Our anwers to the points raised by H. Rott in ***italic**:*

Verification of precipitation and accumulation on the ice field is largely missing due to the lack of data. In particular accumulation is a main source of uncertainty in the mass balance computations. The three mass balance point values in accumulation areas in Fig. 3 underline this problem. There is no 1:1 correspondence (indicated by the line) in the accumulation area. Point 6 (ice core on Tyndall Glacier, Shiraiwa et al. 2002) covers only two years of accumulation, with annual accumulation in the two years differing by as much as 7 m w.e. This is not even adequate for verifying multi-annual mean accumulation at this single point, not to mention accumulation over the whole ice field. For the SMB simulations a large error should be assigned to the accumulation component of the simulations, in particular when stepping down to the scale of individual glaciers.

We agree that the verification of the modelled accumulation is difficult. In Figure 3 we compare modelled accumulation for the same time span as the measurements. The firn corn of Shiraiwa et al. (2002) did not even contain 2 entire years, which makes it difficult to infer inter-annual variability from these data. We are still happy about their measurements, since they prove that extremely high accumulation is taking place at some places on the SPI. Of course four point measurements of accumulation is very little for 12500 km² of ice. This is why we try to quantify the different components of the mass balance for the individual glacier catchments. We can get an idea about the uncertainties of the individual mass balance components at every glacier by comparing columns 1 and 2 to columns 3 in Table1. We think that this is much more informative then inventing some arbitrarily high a priori uncertainty to the modelled accumulation.

Lacking details on simulation results for individual SMB components impairs comparisons with field measurements and with studies in other glacier regions. Mass balance profiles (specific MB in dependence of altitude) should be provided, e.g. for comparison with balance profiles by De Angelis (2014) and Stuefer et al. (2007).

Mass balance profile plots will be provided for Perito Moreno Glacier and compared to mass balance profiles presented in Stuefer et al (2007) and De Angelis (2014).

For the glaciers in Table 2 it would be useful adding the net balance values for ablation and accumulation areas. Stuefer et al. (2007) specify for Moreno Glacier numbers on net balance for accumulation area and ablation area, based on ice flux through at a gate below the equilibrium line and ablation measurements 1995 to 2003.

We choose a different approach here and compute flux gates at the tongue of the glaciers (columns 3 to 7 in Table 1). For our analysis (equation 1) no separation in net balances for the accumulation and ablation area is necessary. A comparison with the analysis of Stuefer et al. (2007) will be provided in specific mass balance profile plot (see above).

Late summer snow line (e.g. De Angelis, 2014, Section 2.5) would be useful for checking the SMB model performance near the equilibrium line.

We compare the ELA's obtained from our model to the observed snowline altitudes at the end of the ablation season by De Angelis (2014) in a new version of the paper.

There is an obvious mismatch between observed retreat of non-calving glaciers and multi-year trends in modelled SMB. Non-calving glaciers (in particular if small) are more directly linked to climate trends than calving glaciers. According to the increasing positive SMB trend in Fig. 4, the retreat of small glaciers should have stopped (or even turned over to advance) during recent years. Davies and Glasser (2012), however, show ongoing retreat of non-calving glaciers. Although the mass turnover of these glaciers is small compared to the calving glaciers of SPI, this seems to indicate some bias (overestimation of accumulation?) in the SMB model.

Our model is producing negative surface mass balances for 182 of the 395 analysed catchments. Several of them are visible as small yellow-greenish patches in Figure 2c). However care has to be taken with the non-calving glacier classification, since formerly non-calving glaciers of the SPI have developed pro-glacial lakes now, similarly as it was documented for the NPI (Loriaux 2013). For example the three glaciers that were classified as non-calving in Rignot et al(2003), (Bravo,Frias and Olvidado) have all developed pro-glacial lakes now.

Besides, one would expect that increase in accumulation is reflected in increase of surface height in level parts of the ice sheet (in areas with little motion). This has not been reported by geodetic data.

The increase in accumulation could be cancelled out by an acceleration which has been observed at the tongues of several glaciers (see your statement below), which should probably propagate up to higher elevations as well.

The relevance of computing calving fluxes using velocities of a single date for comparison with fluxes over multi-year periods (Table 1) is doubtful. The lack of information on calving cross sections further increases the uncertainty. Several of the main calving glaciers show strong temporal variations of calving velocity (e.g. Muto et al., 2013; Sakakibara et al., 2013). Comparisons of SMB inferred and velocity-based calving fluxes should better focus at a few glaciers where information on calving cross section is available (e.g. from bathymetric data, ice thickness, height above floating) and should account for multi-annual variations in velocity. Accurate data on retrieved calving fluxes would be important for checking the performance of inferred calving fluxes (and SMB).

Again we agree with the reviewer in most of the points. However, we think that our analysis, although containing high uncertainties, is still valuable. Indeed, the observed acceleration of many glaciers is probably one of the reasons for the disagreement of the values presented in columns 1, 2 and column 3 in Table 1. Due to the apparent underestimation of current glacier velocities, column 3 in Table 1 can be considered as lower limit of possible calving fluxes for glaciers on the SPI whilst column 2, due to reasons discussed below, provides probably the upper estimate.

Further issues:
Information should be provided on the data base and performance of statistical downscaling (mentioned on page 3120, line 13 ff). Statistical downscaling requires a representative observational data base. The only station data shown are precipitation data of three stations (not very close to SPI), each of which covers only a subset of the 35 years (Fig. 4).

Our statistical downscaling is not based on am observational data base, but on the base of a seven year simulation with the regional climate model Weather Research and Forecasting (WRF). The performance of the statistical downscaling can be judged by the correlations indicated in the text. For further details on the downscaling technique we refer to Schaefer et al. (2013).

The error estimate for the inferred calving fluxes (Table 1) should be revisited. At least for Moreno Glacier there is a consolidated number for 1995 – 2003 (0.36 Gt/yr, Stuefer et al.), whereas the SMB inferred calving flux for 2000-2011 is 4 times higher.

The errors denoted in column 1 and 2 of Table 1 are not meant as error estimated, but a priori quantified errors by the authors of the geodetic mass balances. This will be will pointed out better in a new version of the manuscript. We will also discuss in more detail the validity of this quantifications of errors.

The performance of the geodetic balances, based on differencing of DEMs retrieved from spaceborne sensors, is critical for estimating calving fluxes from SMB data. The authors use data published by now (only option anyway). Nevertheless, I want to bring forward some points that might be relevant for future work. Regarding the 1975-2000 Volume change, Rignot at al. (2003; Notes 15. and 16) explain that the 1975 DEM did not cover areas at elevations above 1200 m, whereas the SMB simulations extend over the whole ice field. For recent years, new evaluations of volume change based on single pass interferometry data of 2001 and 2012 (Abdel Jaber et al., 2013) indicate less mass depletion than data based on SRTM/optical DEM differencing (for which earlier versions agree better with SRTM-TanDEM-X differencing, both for NPI and SPI).

This is very interesting. Lower overall mass losses would imply lower inferred calving fluxes, which would bring the inferred calving fluxes (columns 1 and 2 Table 1) in better agreement with the calving fluxes estimated from front velocities (column 3 in Table 1). We are looking forward to see the detailed data of Jaber et al. (2013) published in a peer-reviewed journal (e.g. The Cryosphere).

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