Understanding Greenland Hydrology Using a Remotely Sensed Approach

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Greenland Ice Sheet (GrIS)
Supraglacial Lake
Supraglacial River Network
GrIS Supraglacial Hydrology

- Storage (Supraglacial lake)
- Meltwater → Transport (Supraglacial river)
- Internal storage
  - Flow into the ice sheet
  - Internal transport
- Release (Moulins)

- Mass loss
- No mass loss

- Leave the GrIS
- Impact ice flow
GrIS Supraglacial Hydrology

How is meltwater transported and released on the ice surface?
Does meltwater leave the ice sheet or store in the ice sheet?
Supraglacial Hydrologic Features
15 m Landsat-8 imagery
15 m Landsat-8 imagery

Delineation of supraglacial hydrologic features

Legend
- moulin
- path distance
- river
- lake
- catchment

River cross section

River longitudinal continuity
15 m Landsat-8 imagery
15 m Landsat-8 imagery

Three large internal catchment (>150 km²)

Morphometry of supraglacial hydrologic features
Landsat-8 vs. WorldView-1
High-resolution WorldView-1 (0.5m)
High-resolution ice surface mapping

$L = 3372$ km
$D_d = 61$ km/km$^2$
Wide (>4 m) WV panchromatic rivers

Landsat-8 panchromatic rivers

High-resolution ice surface mapping
Supraglacial river width and depth

Supraglacial river networks of different orders
GrIS Supraglacial Hydrology

How is meltwater transported and released on the ice surface?

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GrIS Supraglacial Hydrology

Does surface meltwater leave the ice sheet or store in the ice sheet?

Efficient meltwater drainage through supraglacial streams and rivers on the southwest Greenland ice sheet

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GrIS Supraglacial Hydrology

Does surface meltwater leave the ice sheet or store in the ice sheet?

Greenland Is Melting Away
Multi-resolution satellite imagery can provide direct observation of the Greenland Ice Sheet.

Extensive and complex supraglacial hydrologic system form on the GrIS and greatly impact surface meltwater transport and release.

Future work: linking supraglacial hydrologic features to pro-/en-/sub-glacial processes and ice flow models.
Thanks!