Characterising water sources in glacierized catchments in the northern Tien Shan using stable isotopes, EGU, 4-8 MAY 2020

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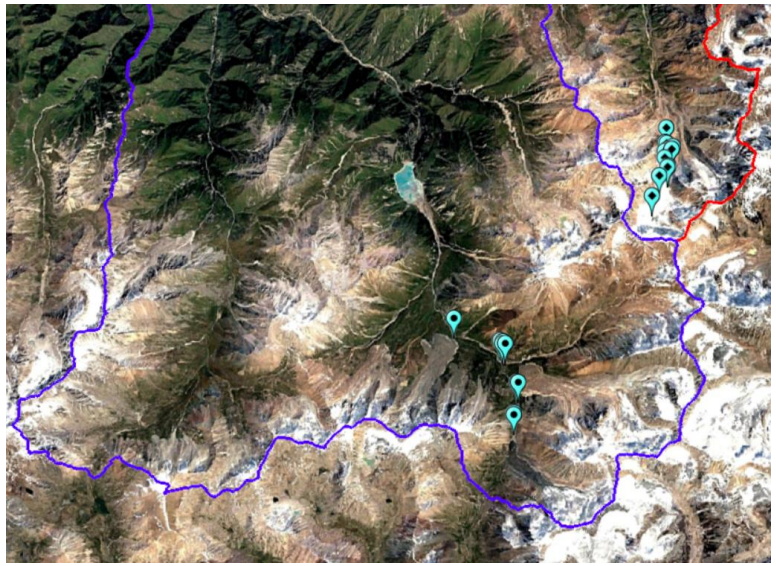
Study area / Sampling program

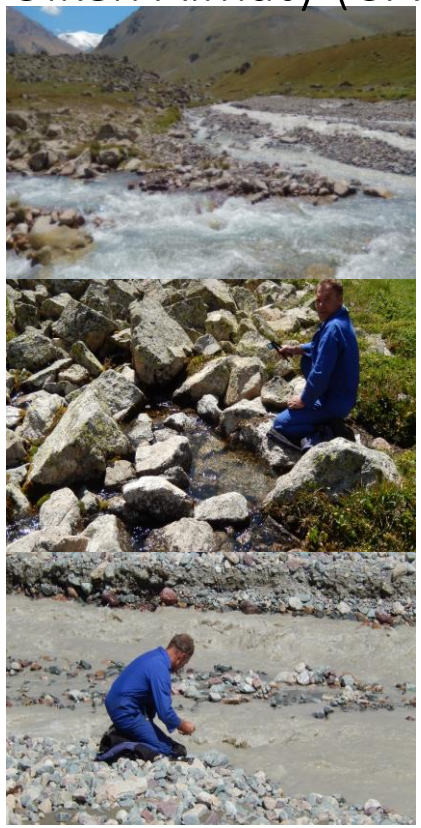
- Sampling points KA
- Sampling points UA
- Border of KA catchment
- Border of UA catchment



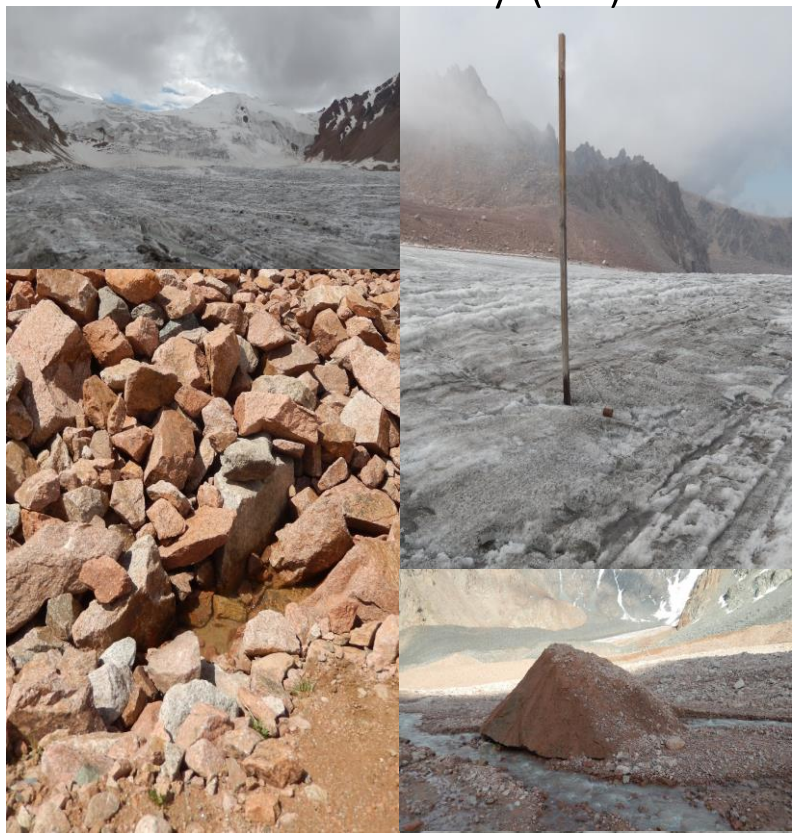
Sources of water:

Liquid precipitation
Snow melt
Glacier ice melt
Rock glaciers
Melting permafrost
Ground water

Ulken Almaty (UA)



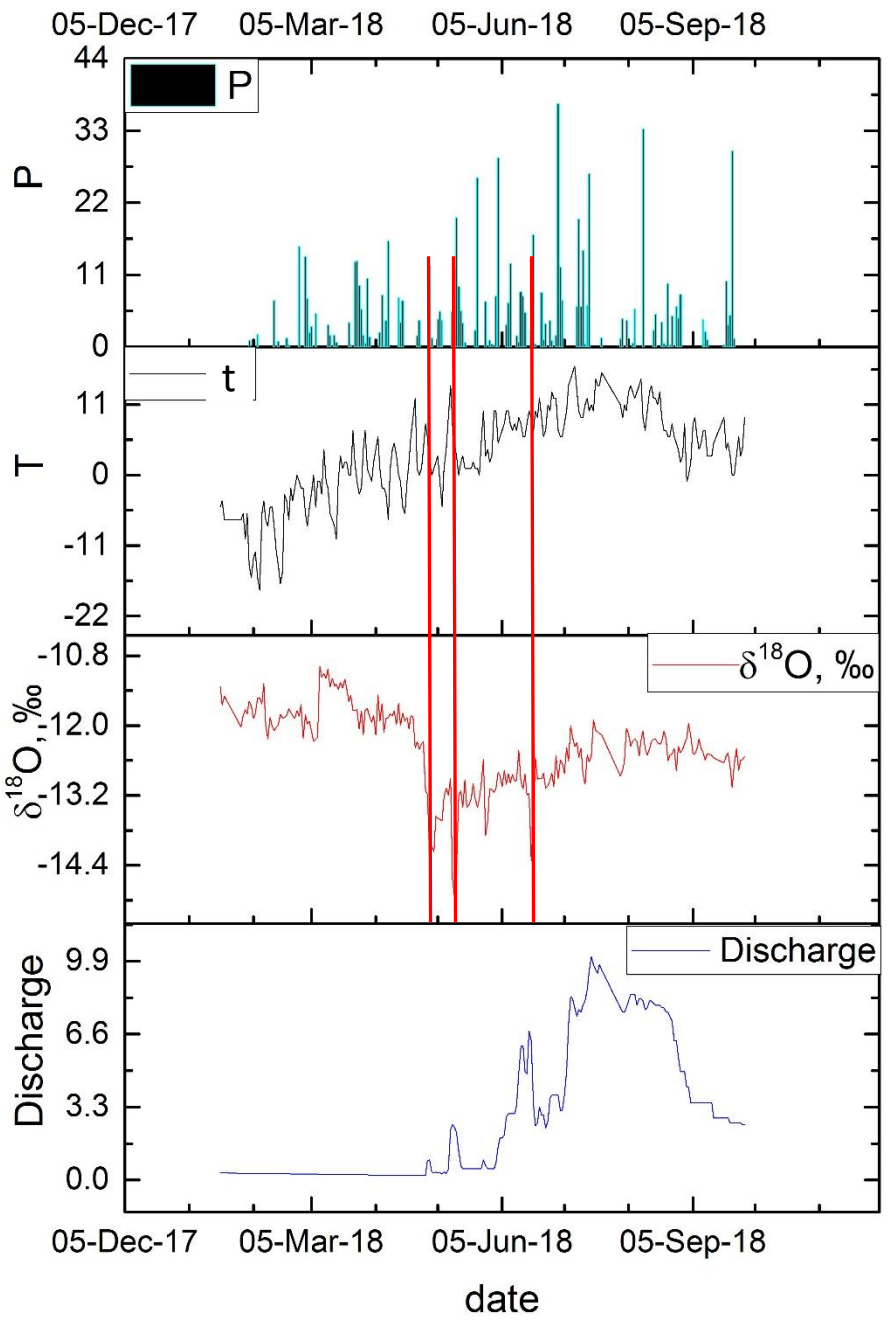
Kishi Almaty (KA)



Catchment	Area, km^2	Number of sampling points
Ulken Almaty	485	Source area (53 samples) + 1 point with daily sampling (251 samples)
Kishi Almaty	1048	Source area (34 samples)

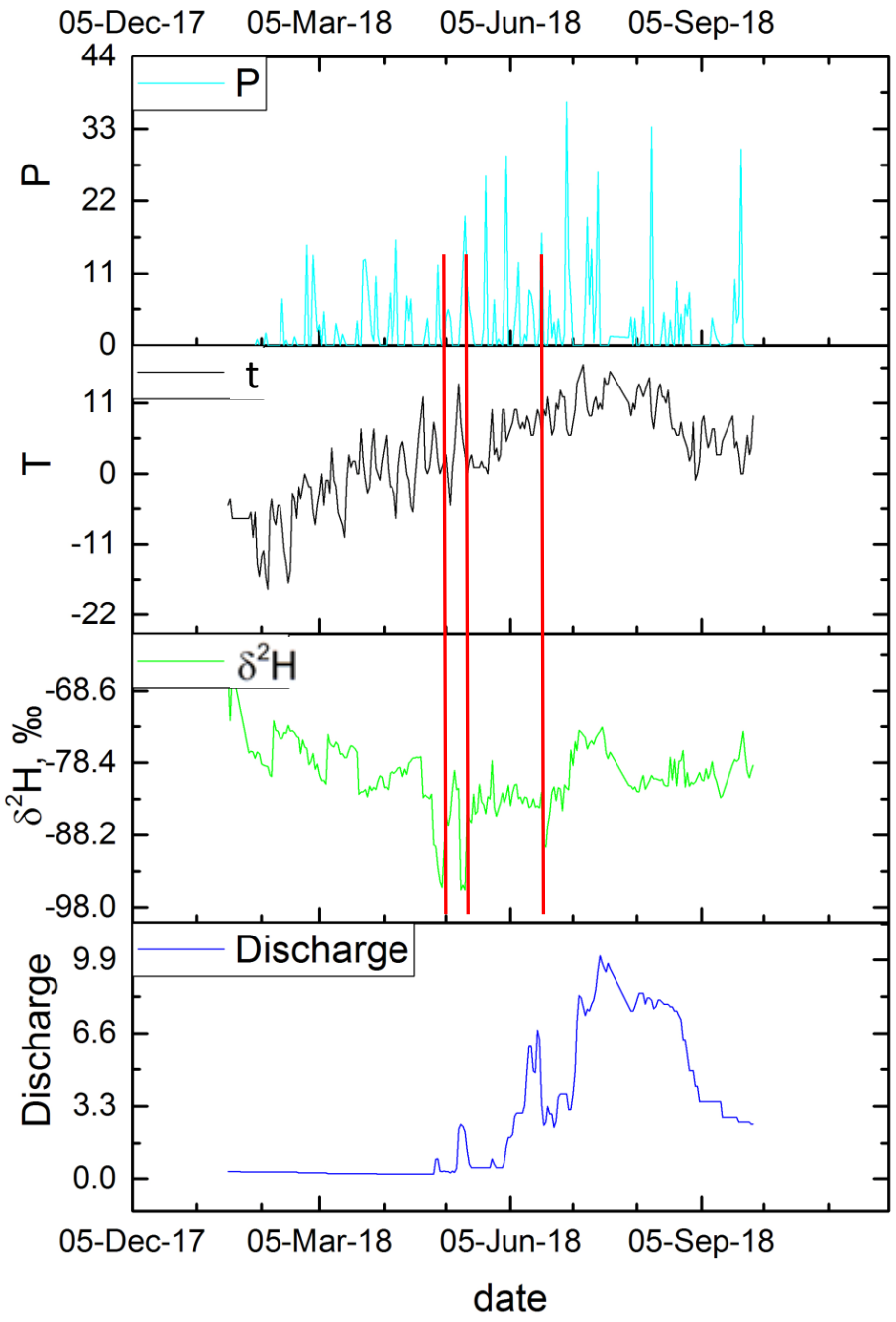
Sampling started in 2017 and is continuing

Preliminary results: Ulken Almaty 2018

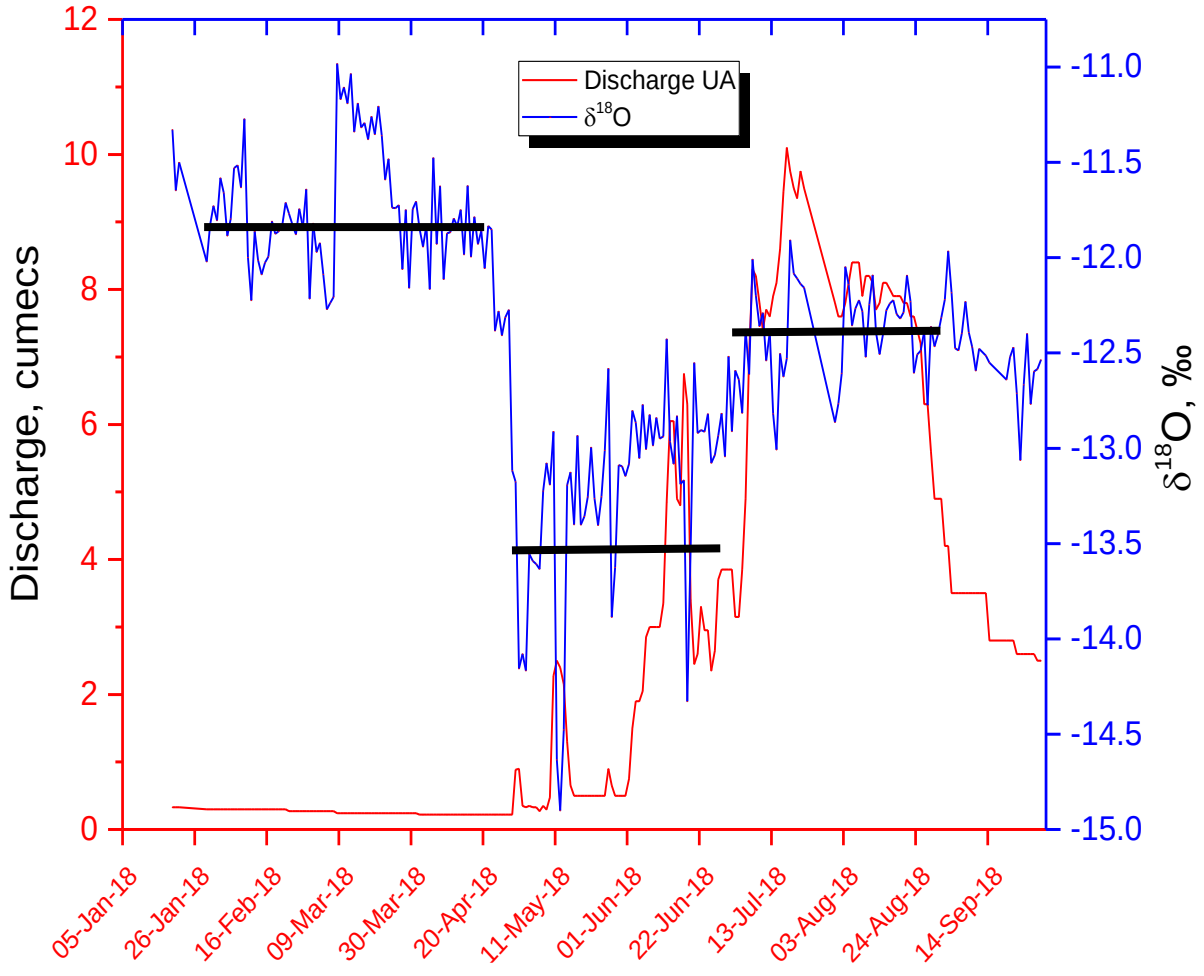


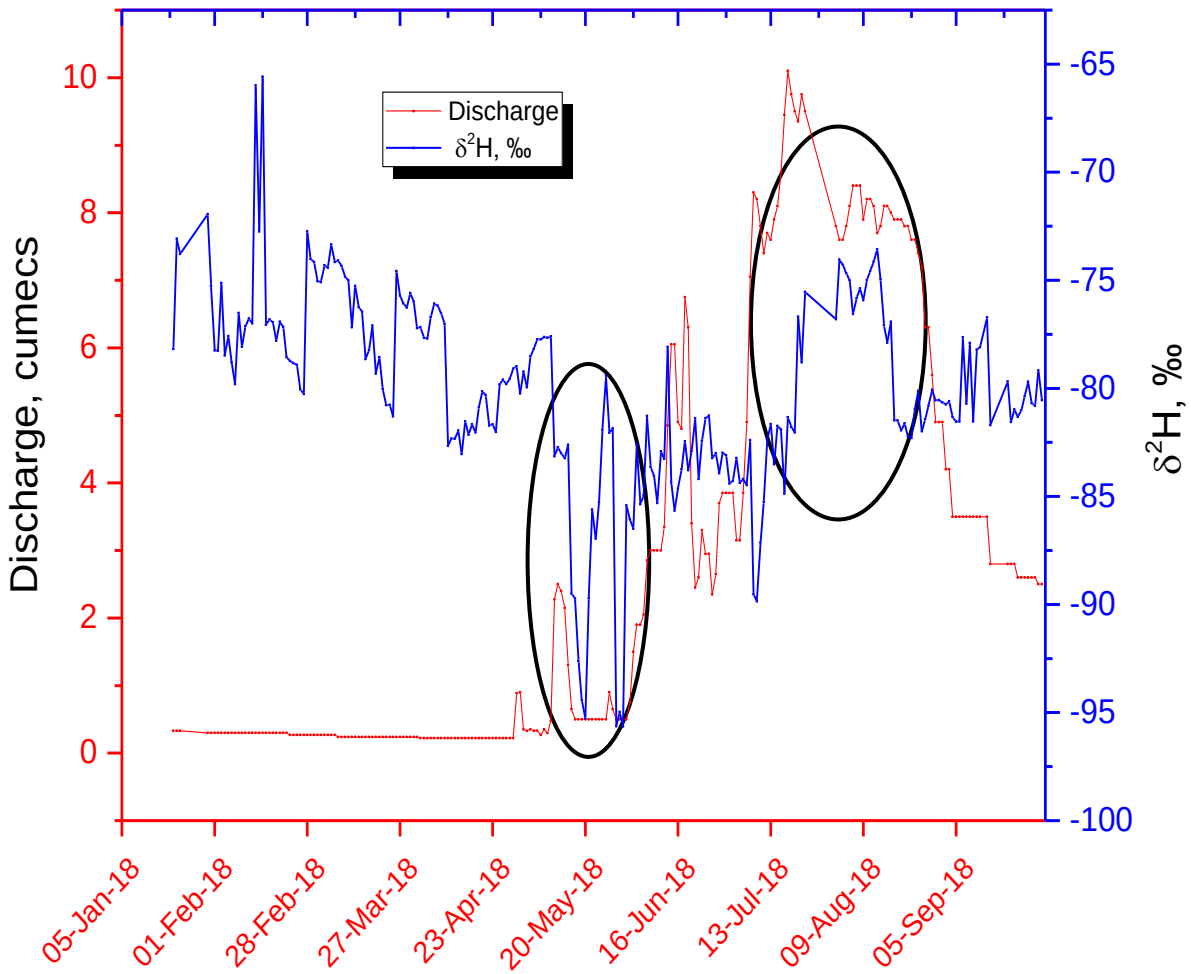
The isotopic concentrations are controlled by precipitation (P) and temperature (T)

The isotopic concentrations vary strongly between periods of low (cold) and high (warm; snow and glacier melt) discharge



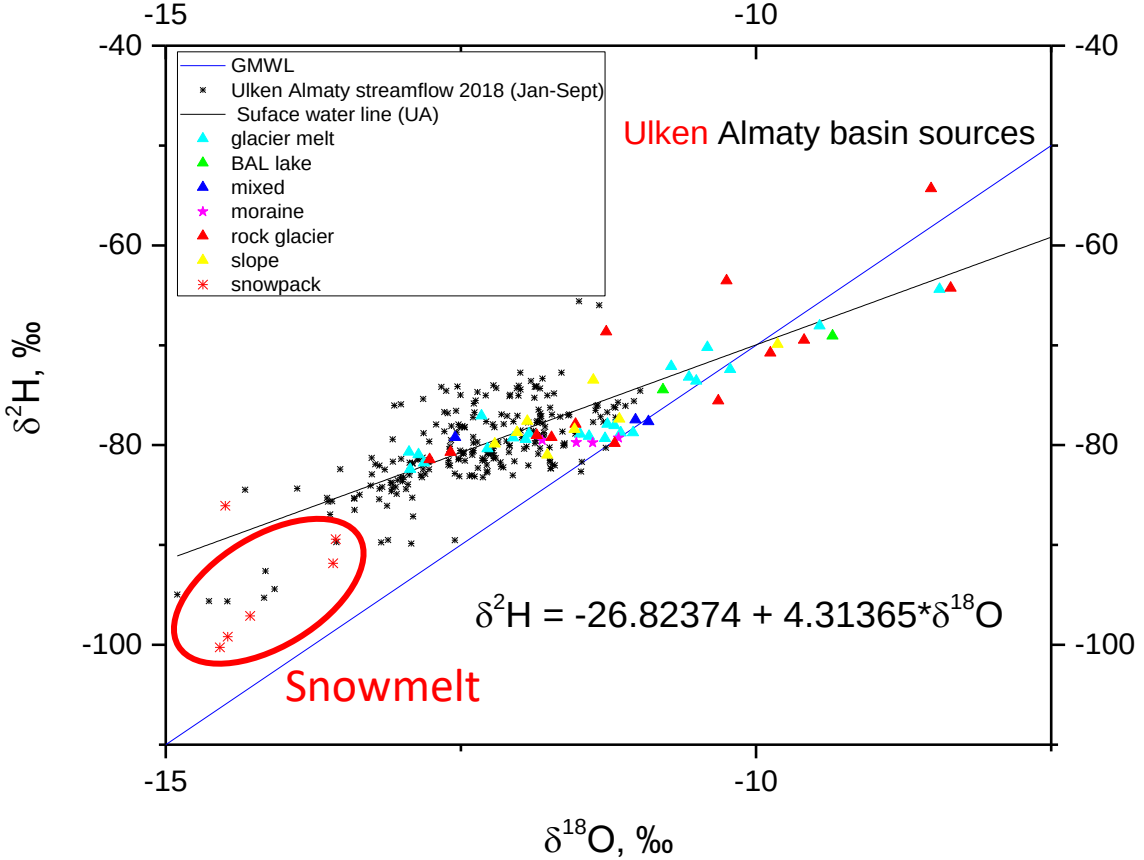
Time series of daily discharge of the Ulken Almaty and concentrations of δ2H and δ18O

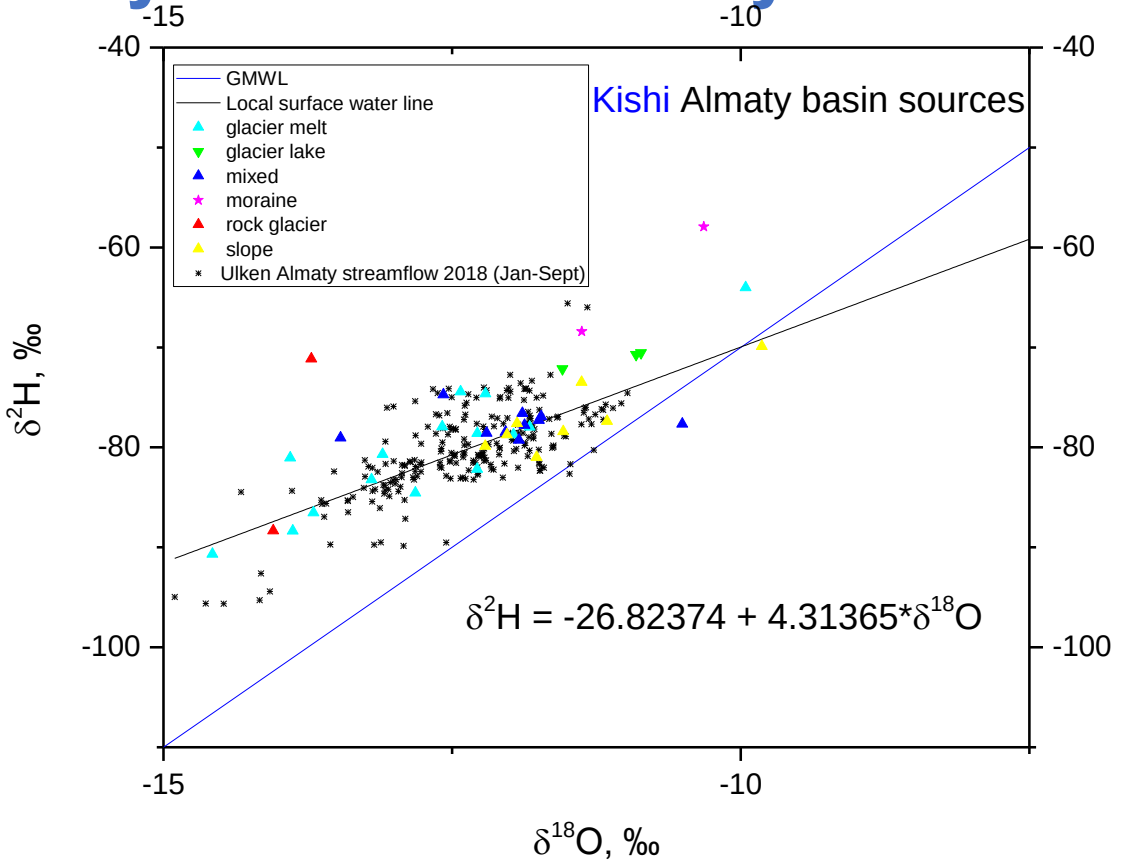




- Low and high discharge events affect concentration of δ^2H and δ^2O (synchronization of some peaks)
- Statistically significant differences in concentration between periods of snow melt and glacier ice melt

Isotopic compositions of the Ulken Almaty streamflow and water from different sources in the Ulken Almaty and Kishi Almaty catchments

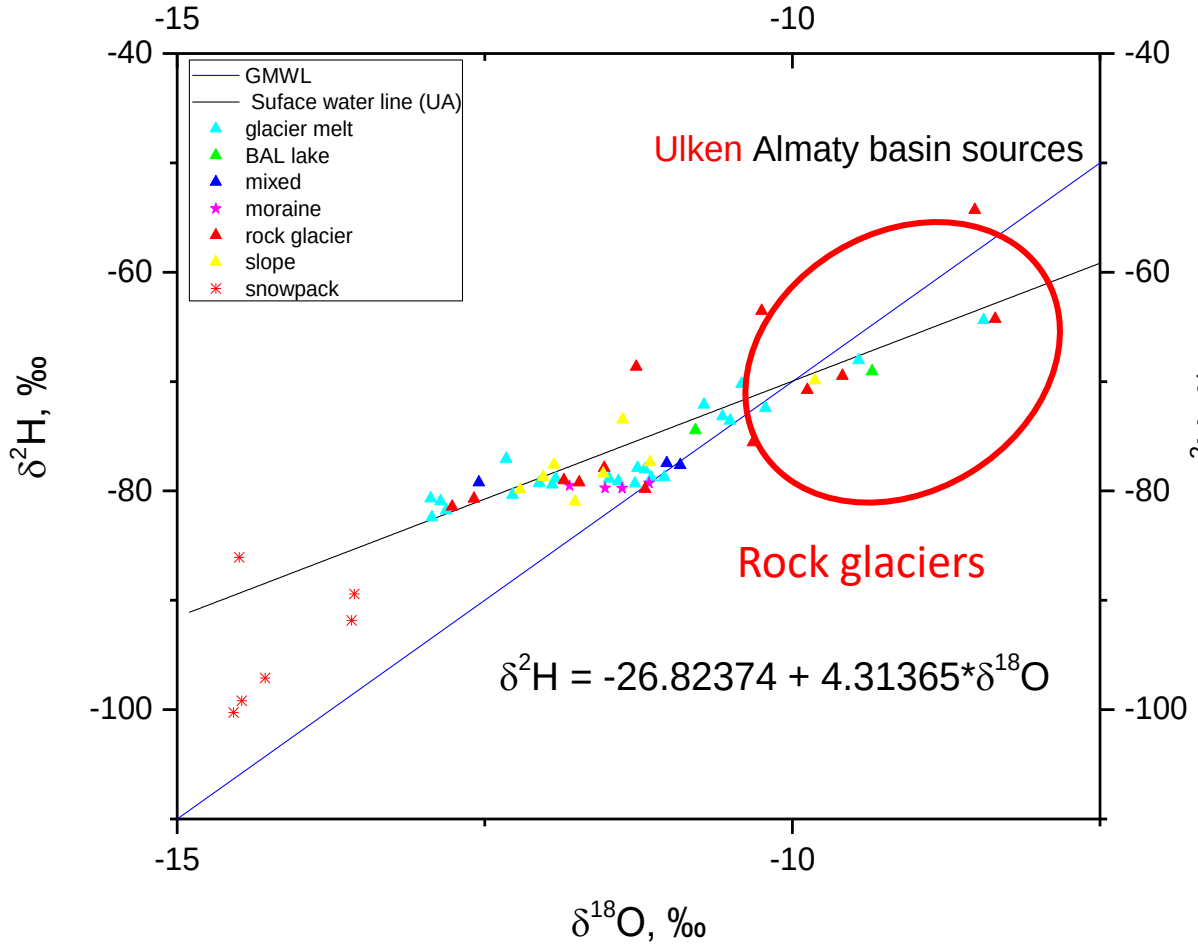


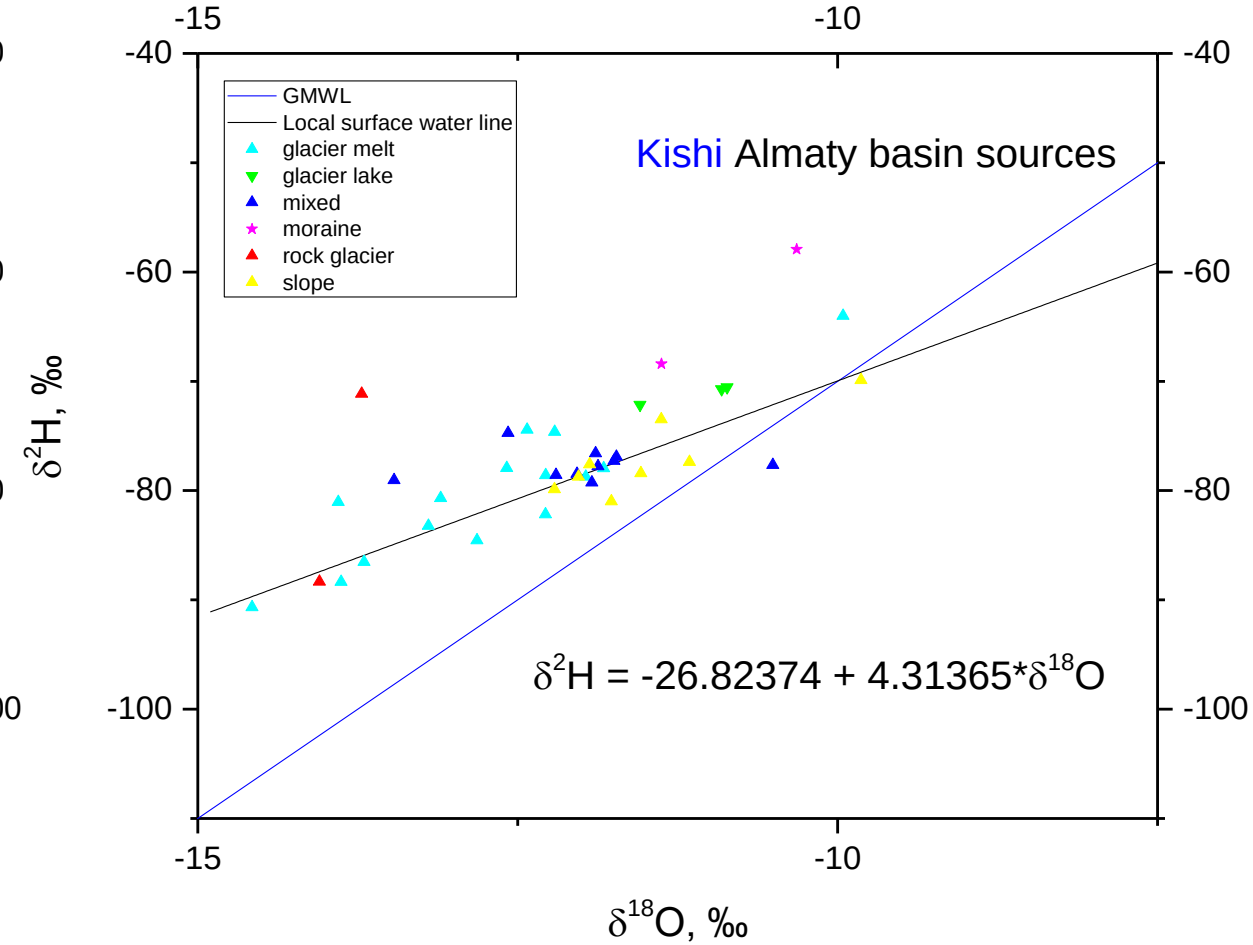


- Snowpack and steamflow during the snow melt period (mid-May - late June) have similar isotopic composition
- Glacier melt water has very similar isotopic composition to that of streamflow during the glacier melt season (July-August)
- Isotopic signatures of ice melt vary between the Ulken Almaty and Kishi Almaty catchments
- Results from the Kishi Almaty are closer to the conceptual diagramme[1]: more depleted ice melt water
- Water samples were collected from screes and slopes: Isotopic signatures were similar to those of ice melt in the Ulken Almaty

[1] Gibson J J, Edwards T W D, Birks S J, St Amour N A, Buhay W M, McEachern P, Wolfe B B and Peters D L 2005 Progress in isotope tracer hydrology in Canada *Hydrol. Process.* **19** 303–27

Isotopic compositions of samples collected from different sources in the Ulken Almaty and Kishi Almaty catchments





- Isotopic signatures of similar water sources are different in the two catchments located close proximity. In the Kishi Almaty, glacier ice melt and water from rock glaciers have more depleted compositions in comparison with the Ulken Almaty where glacier water is more enriched

Discussion and Conclusions

According to the preliminary results from 2017 and 2018:

Streamflow Ulken Almaty:

- During the low flow and high flow seasons, different concentration of δ^2H and $\delta^{18}O$ are observed;
- Different isotopic signatures during snow and glacier melt period;

Sources of water in the Kishi Almaty and Ulken Almaty:

- Isotopic signatures of the same water sources are different in two catchments: In the Kishi Almaty, glacier melt is more depleted;
-Discharge from rock glaciers is clearly distinguished and has more enriched istopic composition;
-Samples from slopes / screes and glacier melt have similar composition in the Ulken Almaty but not in the Kishi Almaty: **Presence of ground ice in the Ulken Almaty? Subsurface glacier runoff?**
- Glacier melt water has isotopic composition equivalent with that samples of streamflow in the Ulken Almaty for June-August

The sampling programme has been expanded in 2019 to the Ulken Almaty and Kishi Almaty (Kazakhstan), Ala-Archa and Chon Kyzyl-Suu (Kyrgyzstan), Chirchik (Uzbekistan), Varzob-Kofarnihon (Tajikistan) catchments enabling the development of the most comprehensive data set on water isotopes in Central Asia