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Understanding Snowmelt Interaction with the Environment in a Changing Climate: Insights from a Small Coastal Mountainous Catchment in Svalbard

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LinkIng and QUantifying the Impacts of climate change on inlanD ICE, snow cover, and permafrost on water resources and society in vulnerable regions

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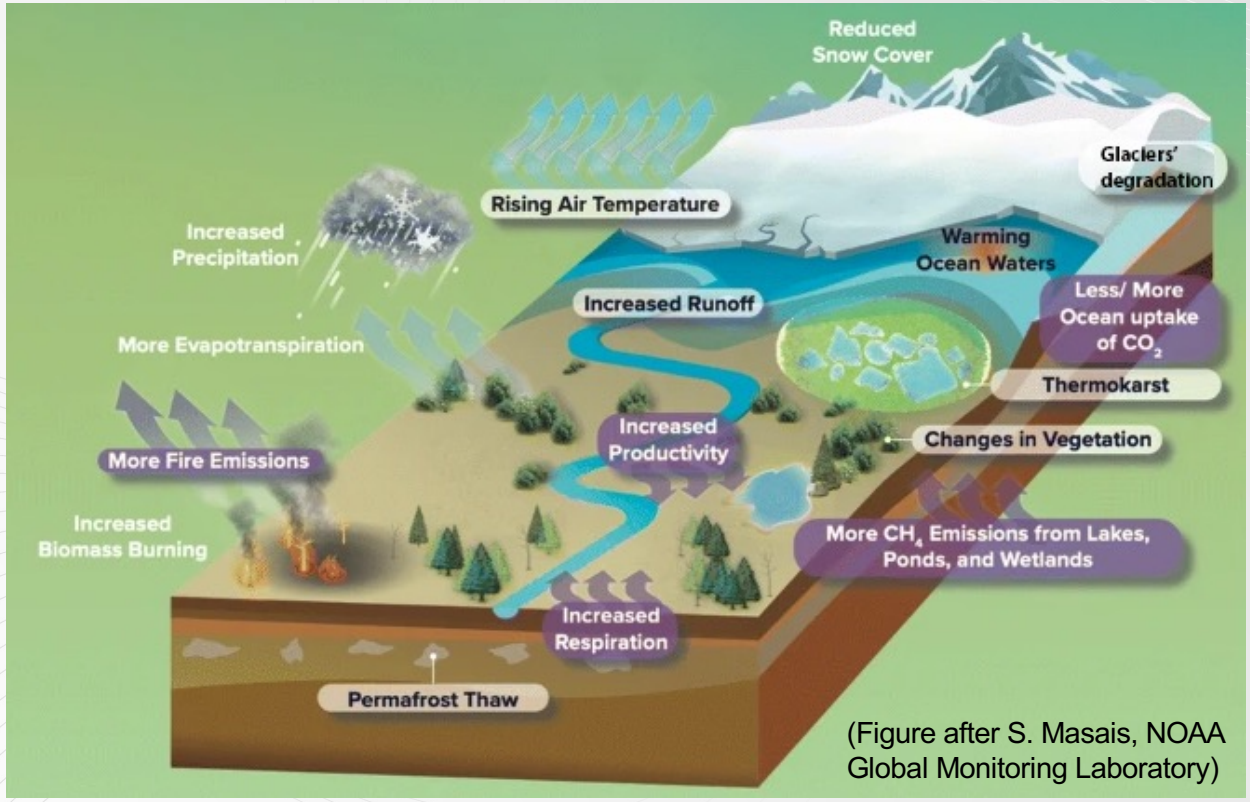
Climate change effects on hydrological cycle in Arctic



(Figure after S. Masais, NOAA Global Monitoring Laboratory)

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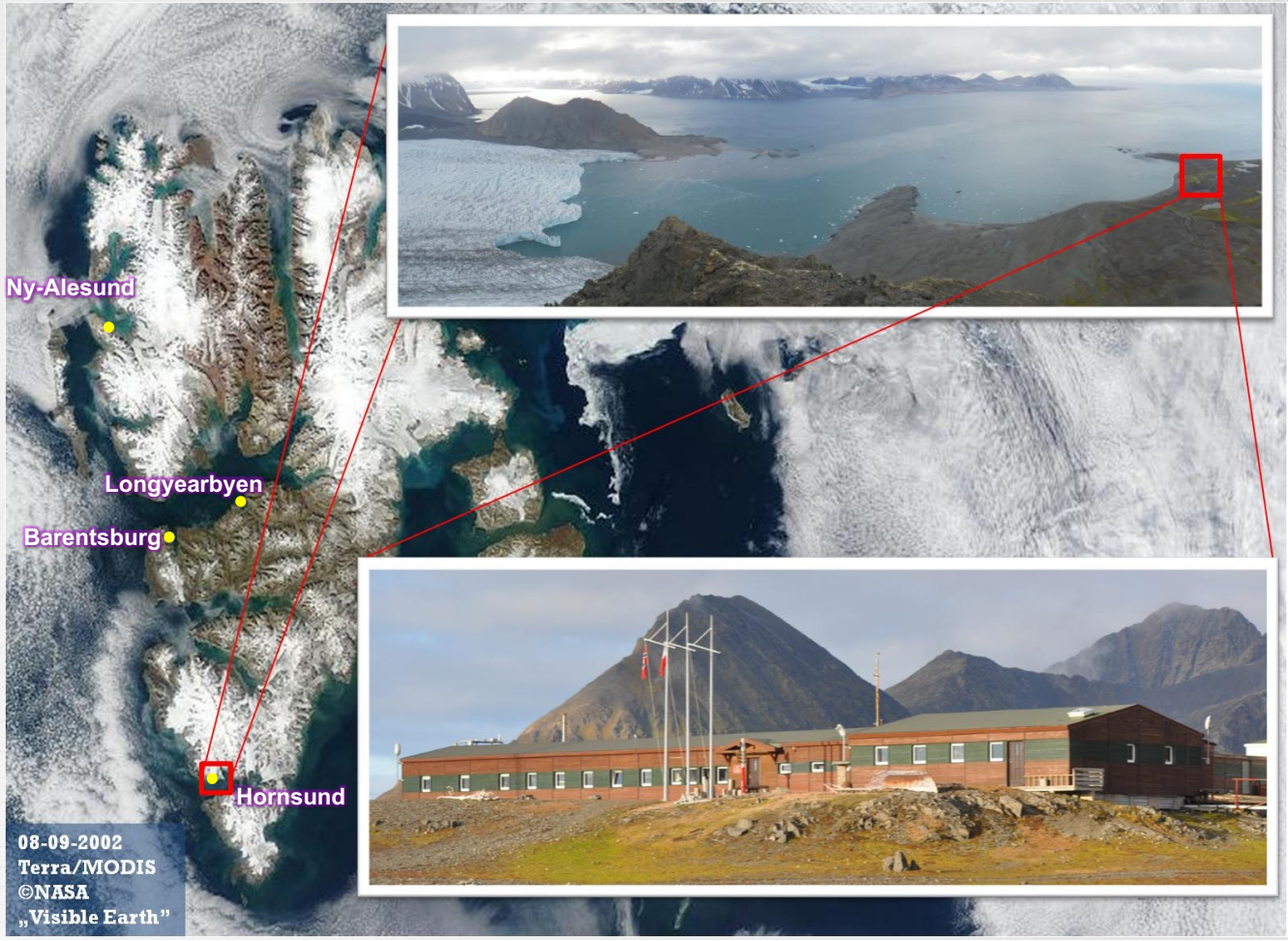
Polish Polar Station Hornsund

Founded in 1957 (International Geophysical Year)

Operates year-round since 1978

One of four permanent settlements in Spitsbergen

Only year-round operated Research Infrastructure in SW Spitsbergen



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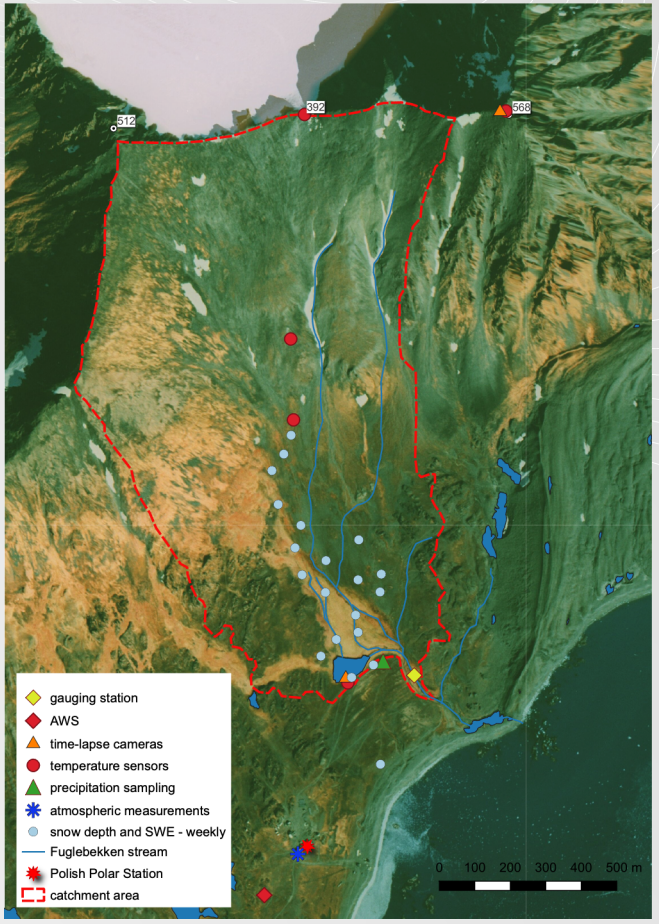
Fuglebekken catchment

F = 1.28 km^2
H = 3 – 500 m



- SWE distribution monitoring
- fresh snowfall and precipitation sampling
- Hydrological monitoring
- Hydrochemical monitoring
- permafrost monitoring - 3 boreholes
- Time-lapse camera
- nearby WMO meteorological station

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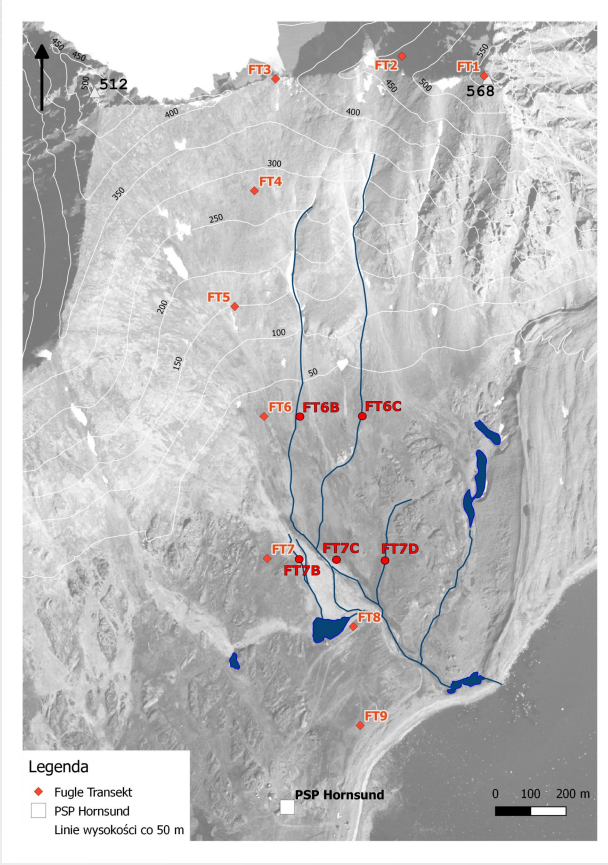
Fuglebekken catchment isotopic sampling campaign 2024

- Time period: 08.05.2024 – 24.09.2024
- Fuglebekken river runoff - daily
- Precipitation – event based
- Snow: 2 snowpits by layers 13.05 and 07.06
- Snow from the surface in 12 points

across the watershed 08.05, 14.05

- Sampling from 6 boreholes 2-6 times during season



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Snowmelt modelling: 2.5D AMelt model

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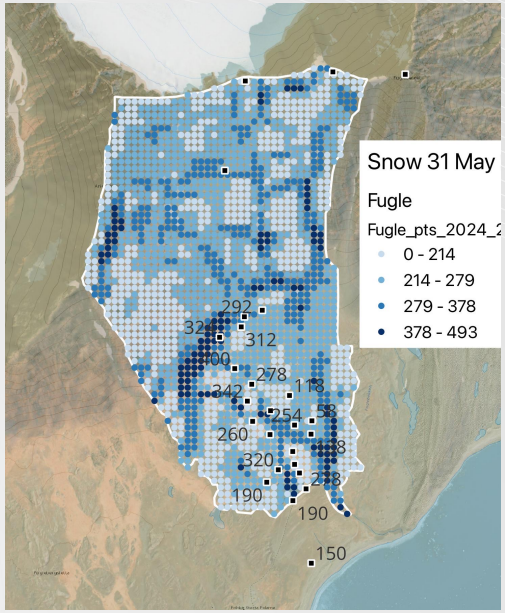
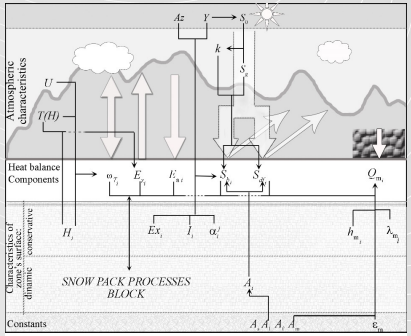
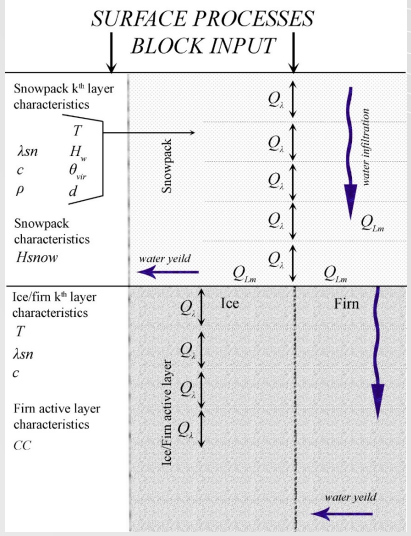
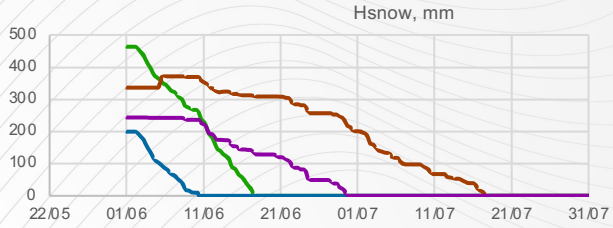
Input: - Radiation, Temperature, Precipitation, Air humidity, Wind speed from the Hornsund WMO station

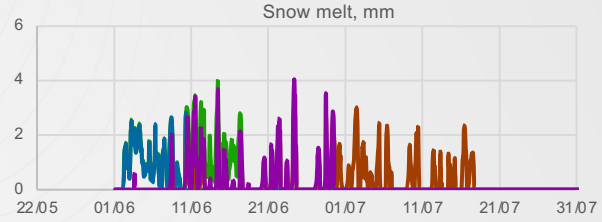
- Snow depth and density measurements in 26 points around the basin
- Verified against time-lapse photos











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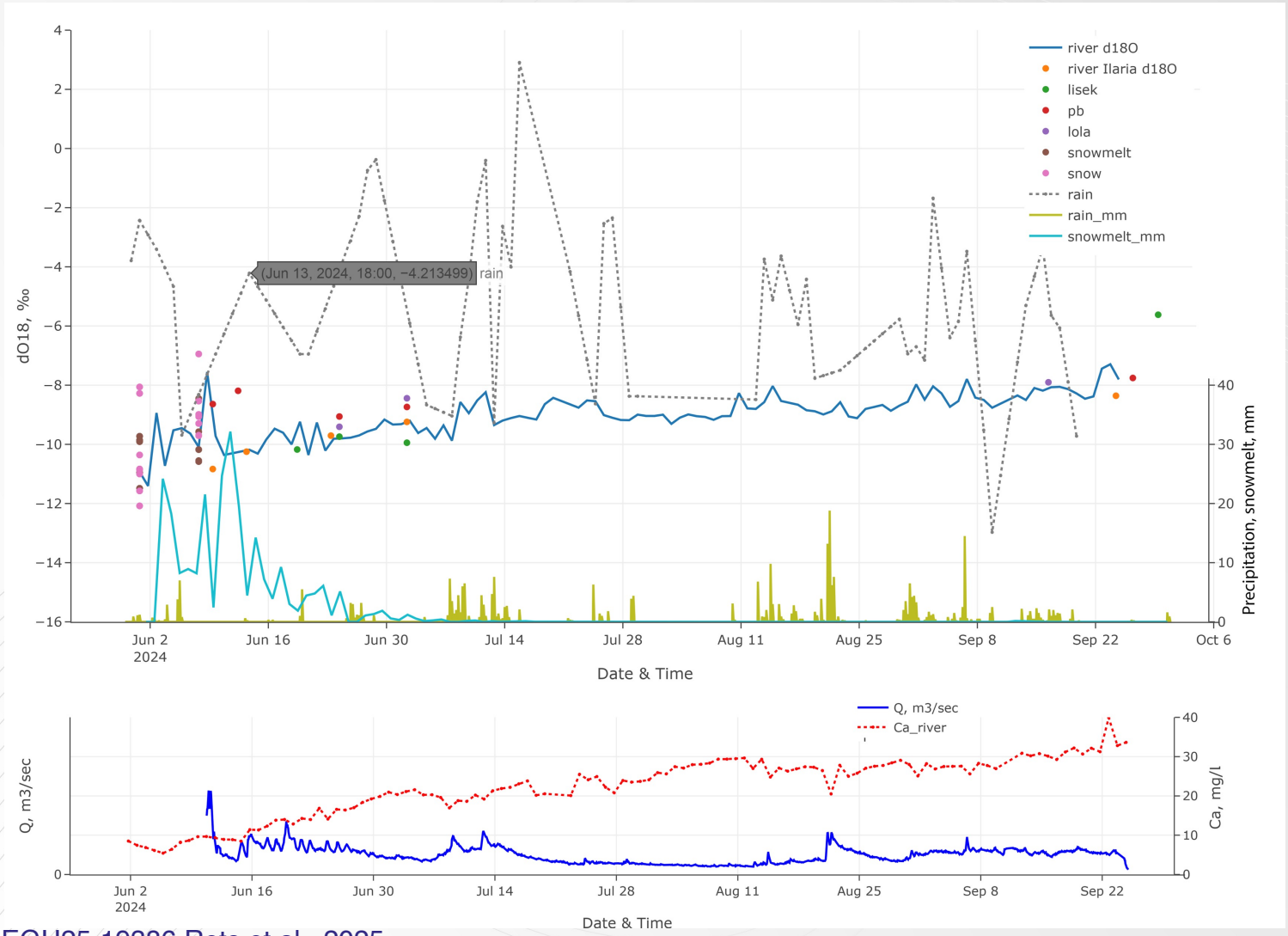
Results (1/3)



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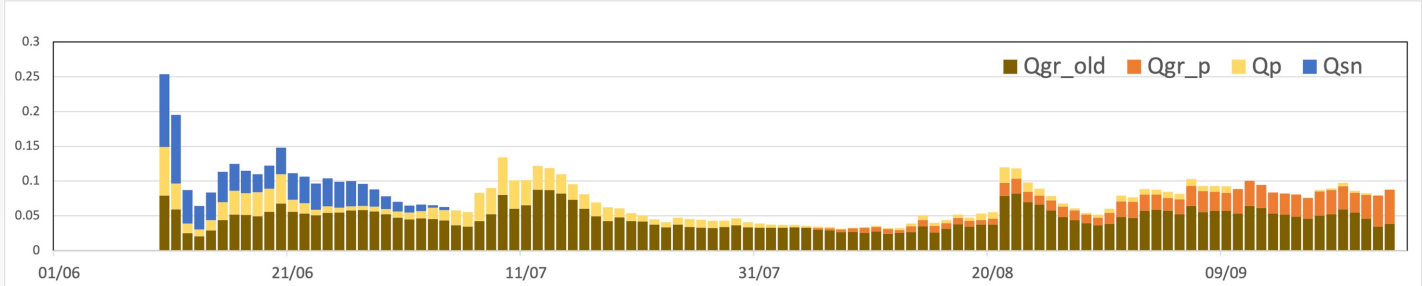
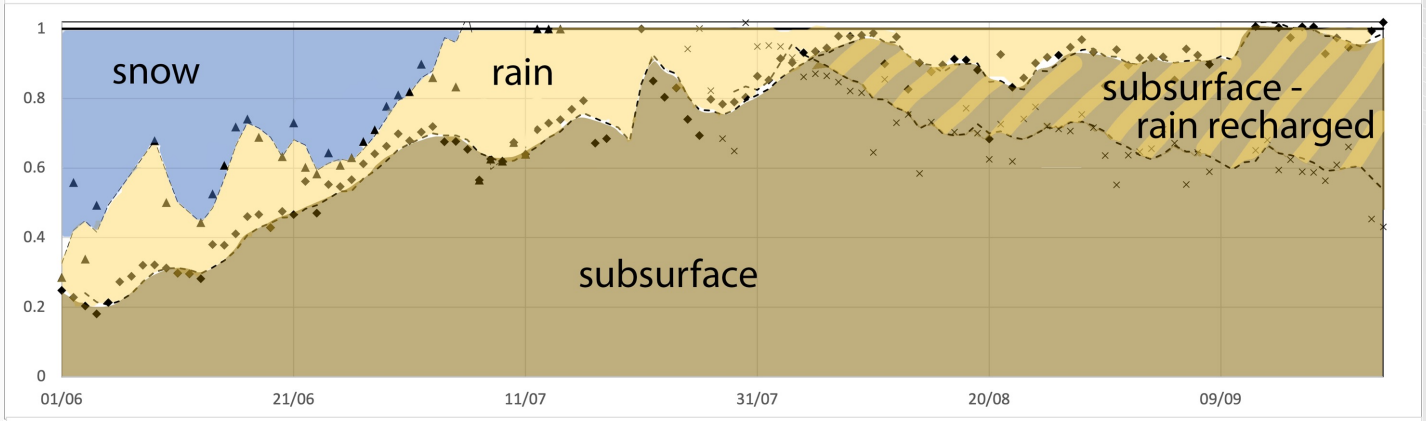
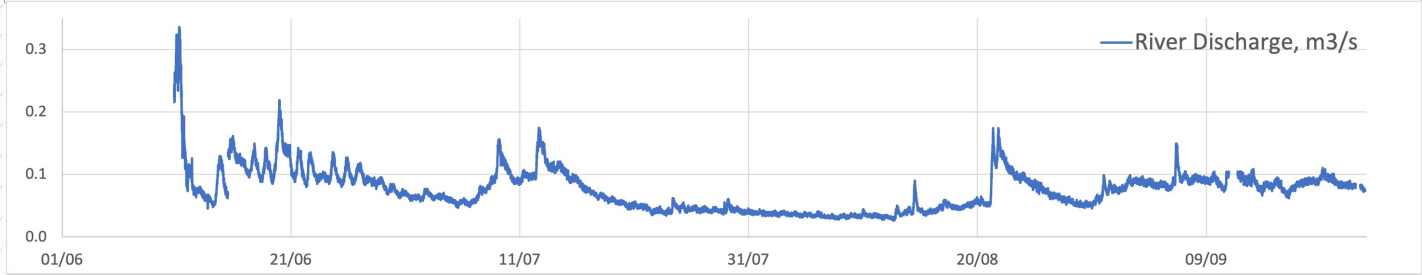
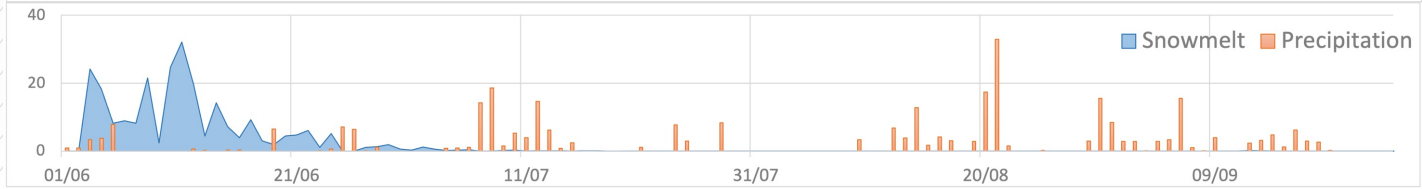
Results (2/3)









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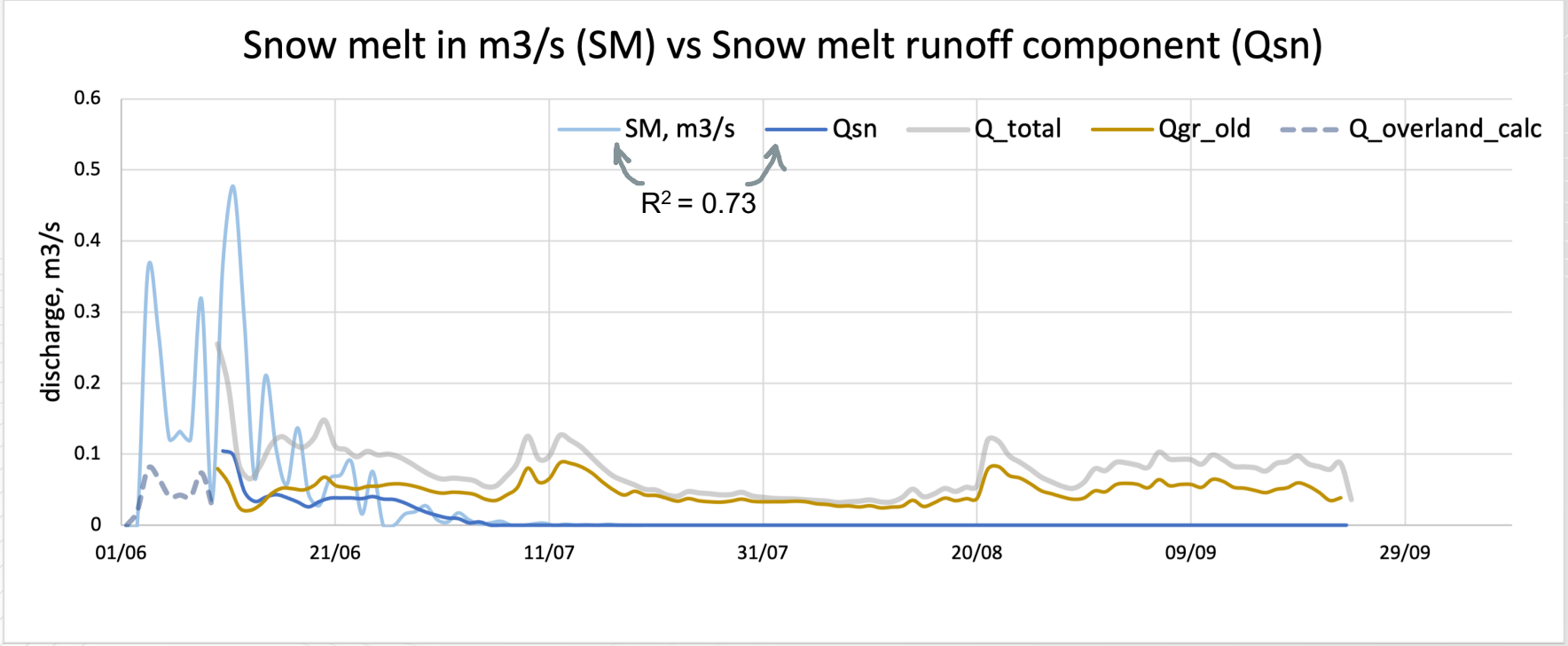
Snow melt in m^3/s (SM) vs. Snow melt runoff component (Q_{sn})



Conclusions

- Half of the snowmelt water, at the lowest estimates, is drained through the subsurface part of the basin
- After significant winter thaws, subsurface water bears snowmelt isotopic signal in the beginning of the summer season
- Rain groundwater recharge component becomes considerable from the end of July – beginning of August and gradually rises up to 40% by the end of September

If you have any comments or questions, please reach out at erets@igf.edu.pl

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