

# Modeling the response of Greenland outlet glaciers to global warming using a coupled flowline-plume model

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## 0.1 Glacier geometry

For the present-day condition, the SMB for the glaciers was calculated from relaxation to observed surface elevation  $h_s^{\text{obs}}$ , with a different relaxation time scale  $\tau$  for each glacier (see section ??):

$$\dot{B}(x,t) = \frac{h_s^{\text{obs}}(x) - h_s(x,t)}{\tau} \text{ in m/yr.} \quad (1)$$

5 With the latter equation we calculated the present-day ( $t = 0$ ) SMB during the spinup experiment, similarly to ?. Such that

$$SMB_{impl} = \dot{B}(x,0) \quad (2)$$

For future scenarios, we added the anomaly of the SMB (relative to the year 2000) to the present-day SMB ( $SMB_{impl}$ ).

The anomaly for each grid cell of the glacier was computed from interpolation of the MAR anomaly of the centerline of the individual glacier and additionally corrected for the glacier elevation change similarly to the surface runoff (Eq. ??), but for the

10 SMB-calculation,  $\Delta h_s$  is the glacier elevation change compared to present-day, assuming that the derived glacier shape from the present-day dataset is for the year 2000.

$$SMB(x,t) = SMB_{impl}(x) + (SMB_{\text{MAR(MIROC)}}(x,t) - SMB_{\text{MAR(MIROC)}}^{2000}(x)) + \left( \frac{\partial SMB}{\partial z} \right)_{\text{MAR(MIROC)}}(x,t) \Delta h_s(x,t), \quad (3)$$

The time series of cumulative SMB (without surface correction) and the annual subglacial discharge for each glacier are  
15 shown in the supporting information (Fig. S1 and Fig. S2).