TCD) report the precipitation gradient along the altitudinal transect until 5600 m. They observe a clear rise in precipitation with elevation until approximately 2500ma.s.l. At higher elevations, they observe an exponential decrease

p5378 (1-3) I suggest to report here the study just published few months ago by Thakuri et al., 2014 reporting the surface are loss on the south side of Mt. Everest from 1962 to 2011 considering five intermediate using optical satellite imagery. They found an overall surface area loss of 13.0$\pm$3.1%.

Comment: this result in term of surface area loss is strictly comparable with the decrease of 15.6% in term of ice volume observed in the manuscript for the same period. I will underline in the discussion section that the general statement “surface area loss in debris coverage glaciers is not representative of the real mass loss” is rejected.

p5379 (4) Here I would report data for precipitation for north and South slopes of Mt Everest. At Piramid station (1994-2013) the total annual precipitation is 463 mm (Salerno et al., TCD). In the north I would cite Yang et al., 2006.

p5379 paragraph 1.2. I think that in this section needs to be specified for the readers that in the Dud Koshi the shrinkage of the glaciers in south of Mt. Everest is the lowest of the region as reported by Thakuri et al., 2014 using surfaces and terminus. The same considerations could be reached considering the mass balance differences reported by other authors (e.g. Yao et al., 2012).

p5379 (17-20) Salerno et al., 2014 (on TCD) find just higher trends for minimum temperature.

p5379 (2-6) Salerno et al., 2014 (on TCD) find a huge decreasing trend at high elevation.

p5379 (5-22) Salerno et al., provides the precipitation gradient

Yatagai et al., 2012 APHRODITE: Constructing a Long-Term Daily Gridded Precipitation Dataset for Asia Based on a Dense Network of Rain Gauges

Wagnon et al., 2013 Seasonal and annual mass balances of Mera and Pokalde glaciers (Nepal Himalaya) since 2007

Salerno et al. (on TCD) Weak precipitation, warm winters and springs impact glaciers of south slopes of Mt. Everest (central Himalaya) in the last two decades (1994–2013)

Yang et al., 2006. Climate change in Mt. Qomolangma region since 1971. J Geographical Sciences

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Interactive comment on The Cryosphere Discuss., 8, 5375, 2014.