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Discussions

Interactive comment on "Reconstruction of the 1979–2006 Greenland ice sheet surface mass balance using the regional climate model MAR" *by* X. Fettweis

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First of all, I want to thanks the reviewer #1 for his very useful constructive criticism and his encouragements.

Hereafter the response to the reviewer's questions:

1. It is clear that the higher the resolution is, the better representation of the ablation zone in the model will be. However, the MAR model is not yet parallelized and a 25km-simulation takes already (too) much time. The horizontal resolution of 25 km was chosen because it is a good compromise between the computing time and a reasonable representation of the SMB zones (ablation zone, percolation zone,...). A 25km-simulations beginning in 1969 is soon scheduled as well as a 37.5km (=25 x 3/2)-simulation over the whole period covered by the ECMWF ERA-40 (re)analysis (1958-2006). The computing time for a resolution of 37.5km is divided by 3 against 25km. Long simulations at resolution higher than 25km can't be currently planed except for study cases on small time periods (MAR can run at a resolution of 1 km) or except if the SISVAT module is driven by disaggregated atmospheric MAR fields.

2. The routing scheme is a simplified version of the Multiple Path Distributed Flow Algorithm which uses only the MAR topography. This reference will be added in the paper. The routing scheme uses the runoff rate computed by MAR according to Lefebre et al. (JGR, 2003) and shown in this figure. It discharges the meltwater flux from each pixel to the pixels lower in altitude until the flux reaches the ocean. The routing scheme is run after the MAR simulation and consequently, no interaction of the meltwater coming from the higher pixels with the surface of the pixel (percolation, decrease of albedo, ...) is taken here into account. The distribution of melt water flux to pixels lower in altitude is altitude-weighted.

3. The uncertainty range given for the trend of (SMB, runoff, ...) denotes two standard deviations of the trend (i.e. a significance of 95%). It is computed from the time series plotted on Fig. 4 according to:

$$e_1 = \sum_i (trend(a_i) - a_i)^2 \quad (1)$$

$$e_2 = \sum_i (y_i - mean(y_i))^2 \quad (2)$$

$$range = (e_1/((2006 - 1979 - 1) * e_2))^{0.5} * k \quad (3)$$

where

a_i = time series of the variables plotted in Fig. 4

y_i = time series of the 28 years (1979,1980,...)

$k = 1.96 \Rightarrow$ 95 % significant ($k = 1 \Rightarrow$ 67 % significant, $k = 3 \Rightarrow$ 99.5 % significant)

The range in the snowfall trend of $+$ 0.4 $\pm$ 2.5 km^3 yr^{-2} indicates clearly that the trend is not significant. But, the SMB trend is 95%-significant ($-$ 7.2 $\pm$ 5.1 km^3 yr^{-2}). Any details as well as a discussion about this will be added in the paper.

4. Good idea for the use of the acronym GrIS.

Interactive comment on The Cryosphere Discuss., 1, 123, 2007.