

Section 1: Basal melt rate error analysis

First we find the error associated with ice thickness. We rearrange equation 1 from the text to solve for H, and then propagate the error:

$$Z_s = \left(1 - \frac{\rho_i}{\rho_w}\right) H + \left(\frac{\rho_i}{\rho_w}\right) h_a$$

$$\frac{Z_s - \left(\frac{\rho_i}{\rho_w}\right) h_a}{\left(1 - \frac{\rho_i}{\rho_w}\right)} = H$$

Error in first (Z_s) term:

REMA error in Z_s : $\sigma_{1REMA} = 6 \text{ m}$

ICESat/2 error in Z_s : $\sigma_{1ICES} = 0.2 \text{ m}$

Error in second (h_a) term:

Error in h_a : $\sigma_{h_a} = 1 \text{ m}$

$$\sigma_2 = \left(\frac{\rho_i}{\rho_w}\right) \sigma_{h_a} = 0.89 \text{ m}$$

Error propagation for addition and subtraction:

$$\sigma_H = \sqrt{\sigma_1^2 + \sigma_2^2}$$

$\sigma_H = 6.1 \text{ m}$ for REMA and 0.91 m for ICESat/ICESat-2

Then divide by the constant value on the bottom:

$$\sigma_{HREMA} = 57 \text{ m}$$

$$\sigma_{HICES} = 8.6 \text{ m}$$

$$\frac{DH}{Dt} + H(\dot{\epsilon}_{trans} + \dot{\epsilon}_{lon}) = \dot{m}_s + \dot{m}_b$$

Error in first term:

Start with error propagation for addition and subtraction, then divide by Dt:

$$\sigma_{DHDT} = \frac{\sqrt{\sigma_{HREMA}^2 + \sigma_{HICES}^2}}{DT}$$

$\sigma_{DHDT} = 11.5 \text{ m/yr}$ for REMA to ICESat-2

$\sigma_{DHDT} = 7.2 \text{ m/yr}$ for ICESat to REMA

Error in second term:

$$\sigma_2 = 250 * \sqrt{(4 * 10^{-4})^2 + (4 * 10^{-4})^2} = 0.14 \text{ m/yr}$$

Error in third term: 0.1 m of ice equivalent/yr

Error in basal melt rate:

$$\sigma_{\dot{m}_b} = \sqrt{\sigma_{DHT}^2 + \sigma_2^2 + \sigma_{SMB}^2}$$

$\sigma_{\dot{m}_b} = 11.5 \text{ m/yr}$ for REMA to ICESat-2

$\sigma_{\dot{m}_b} = 7.2 \text{ m/yr}$ for ICESat to REMA

Section 2: Revision of Figure 7

