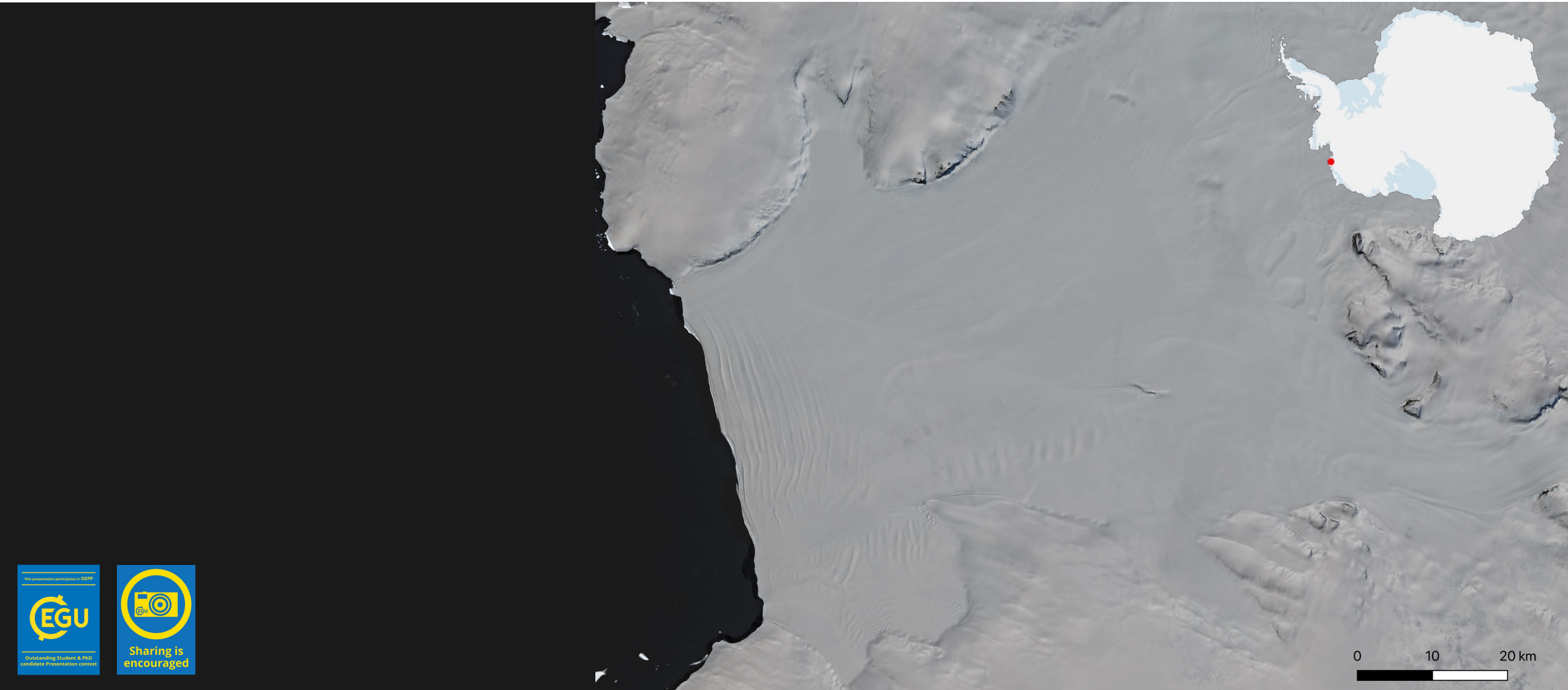
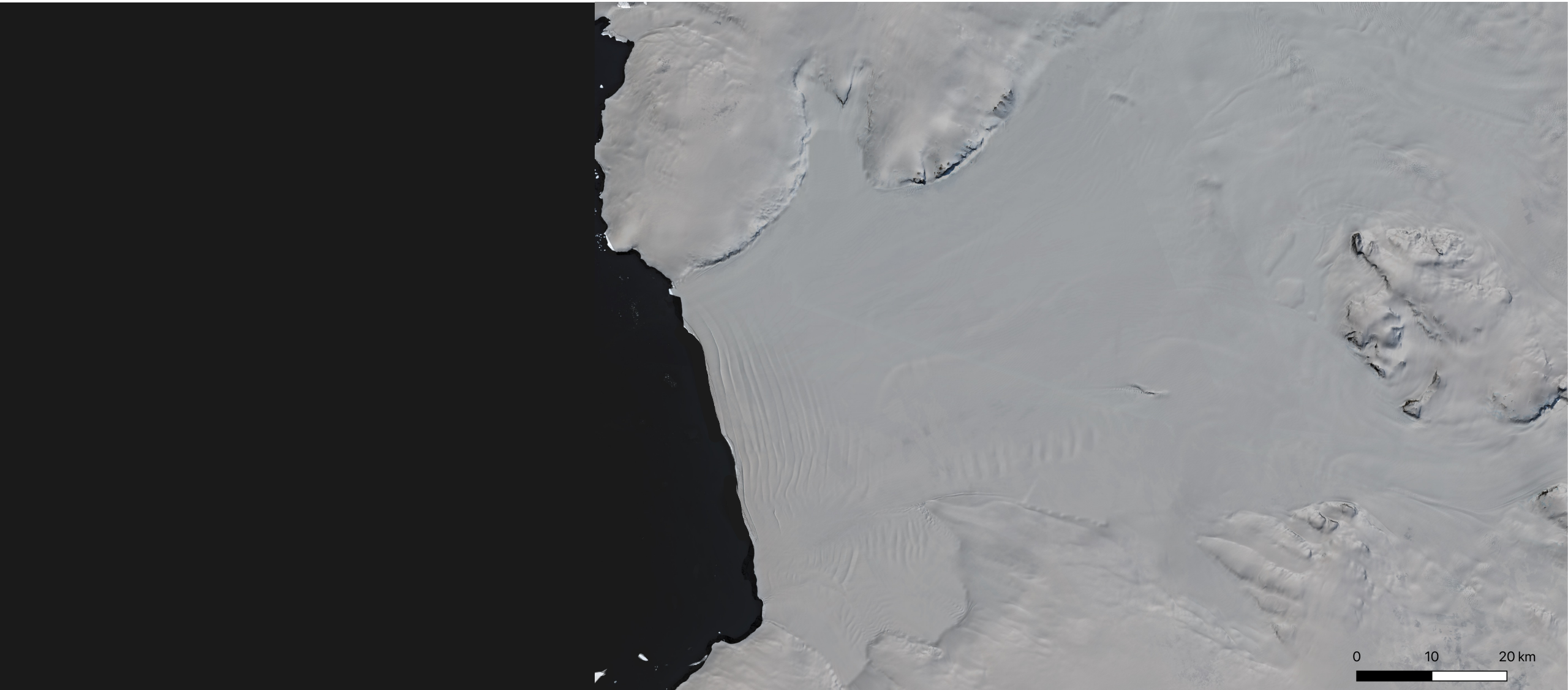
Uncovering basal melt channels on the Dotson Ice Shelf

Ann-Sofie P. Zinck, Bert Wouters and Stef Lhermitte



How can we uncover new basal channels?



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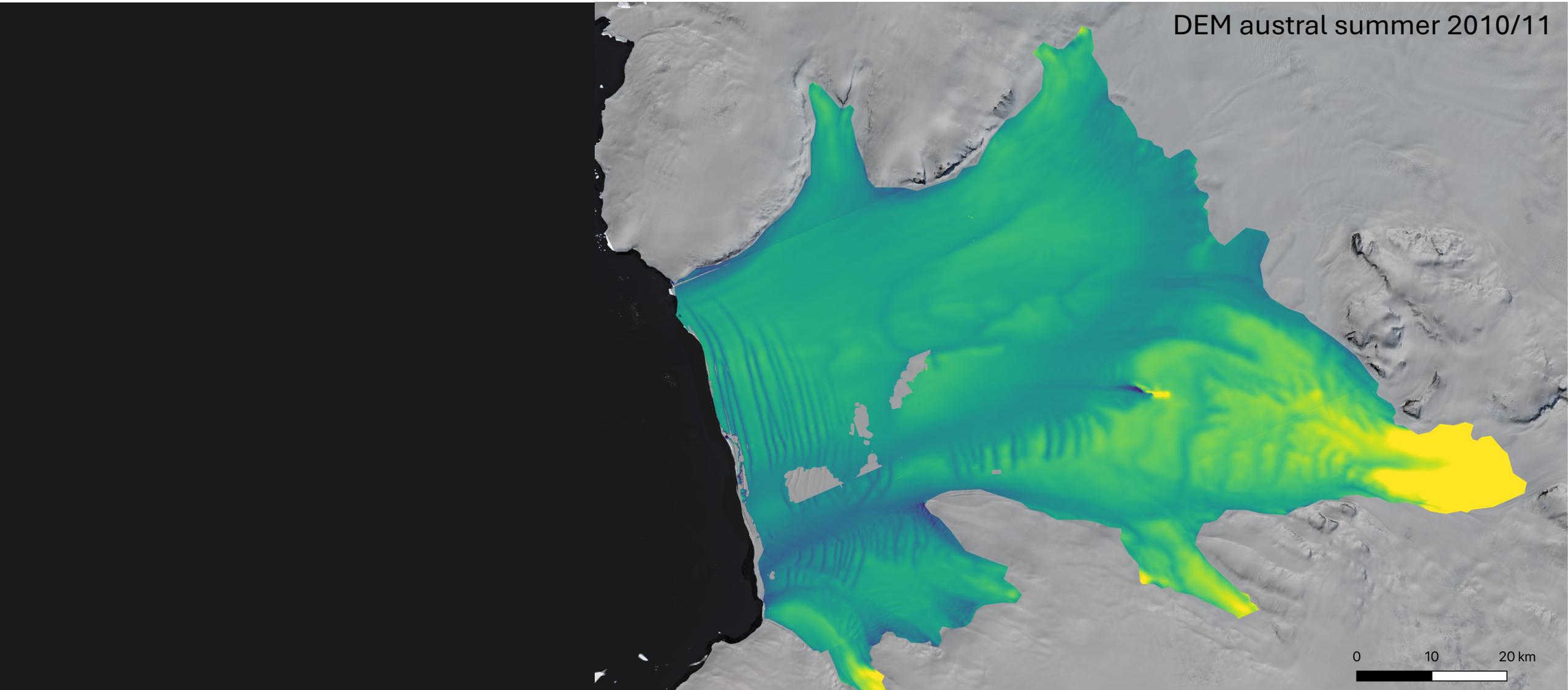

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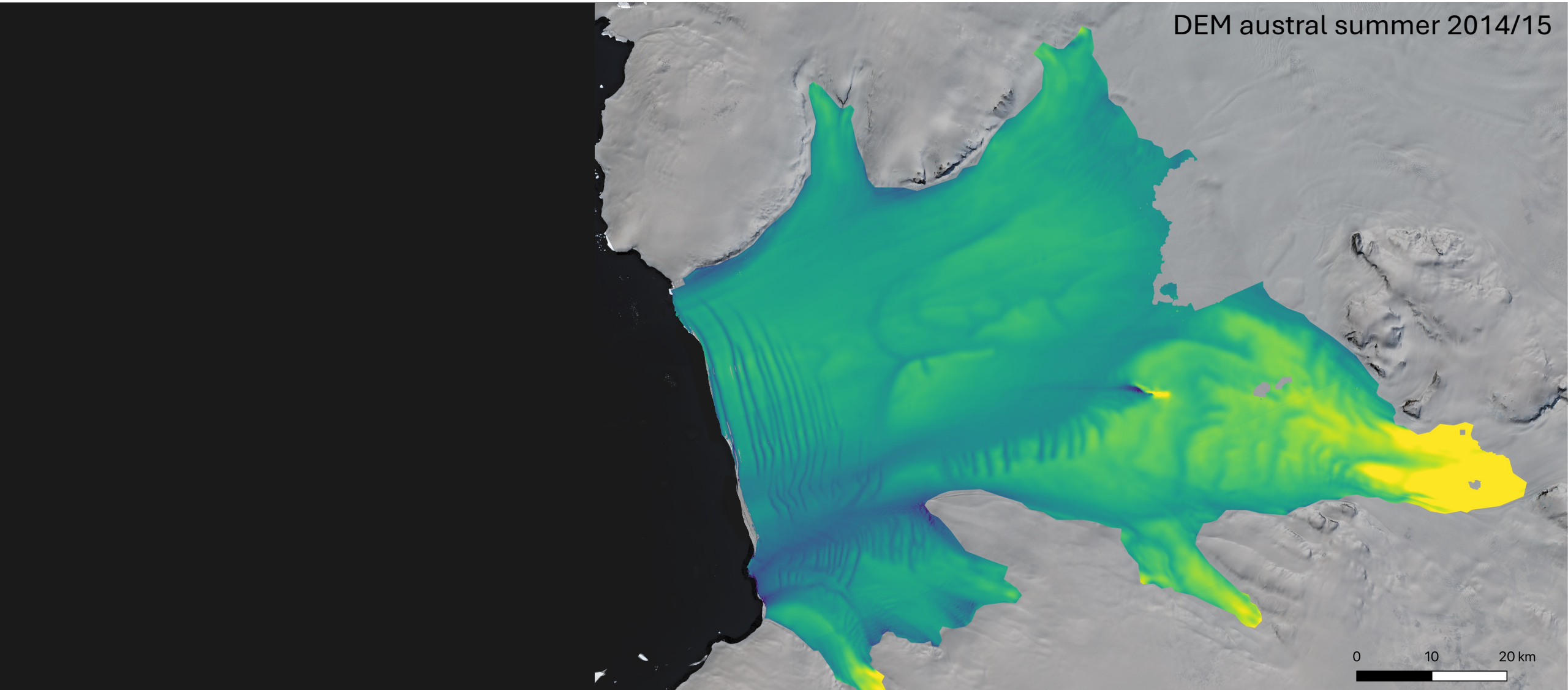
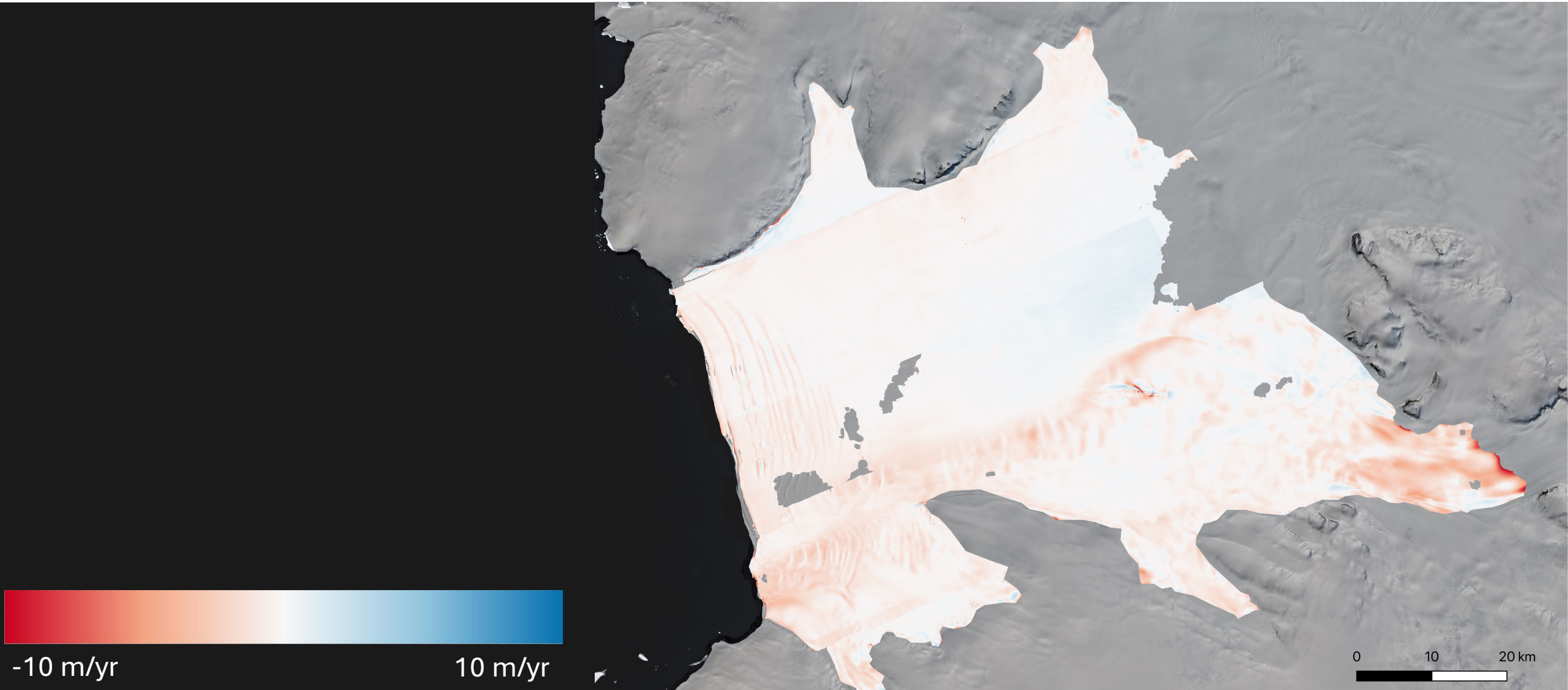


Lagrangian elevation change



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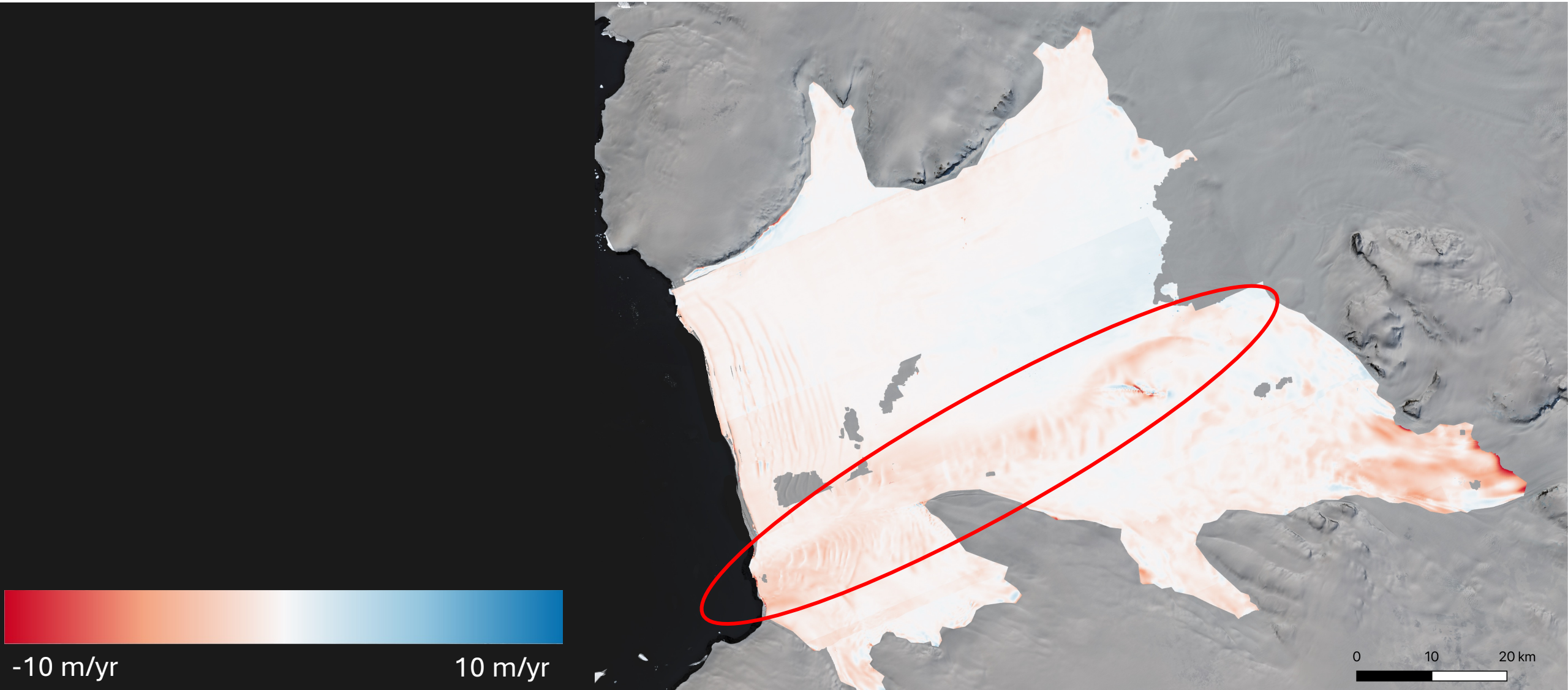
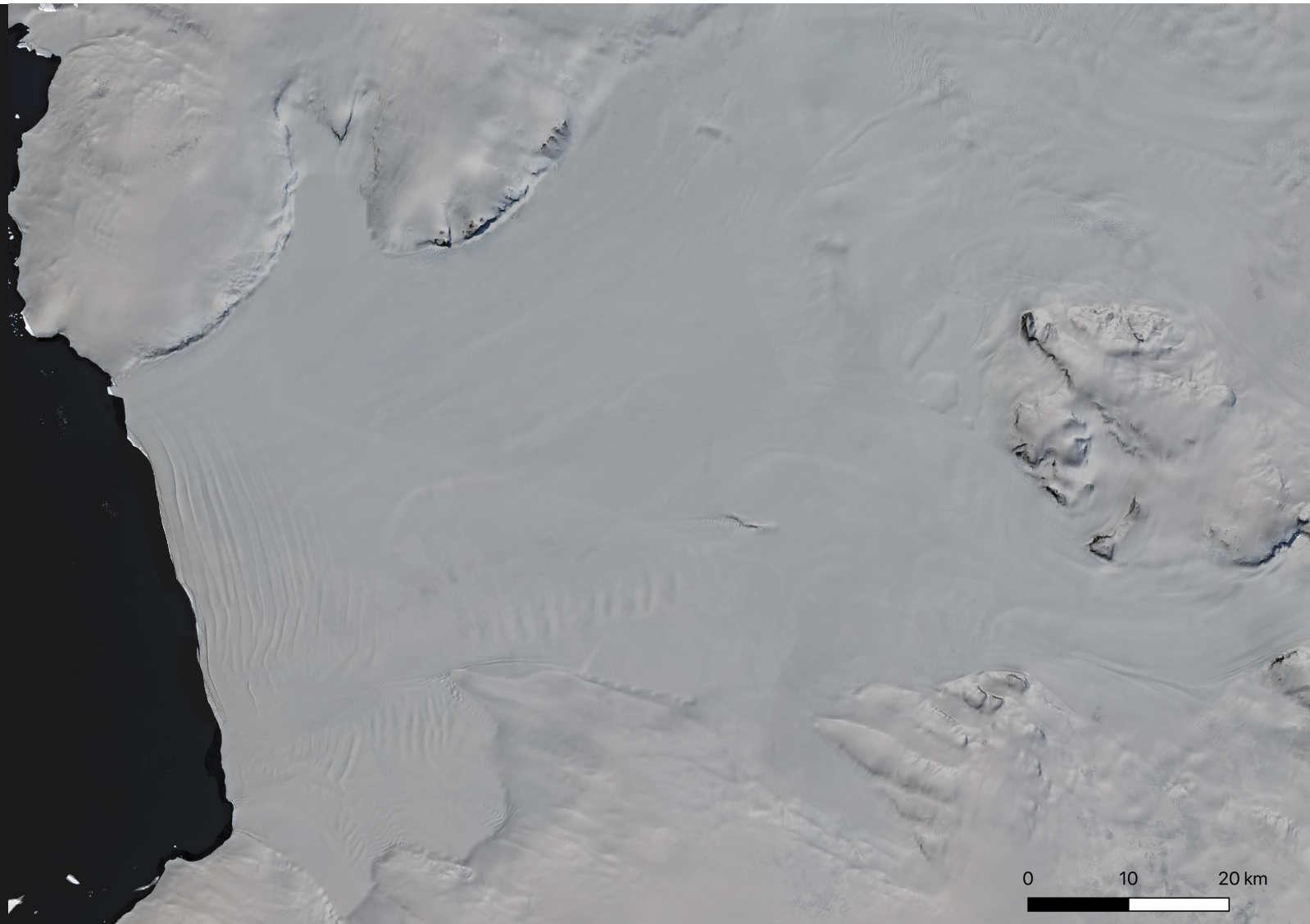


How do we calculate the basal melt rate?

Mass conservation:

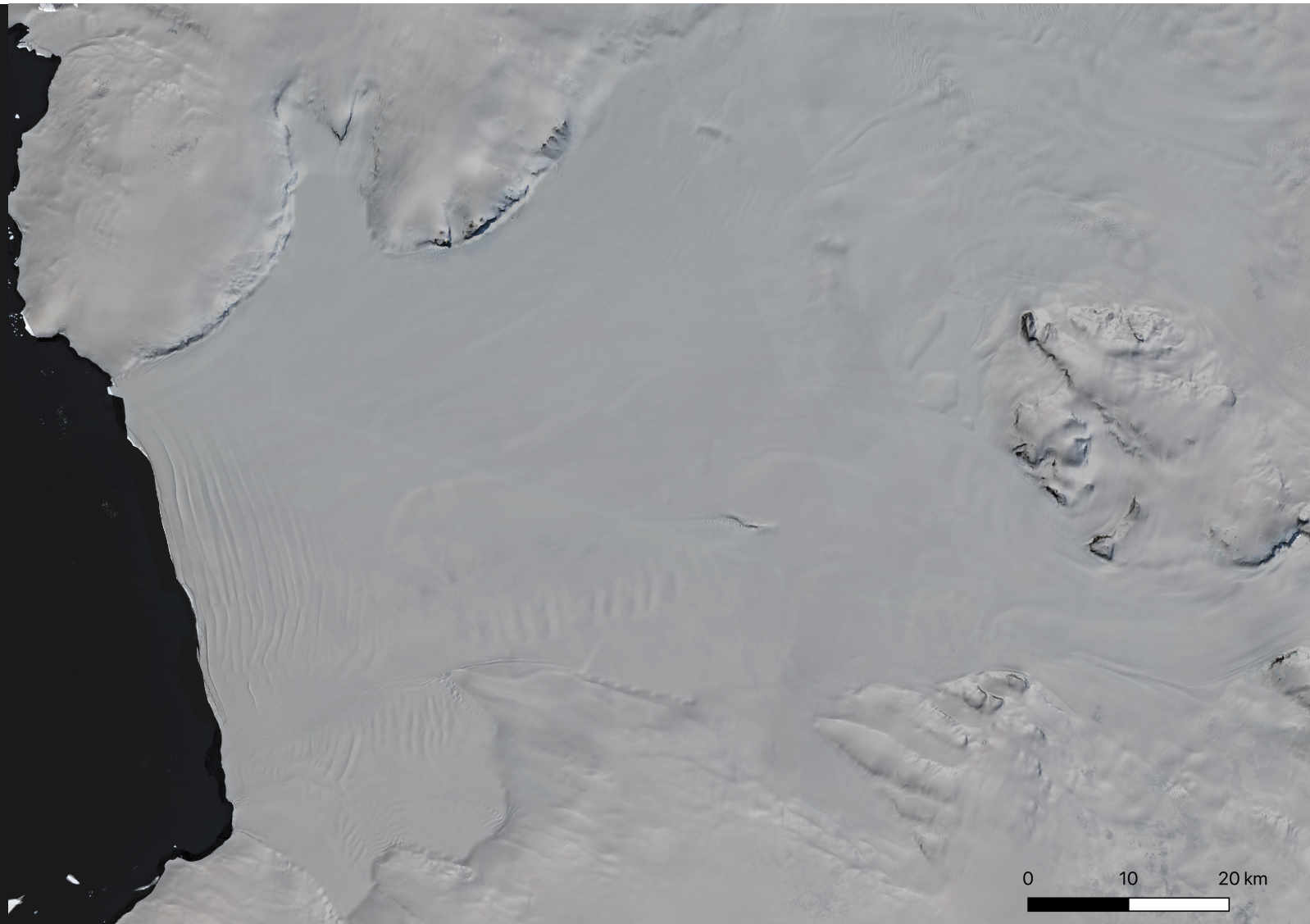


How do we calculate the basal melt rate?

Mass conservation:

- Lagrangian elevation change

$$\frac{Dh}{Dt} = -(h - h_f)(\nabla \cdot \vec{u}) + (\dot{a} - \dot{b})\left(\frac{\rho_w - \rho_i}{\rho_w}\right)$$

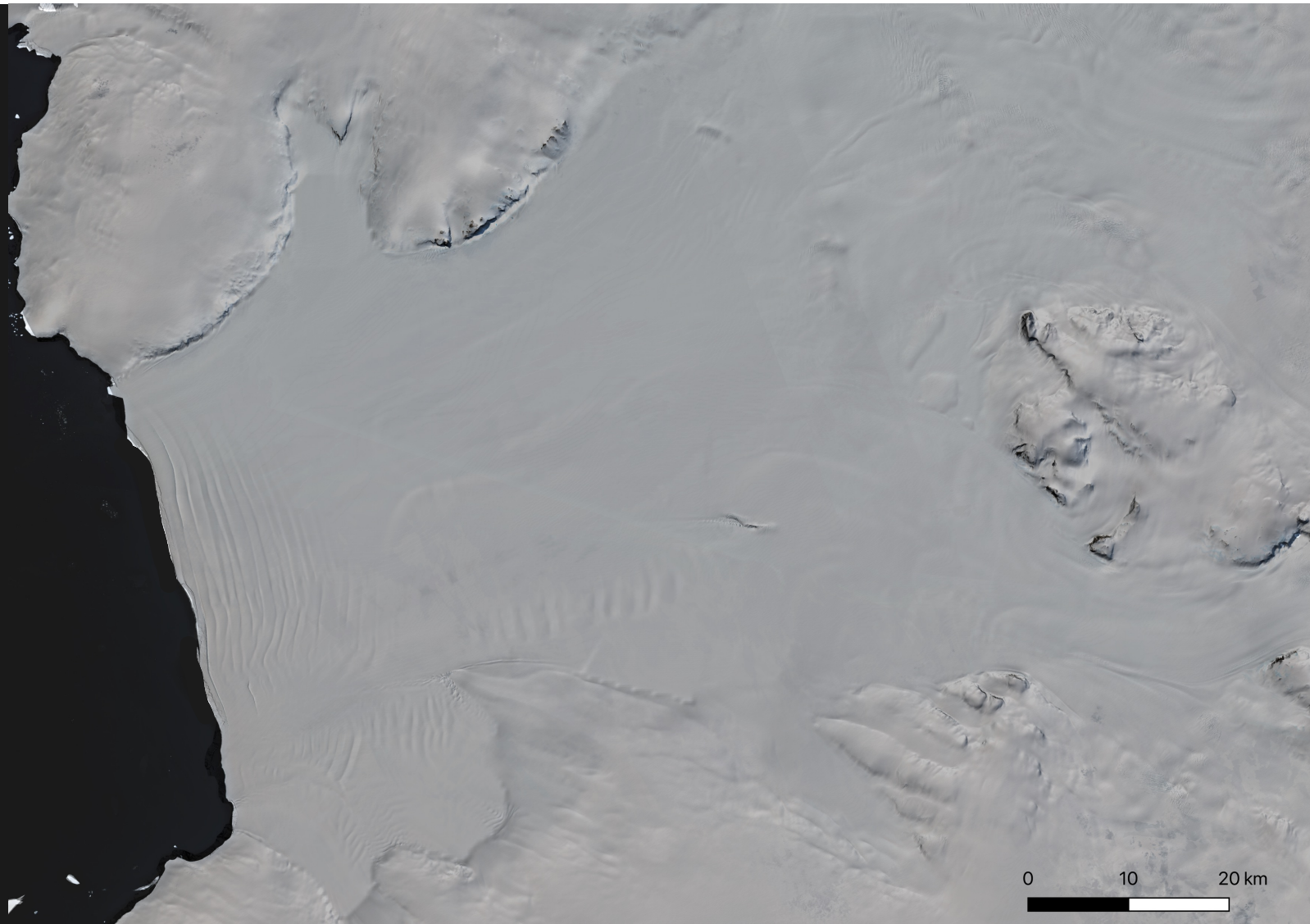


How do we calculate the basal melt rate?

Mass conservation:

- Lagrangian elevation change
- DEM

$$\frac{Dh}{Dt} = -(h - h_f)(\nabla \cdot \vec{u}) + (\dot{a} - \dot{b})\left(\frac{\rho_w - \rho_i}{\rho_w}\right)$$



How do we calculate the basal melt rate?

Mass conservation:

- Lagrangian elevation change
- DEM
- Firn air content

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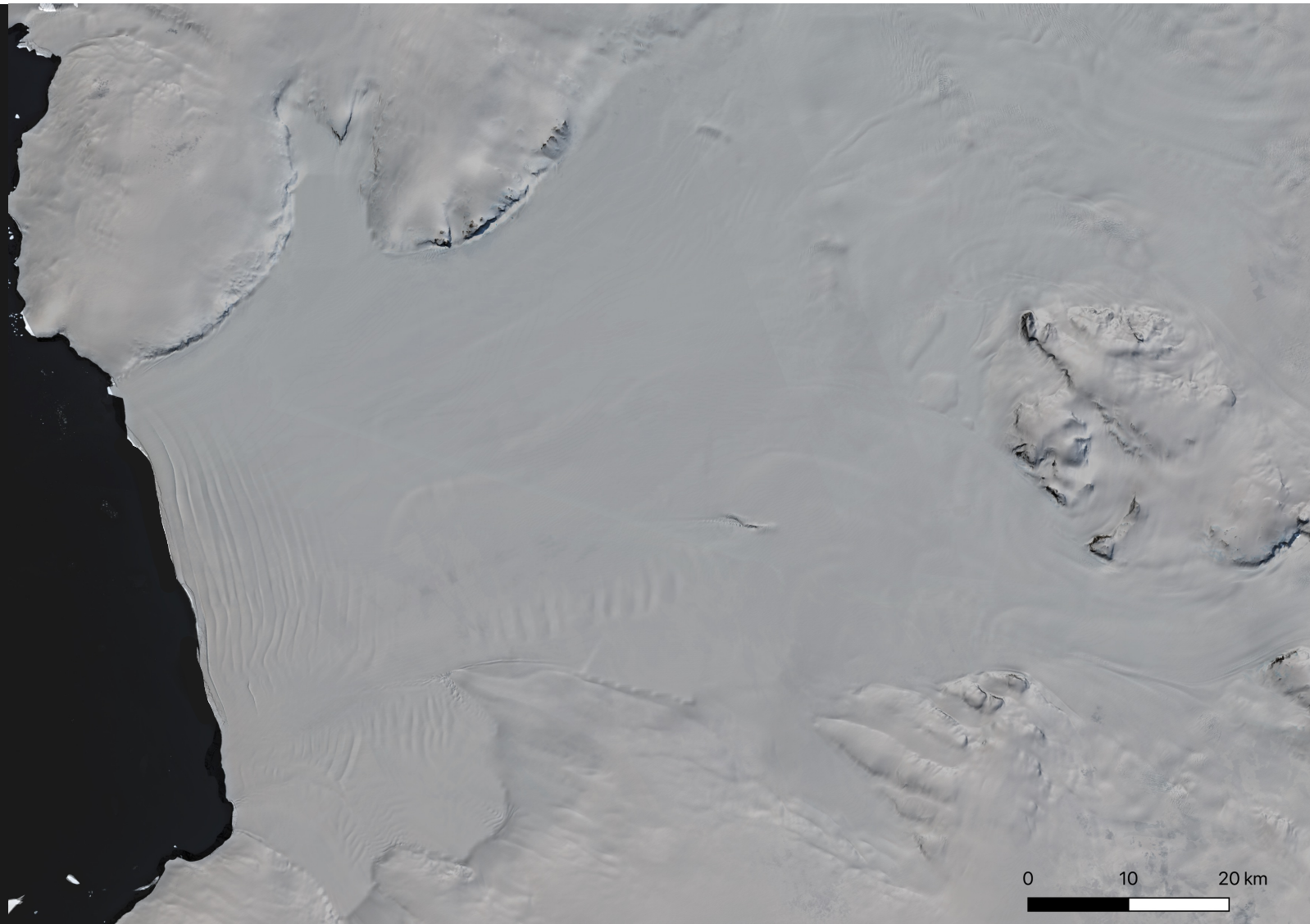
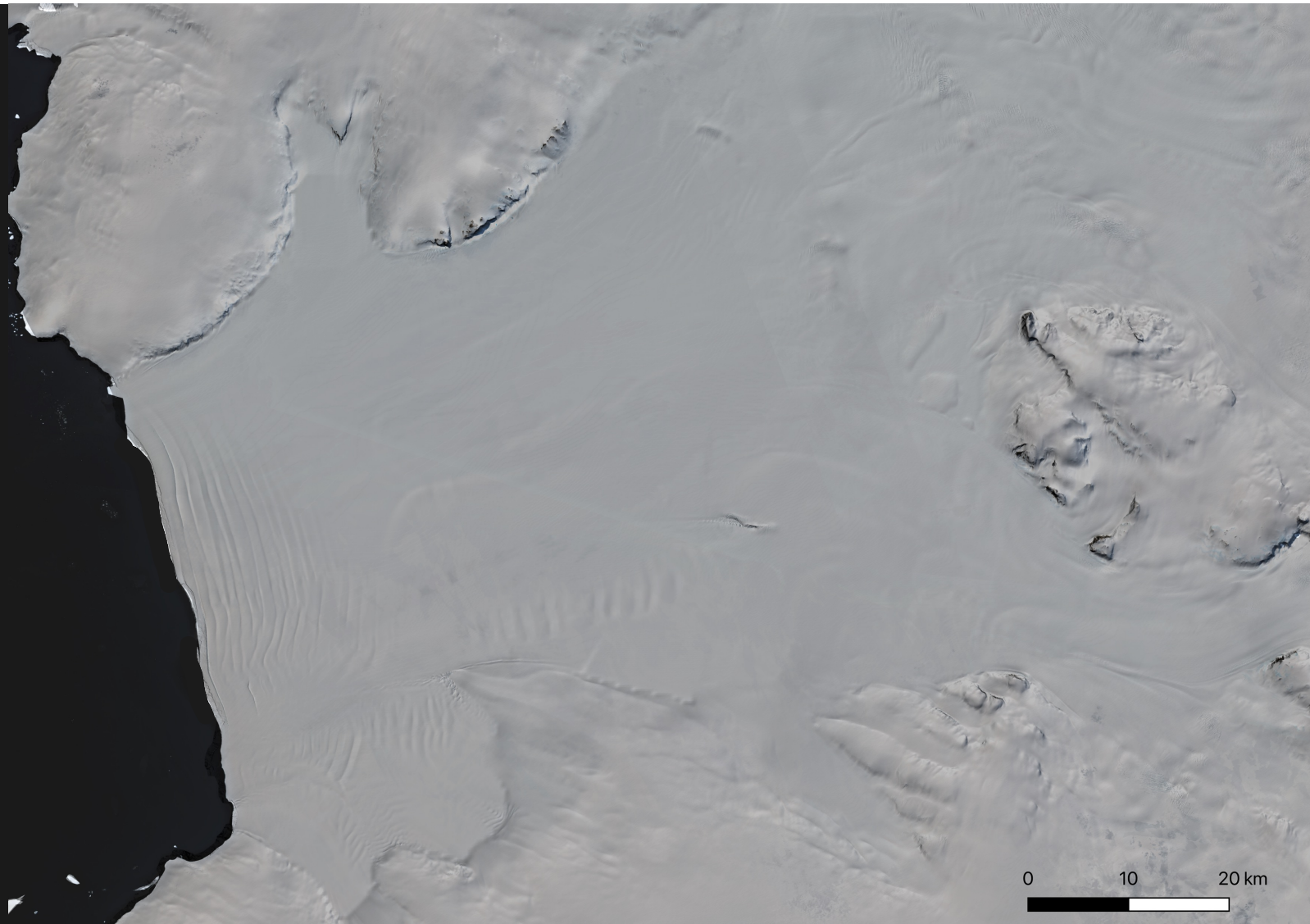


How do we calculate the basal melt rate?

Mass conservation:

- Lagrangian elevation change
- DEM
- Firn air content
- Divergence of the velocity field

$$\frac{Dh}{Dt} = -(h - h_f)(\nabla \cdot \bar{u}) + (\dot{a} - \dot{b})\left(\frac{\rho_w - \rho_i}{\rho_w}\right)$$

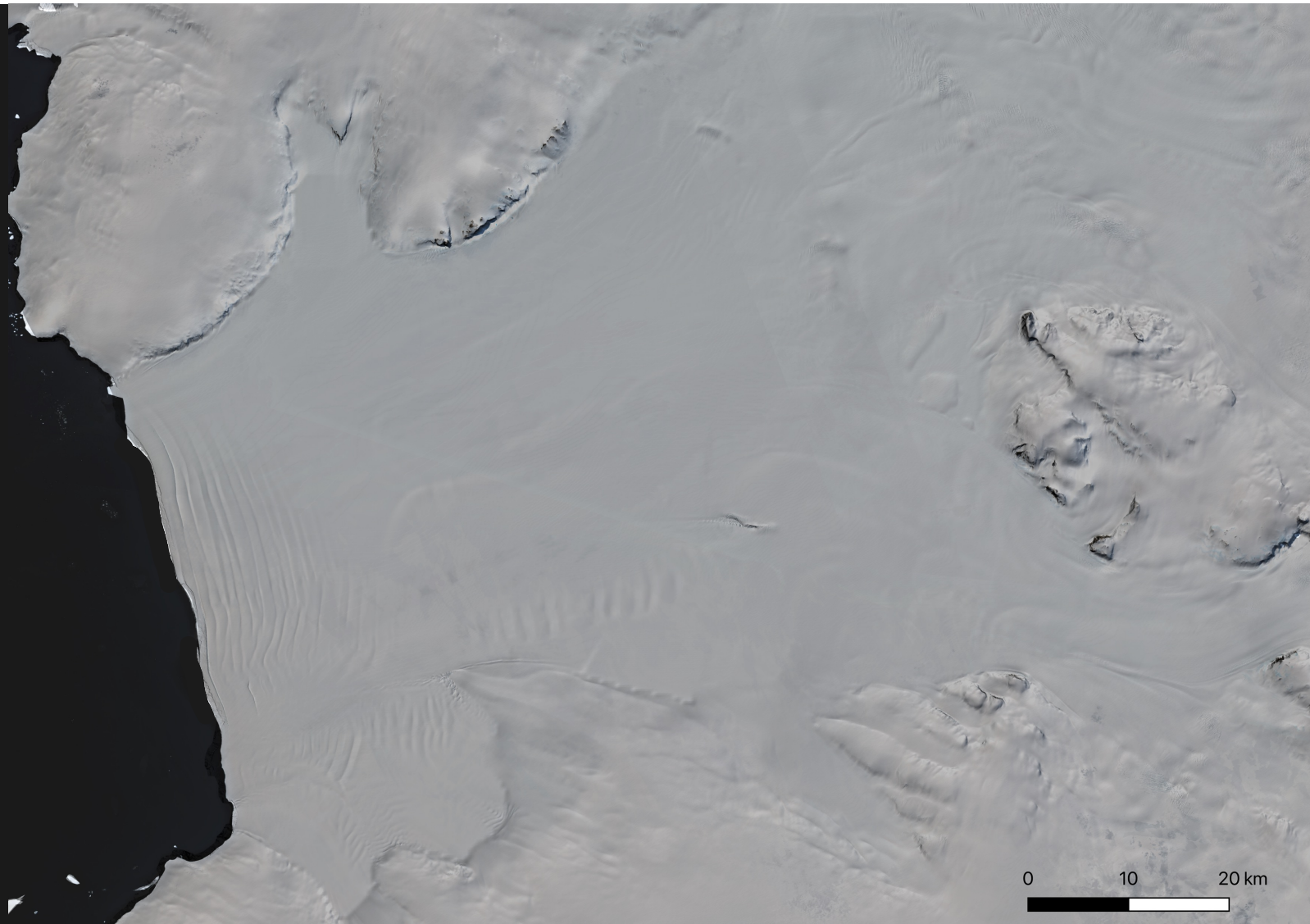


How do we calculate the basal melt rate?

Mass conservation:

- Lagrangian elevation change
- DEM
- Firn air content
- Divergence of the velocity field
- SMB

$$\frac{Dh}{Dt} = -(h - h_f)(\nabla \cdot \bar{u}) + (\dot{a} - \dot{b})\left(\frac{\rho_w - \rho_i}{\rho_w}\right)$$

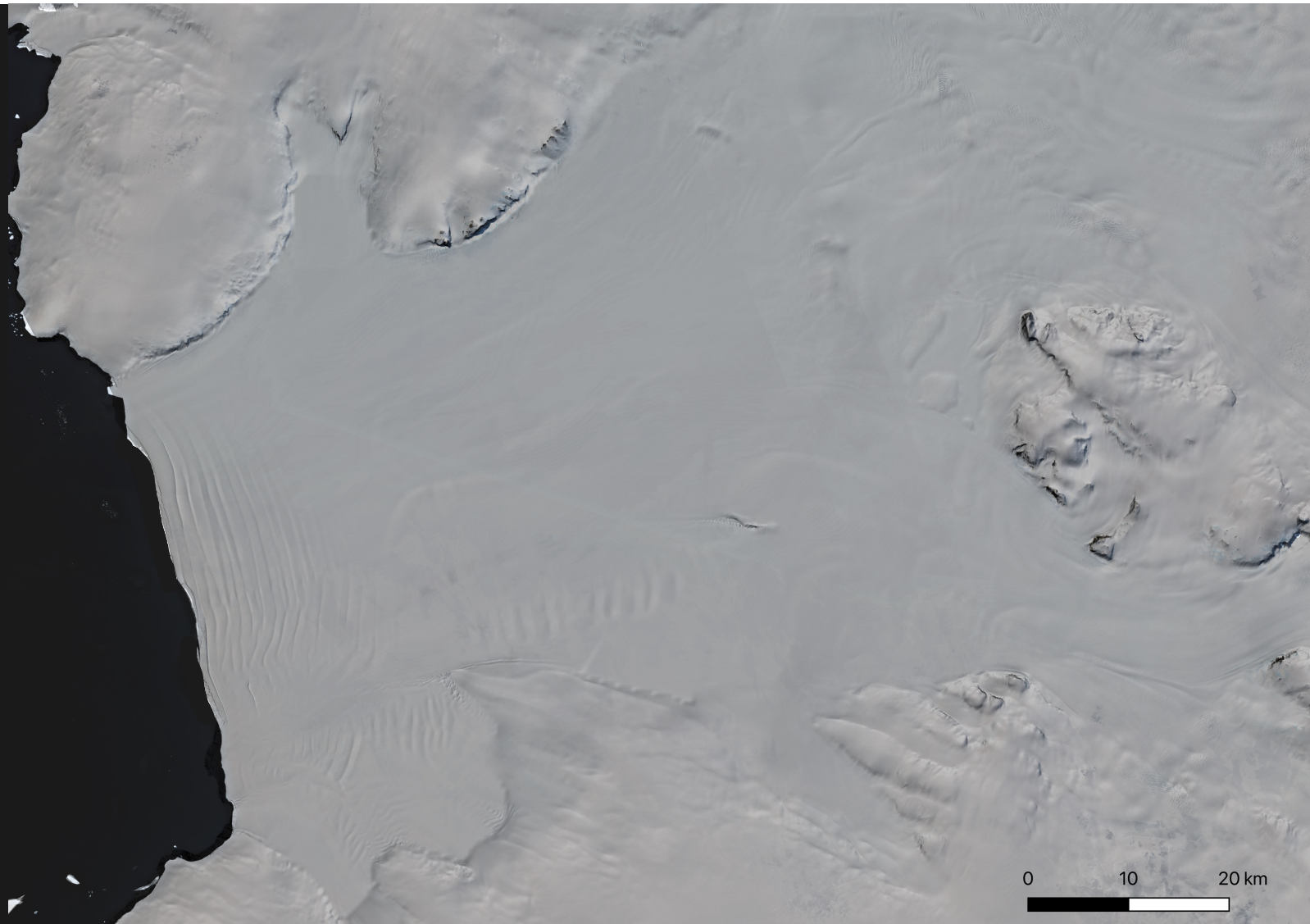


How do we calculate the basal melt rate?

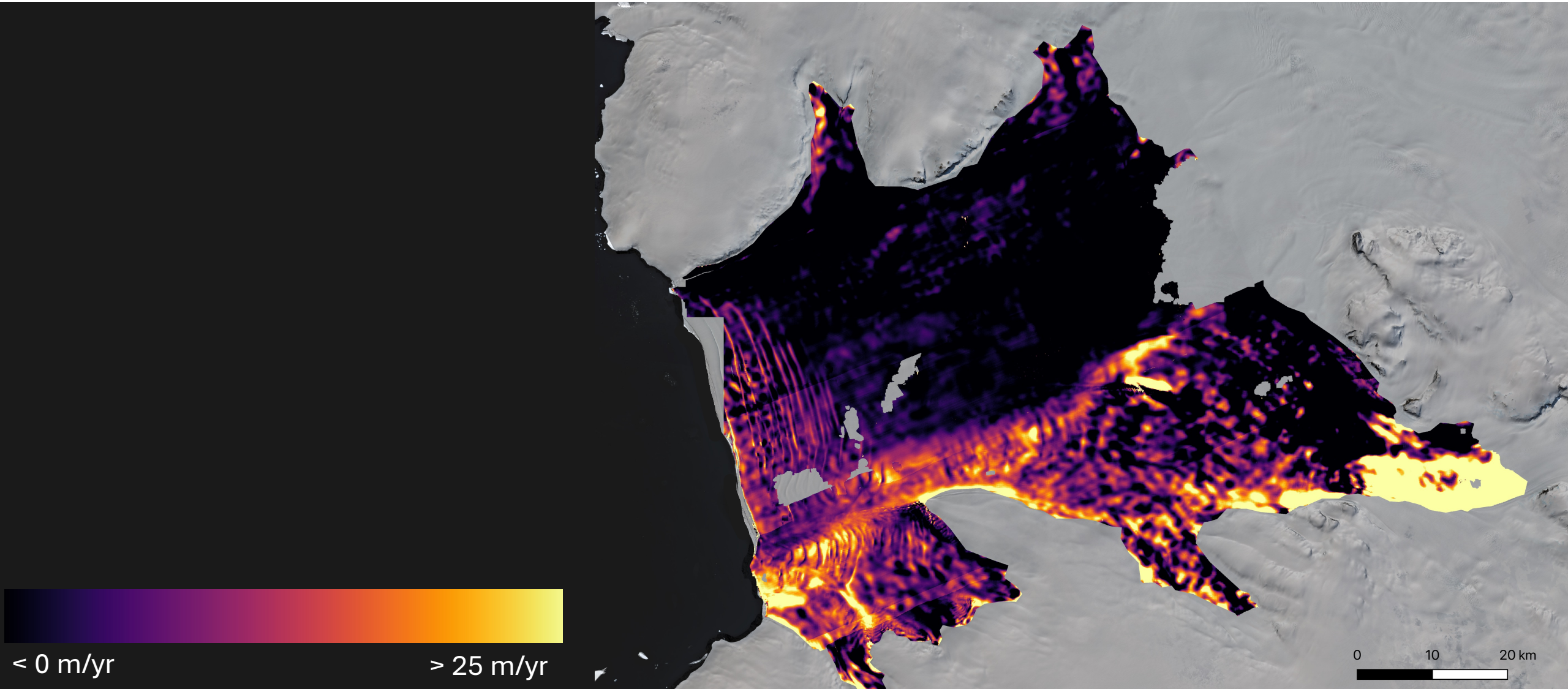
Mass conservation:

- Lagrangian elevation change
- DEM
- Firn air content
- Divergence of the velocity field
- SMB
- Hydrostatic equilibrium

$$\frac{Dh}{Dt} = -(h - h_f)(\nabla \cdot \bar{u}) + (\dot{a} - \dot{b})\left(\frac{\rho_w - \rho_i}{\rho_w}\right)$$



So what does the basal melt pattern look like?



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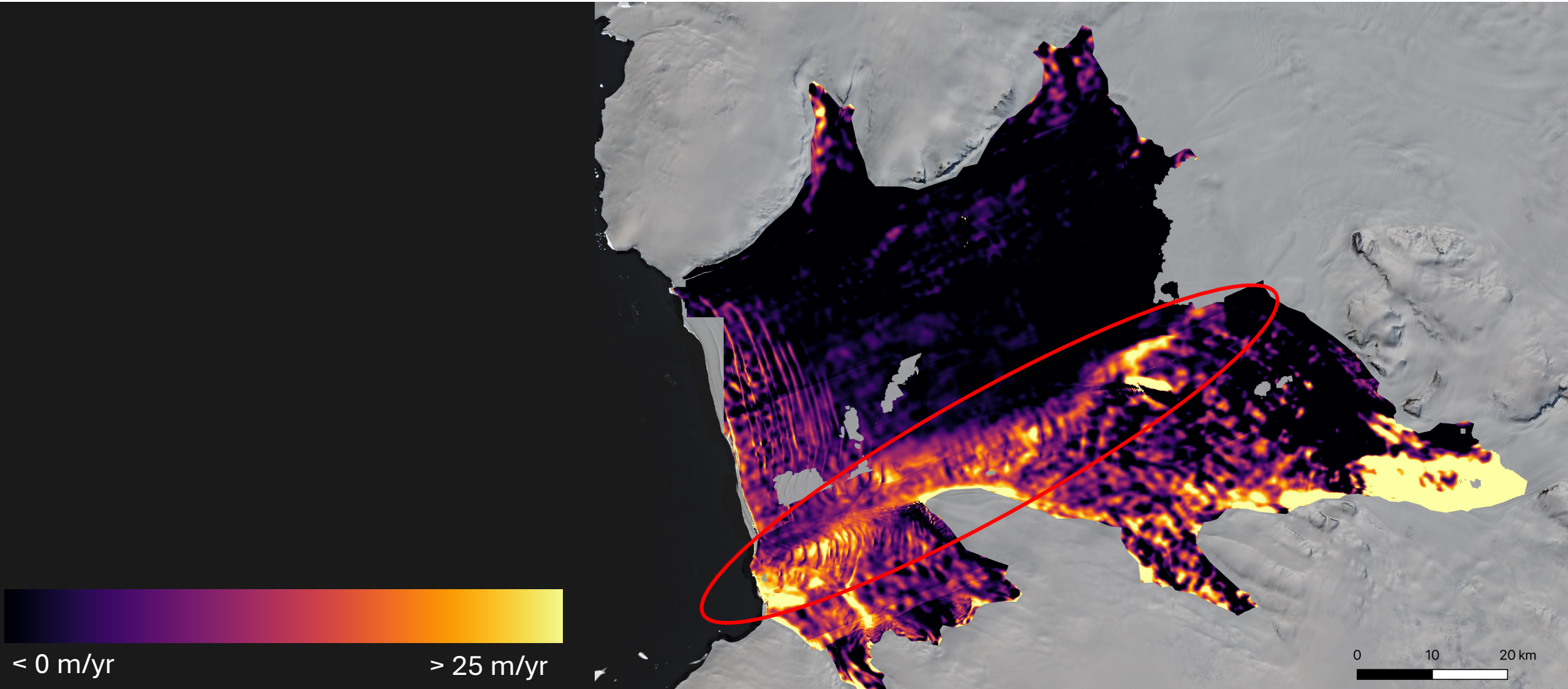

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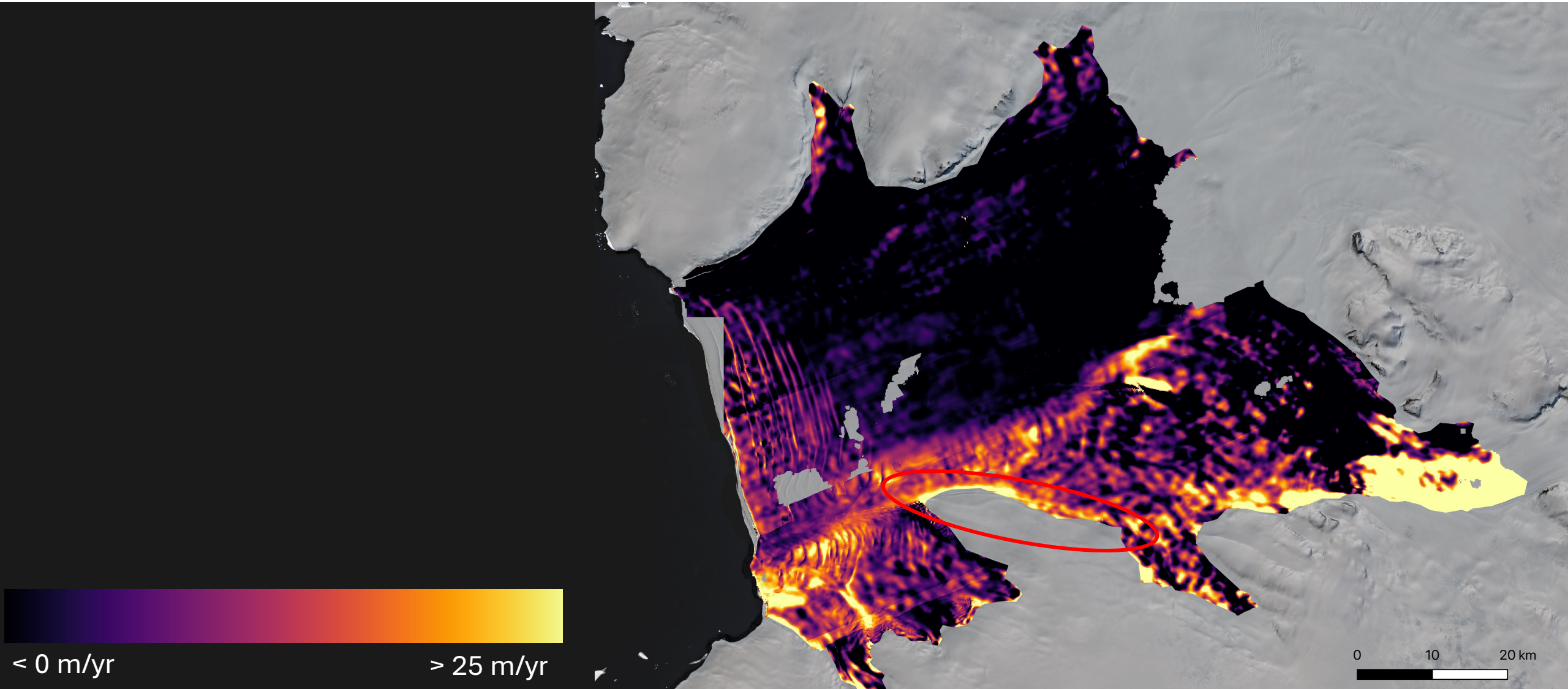

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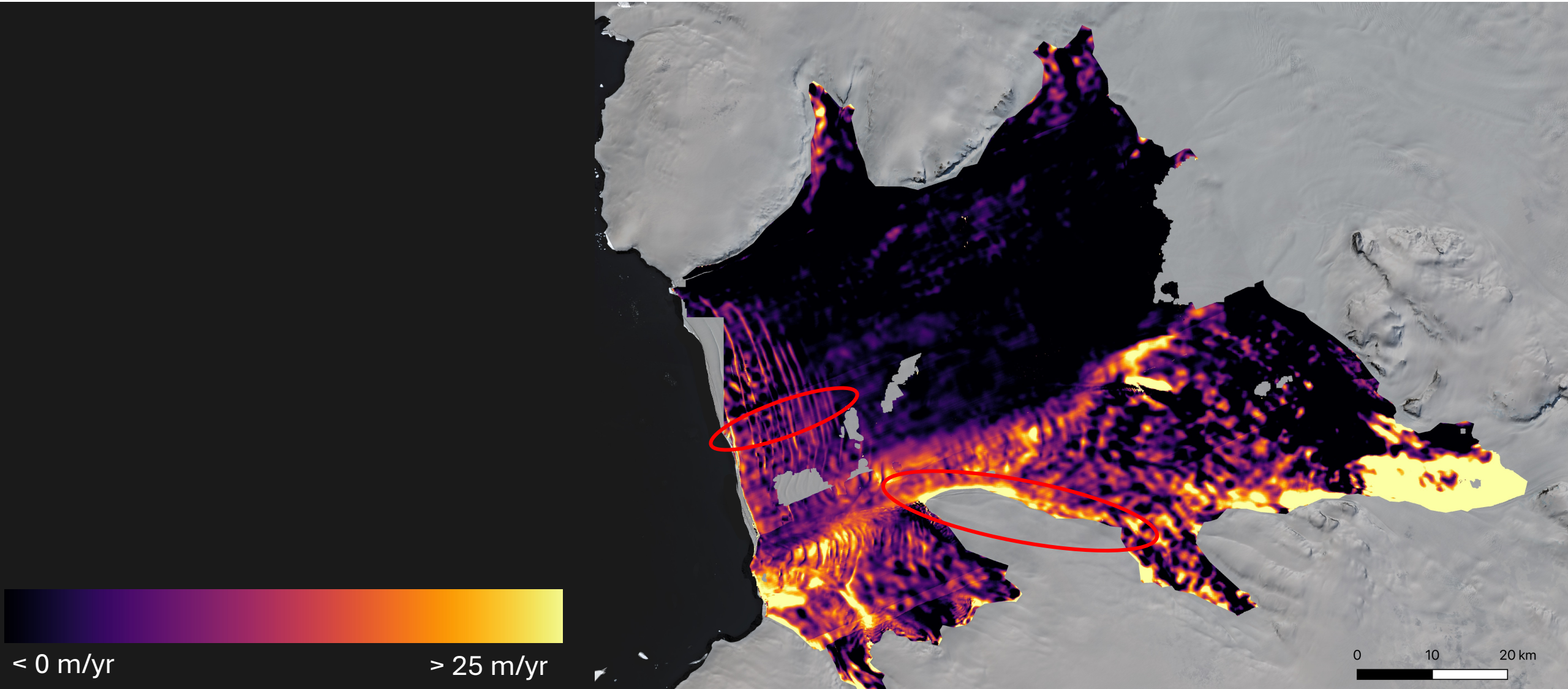
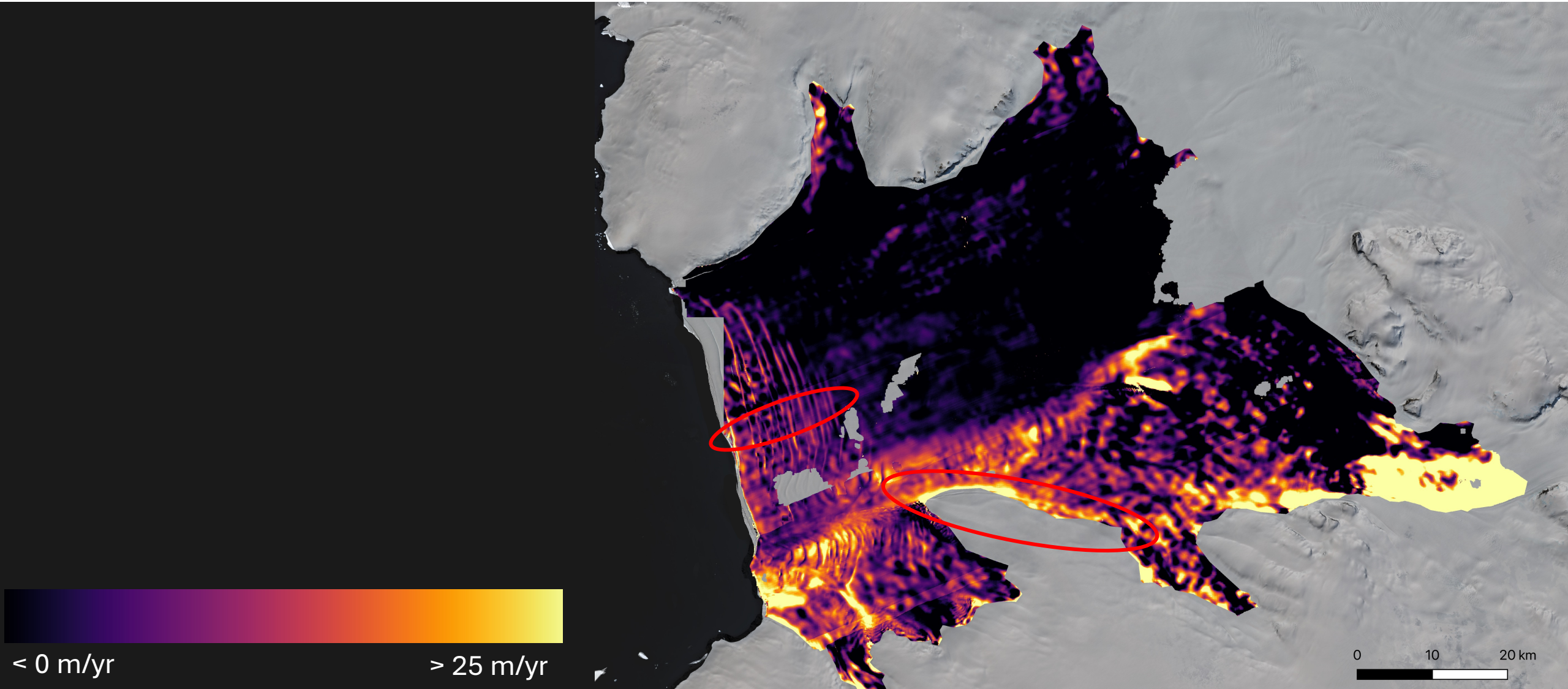
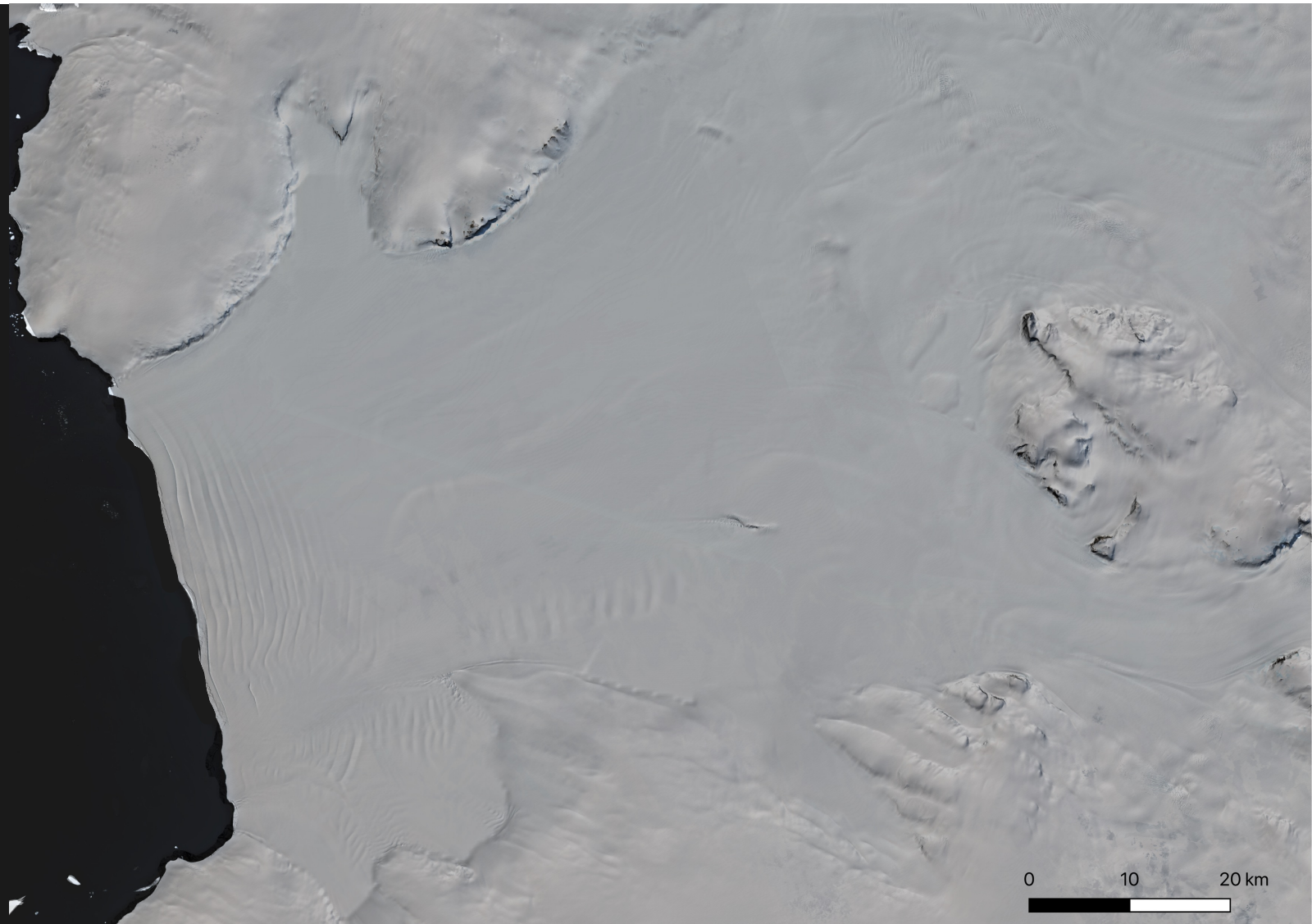


Can we trust these small scale features?



Can we trust these small scale features?

Approach → artificial error



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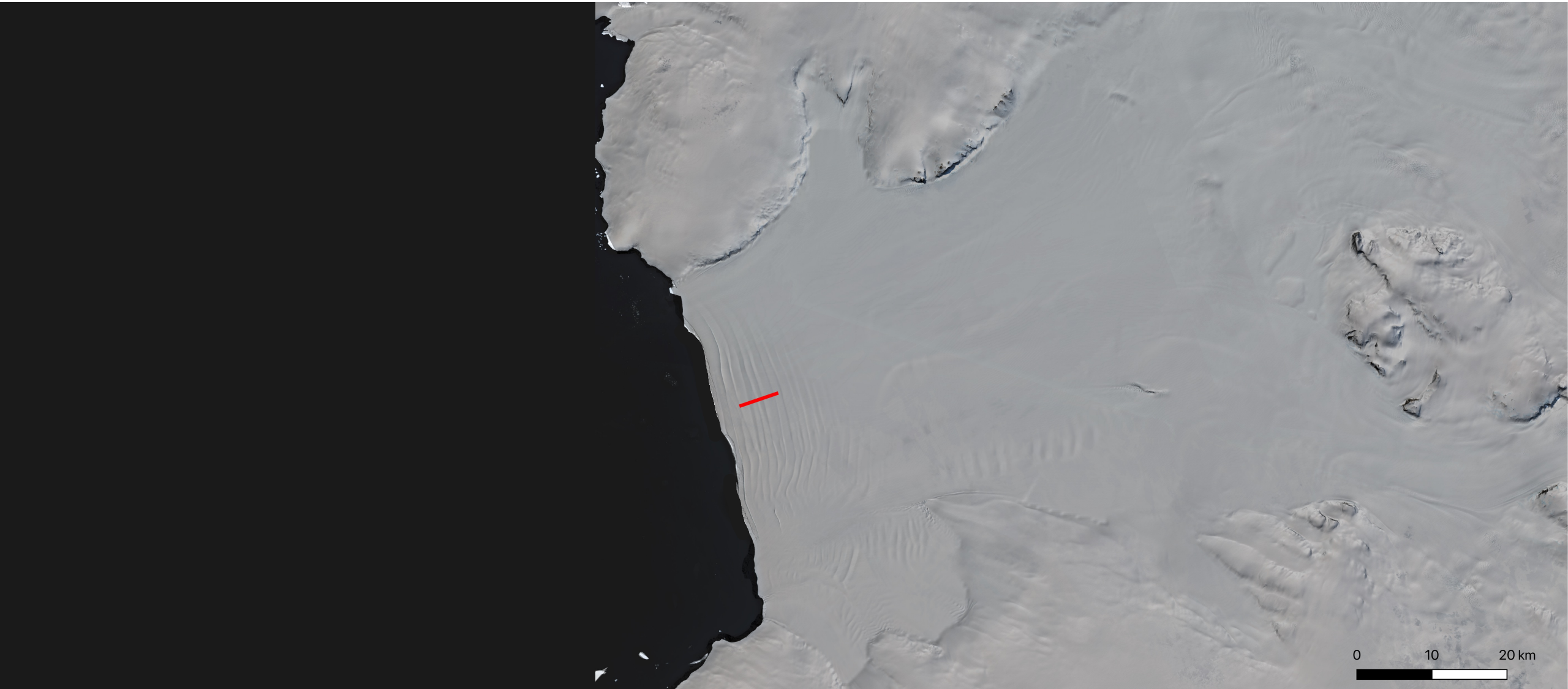

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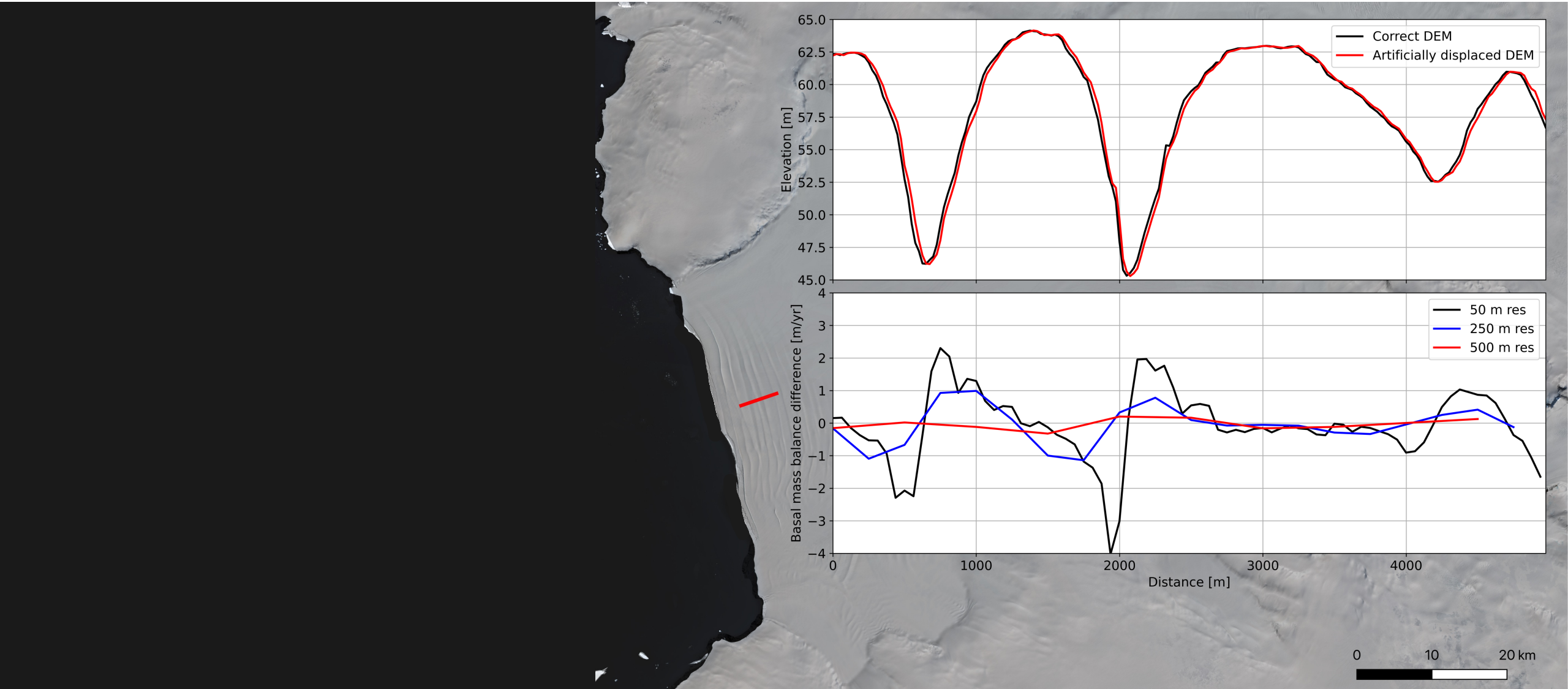
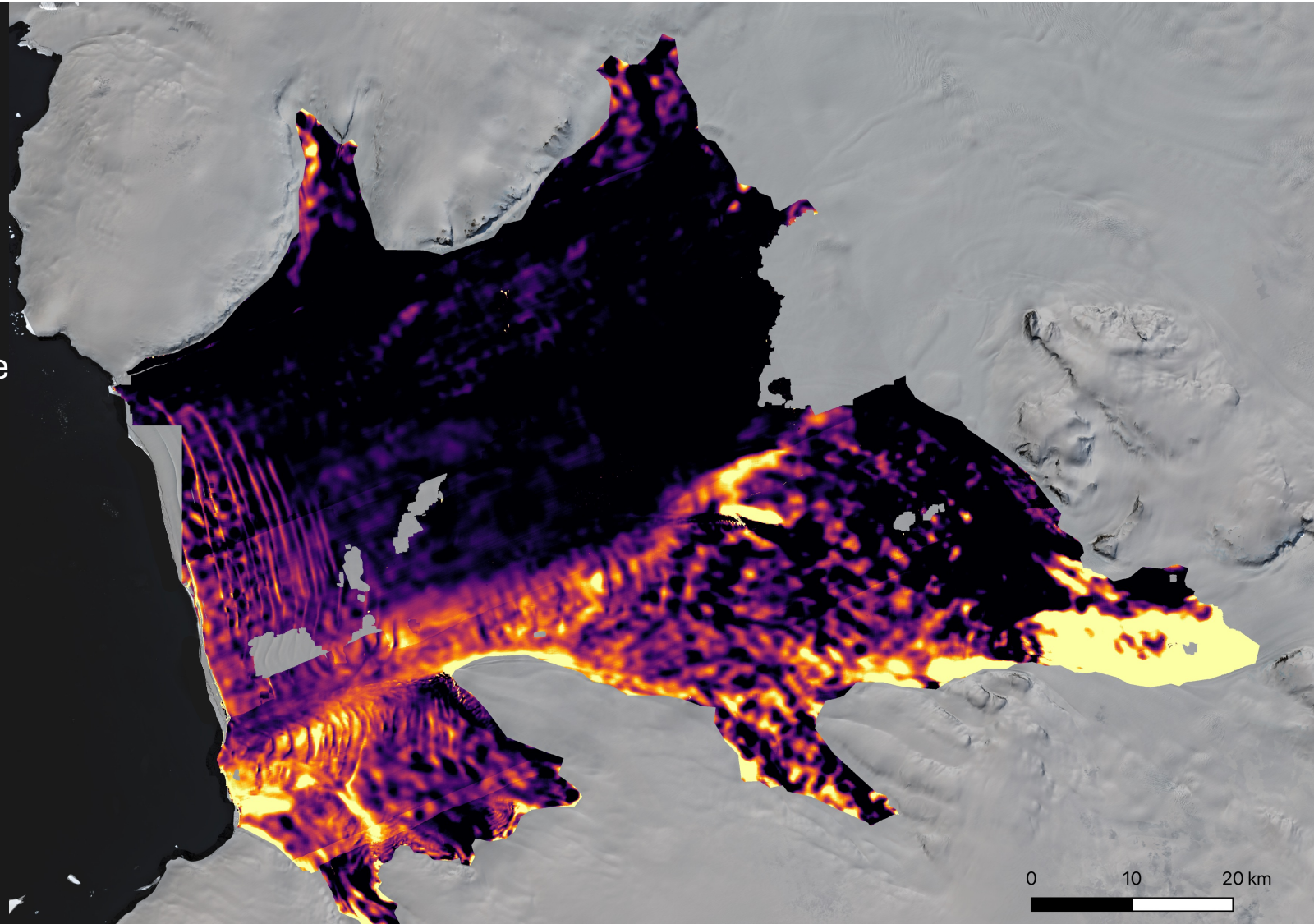


Take home messages

Thank you!

- Basal melting also happens at a fine scale
- High res. DEM → high res. basal melt rate
- Cautious about how high res. we go to



@aszinck
#HiRISE_NWO
a.p.zinck@uu.nl