Interactive comment on “On the recent contribution of the Greenland ice sheet to sea level change” by M. van den Broeke et al.

Anonymous Referee #1
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This is an interesting and useful up-to-date analysis of recent changes in the Greenland Ice Sheet mass balance, considering independent estimates of surface mass balance, solid ice discharge and total mass change from GRACE, that is set in a longer-term context of the last 58 years. The paper is generally well-written and -presented, and the underlying analysis seems proficient, although a few aspects (detailed below) need clarification. I'd be happy to recommend full publication in TC once the authors have addressed the following points.

page 1, line 11: change to "increased refreezing prevents runoff of meltwater FROM OCCURRING, at the expense of...

p.4, l.26: How well do the ERA-40 and ERA-I climatologies agree for the overlap period (1979-2002)? If there is any mismatch, splicing or some other adjustment of the temperature and precipitation etc. fields may be required.

p.5, l.10: "typical uncertainties of 9% and 15% were found for ice-sheet wide integrated accumulation and ablation" - can you comment on regional-scale uncertainties, as these can be much greater and might be important in the context of this study?

p.5, l.21: who are "A. et al. (2013)"?

p.5, l.22 "The uncertainty in monthly GRACE values are..." - how are these uncertainties defined?

p.5, l.26 "we interpolated the GRACE data to the end of the month" - how? E.g. linear or sinusoidal interpolation?

p.6, l.4: change to "are usually assumed TO BE part of...

p.6, l.19 "Until mid-1996, cumulative D represents a straight line, because its annual value is assumed constant at the 1996 value". How reasonable is this assumption and what difference does it make to your results? Rignot et al. (2008) suggest that anomalies in D since ∼1960 are quite variable in time (their Fig. 3).


p.7, l.6: ", the real uncertainties in the trends." - again, how are these defined? Also, comma at beginning of the words in (my above) parentheses should be a semicolon.

p.7, l.31: change to "preventing the surface meltwater FROM REACHING the deeper firn layers and USING the full retention potential".
Remarkably, the summer of 2013 saw a return to near-normal melt conditions, with melt close to the 1961-1990 average, while summer 2015 saw record melting in the northern reaches of the ice sheet (Tedesco et al. 2016). This exceptional interannual variability in the melt climate of the GrIS points towards important roles for large-scale atmospheric drivers (Fettweis et al. 2013, Hanna et al. 2013, 2014 & 2016, McLeod & Mote 2016) and local feedback processes.

And add extra references:

Has year-to-year variability of annual precipitation decreased significantly for the whole period? The graph suggests there may have been a decrease and maybe an opposite trend (recently increased variability) for runoff.

"previous work reported little difference between discharge estimates from the early 1960s and the mid 1990s (Rignot et al. (2008) - this is strictly correct but Rignot et al. (2008, their Fig. 3) also suggest a 50-100 Gt yr⁻¹ change in discharge between these two periods and the intermediate mid-late 1970s and early 1980s period.
