SEASONAL GROUNDWATER STORAGE IN ALPINE CATCHMENTS AND ITS INFLUENCE ON STREAM DISCHARGE

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INTRODUCTION

- Water storage in form of snow strong influences the discharge regime in alpine areas

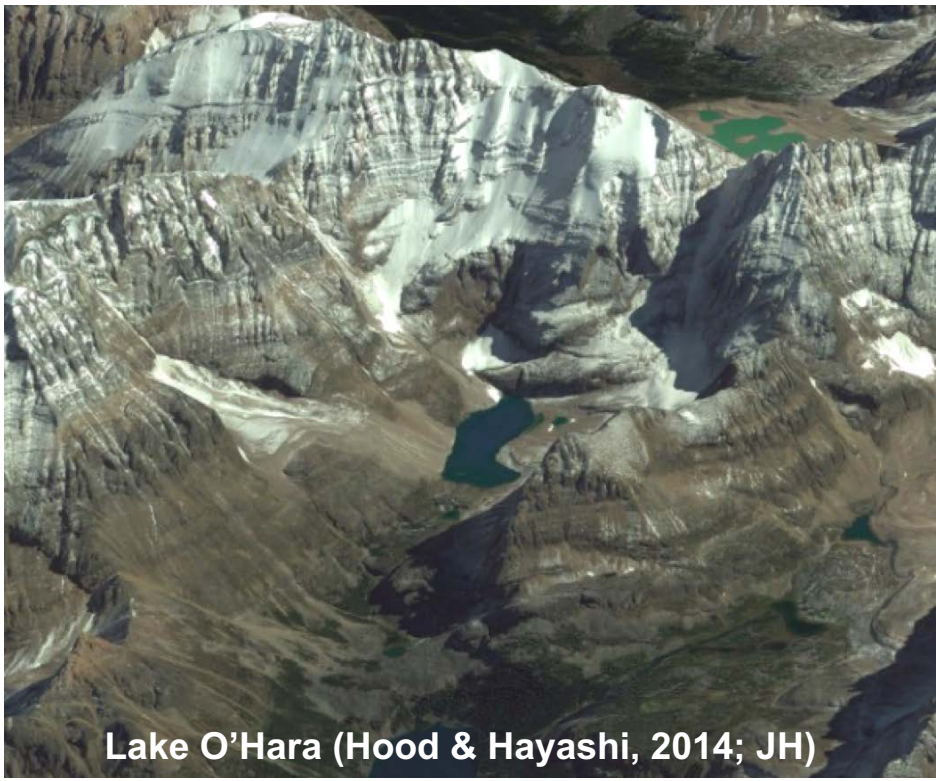
- Increasing temperatures will lead to earlier snow melt and consequently a change in the flow regime, with potentially a lower water availability in late summer/fall

- However, there is limited knowledge on how seasonal groundwater storage could influence the catchment response to earlier snow melt

- **How much meltwater do alpine catchments store and where?**

COMPARISON OF TWO CATCHMENTS


Vallon de Réchy


Lake O'Hara (Hood & Hayashi, 2014; JH)

Geology	Quartzite, Gneiss, Evaporites, Calcschists	Quartzite and quartzose sandstone
Area	10.5 km^2	4.7km^2
Altitude range	2100-3100 masl	2000-3500 masl
Precipitation	1200 mm/a	1000-1200 mm/a

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MIDDLE SECTION

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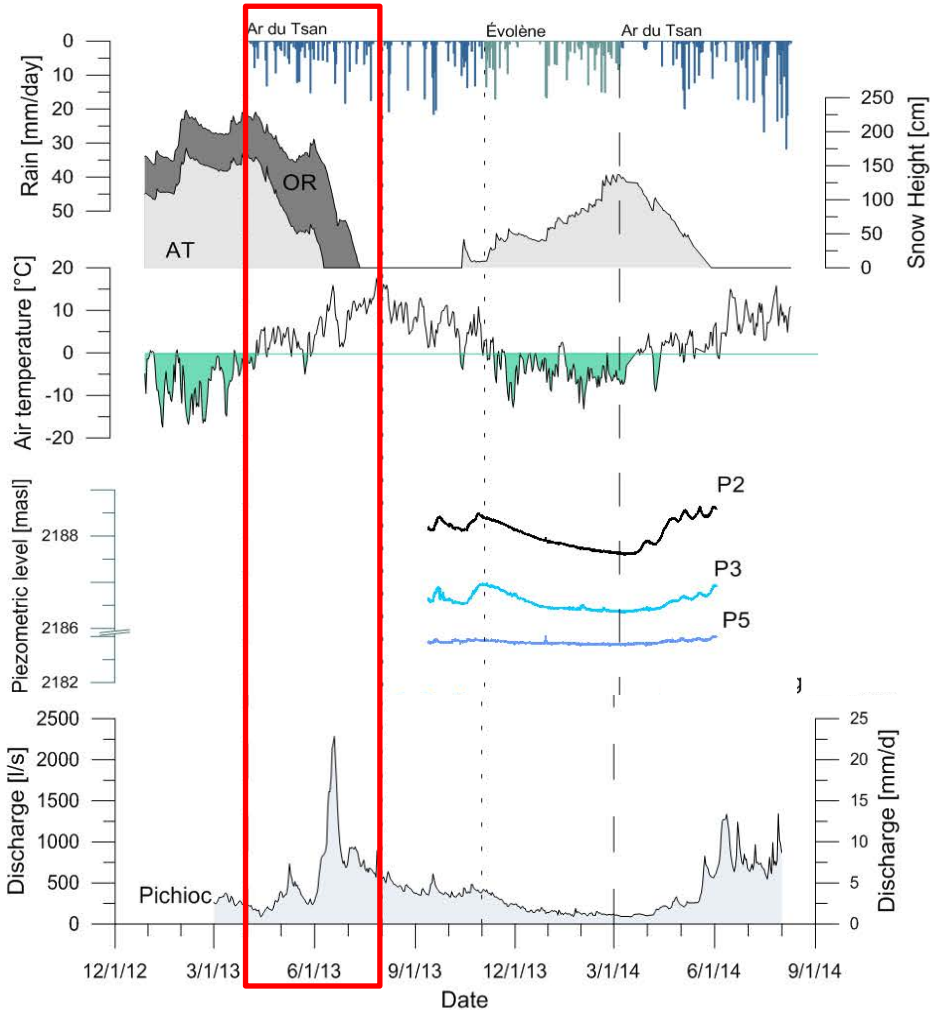
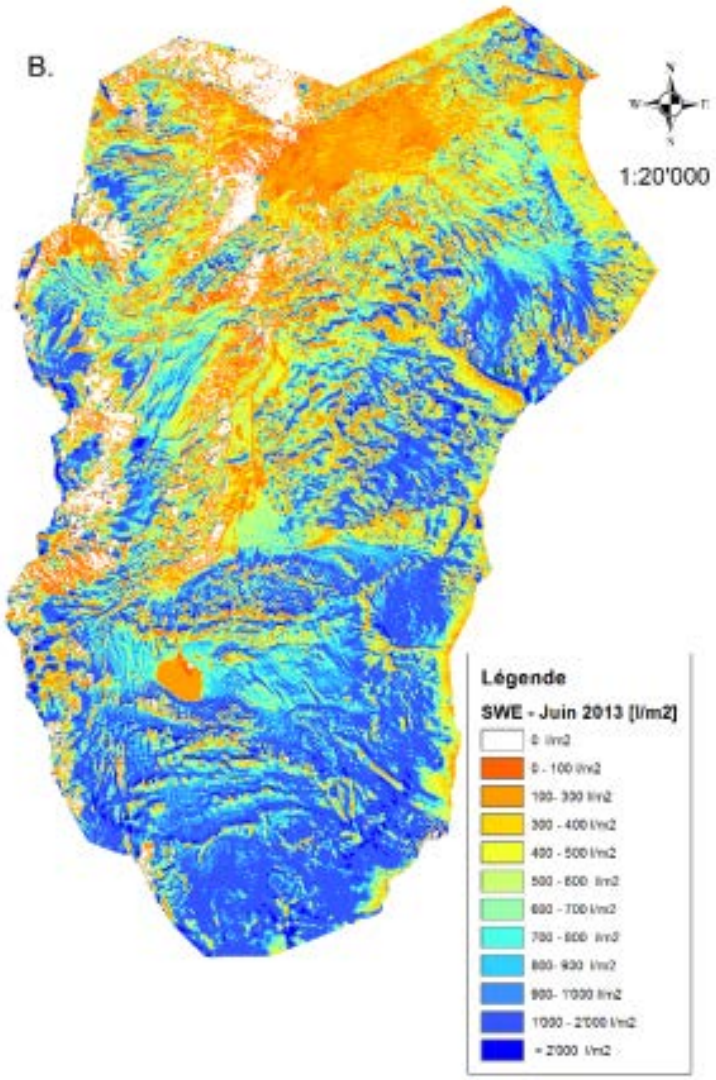
HOW TO EVALUATE GROUNDWATER STORAGE DYNAMICS?

ΔS = **Melt** + Prec – **Total Outflow** - ET – Sublim - Use



SNOW MAPPING BEFORE ONSET OF MELT



Snow volume (SV)

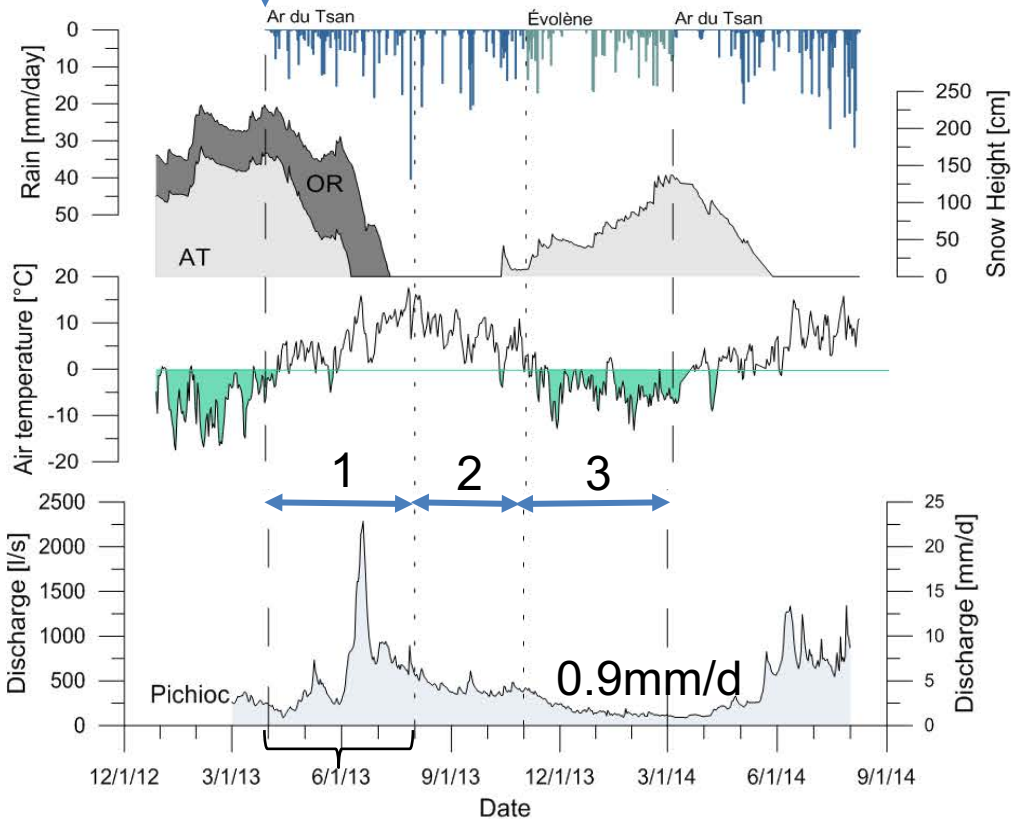
- Helicopter based Lidar mapping before onset of main melt phase

Snow density (SD)

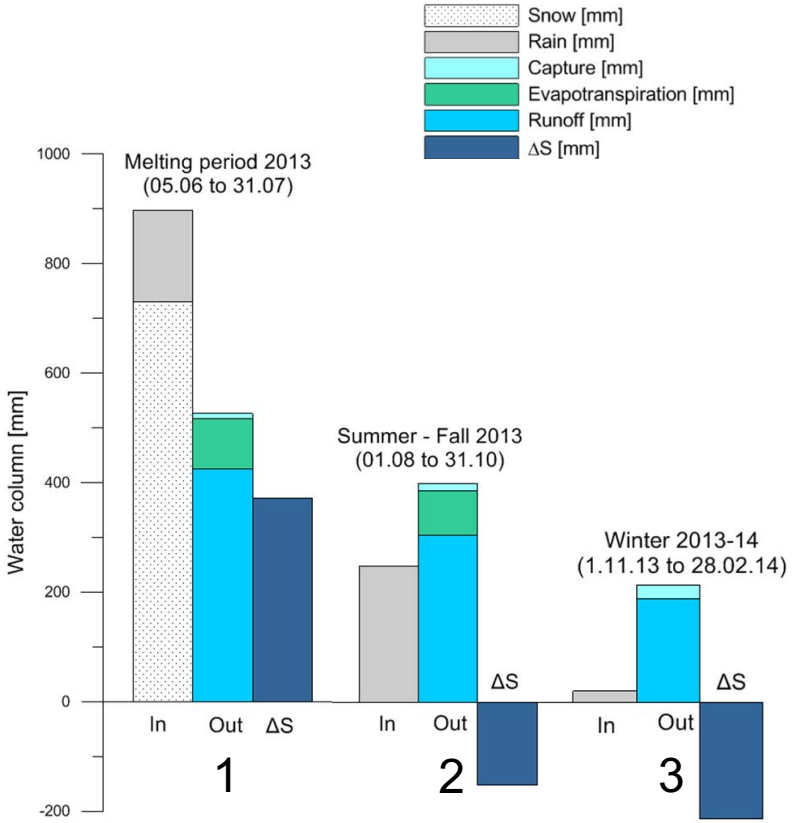
- Measurements
- Snow density model (Jonas et al. 2009) f(season, snow height, altitude, region)

HOW TO EVALUATE GROUNDWATER STORAGE DYNAMICS?

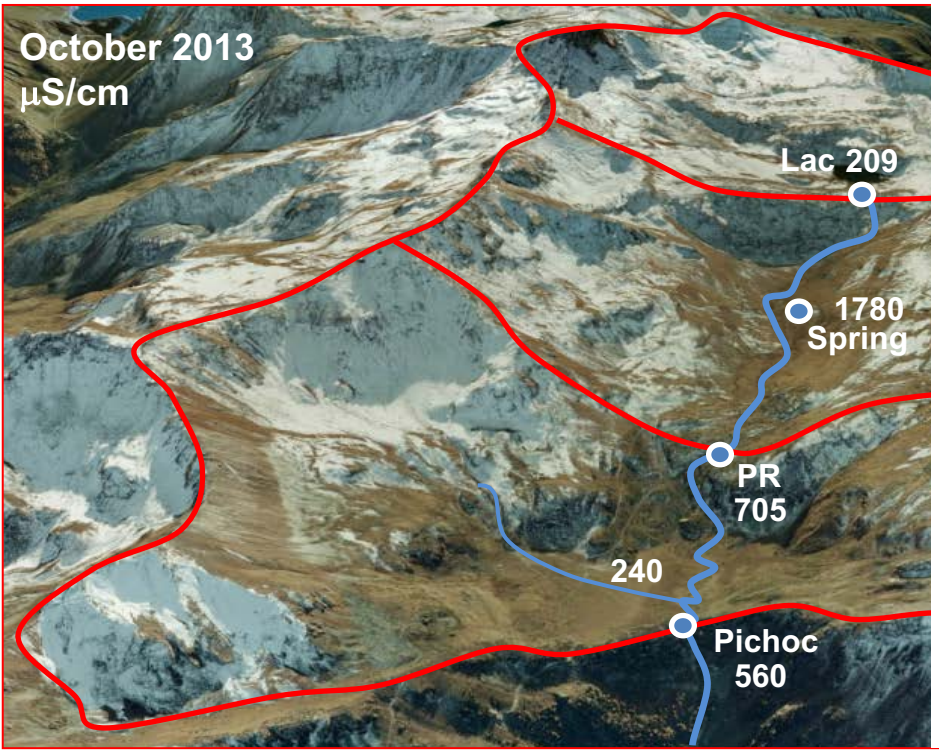
SWE
SD measurement: **695** ± 32 **mm**
SD model: 731 mm

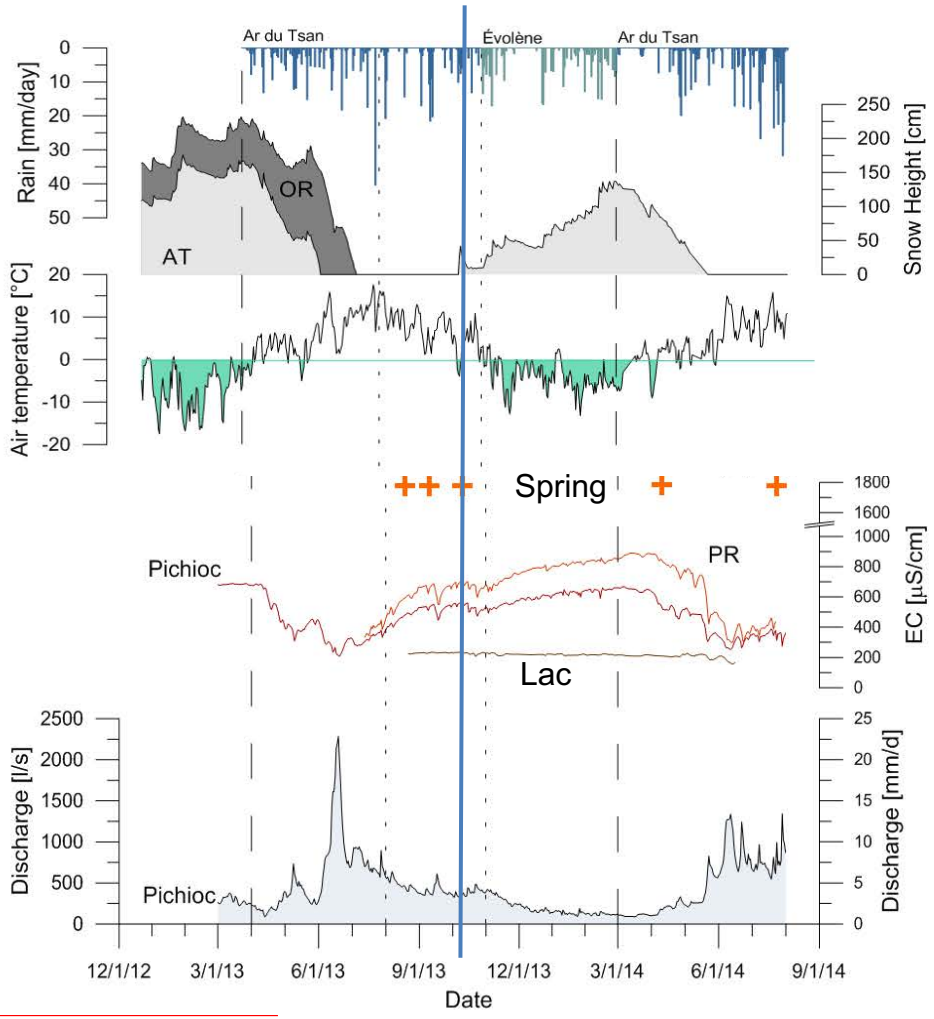


Outflow
425 mm



LOCATION OF GROUNDWATER STORAGE?





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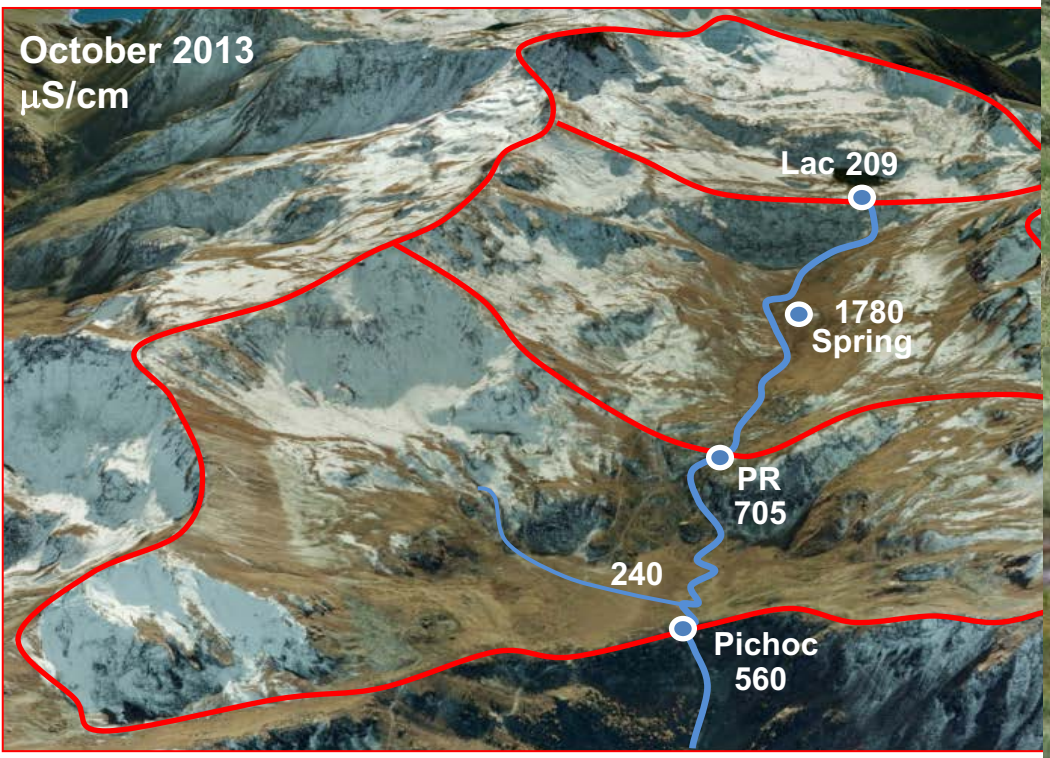

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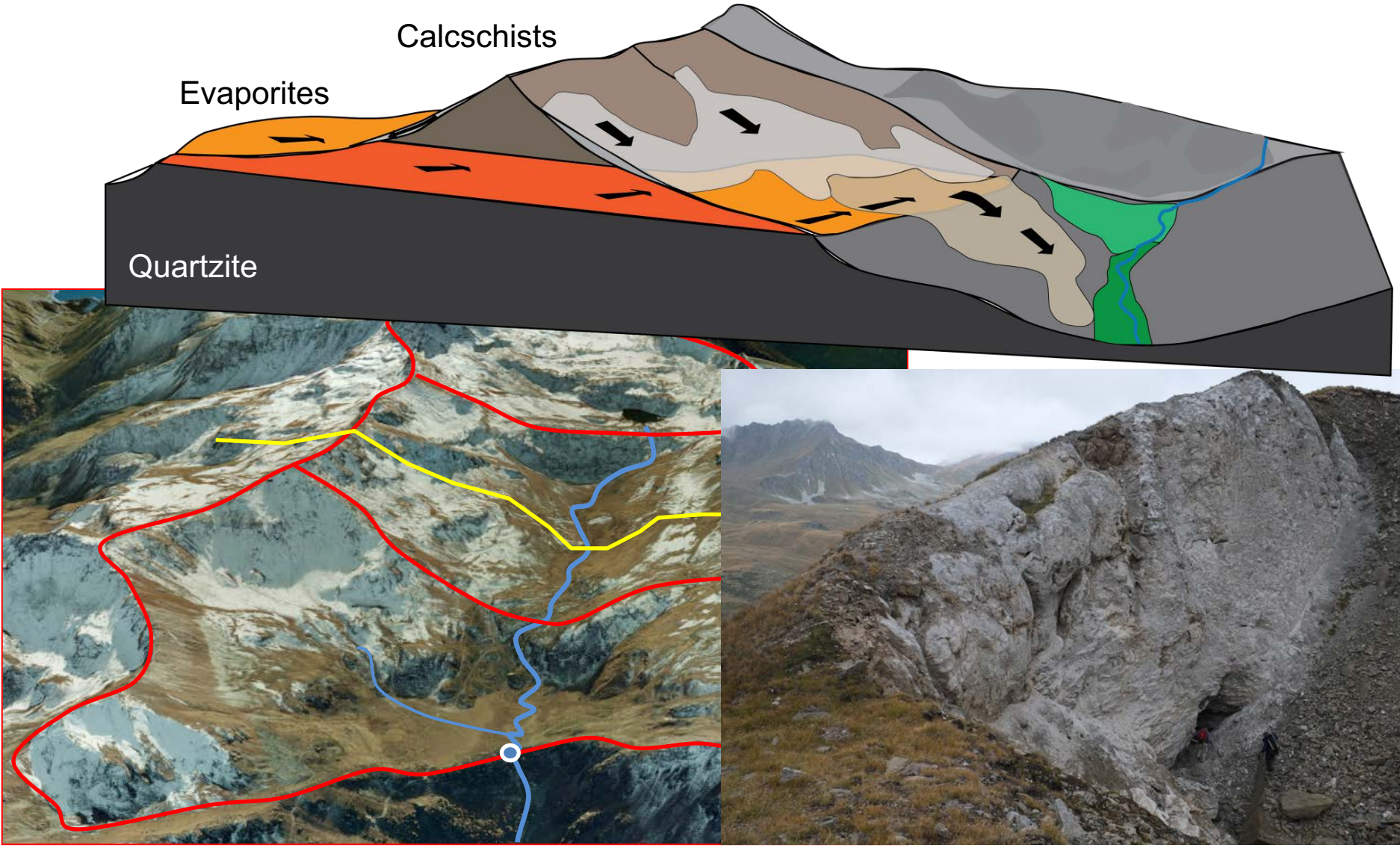
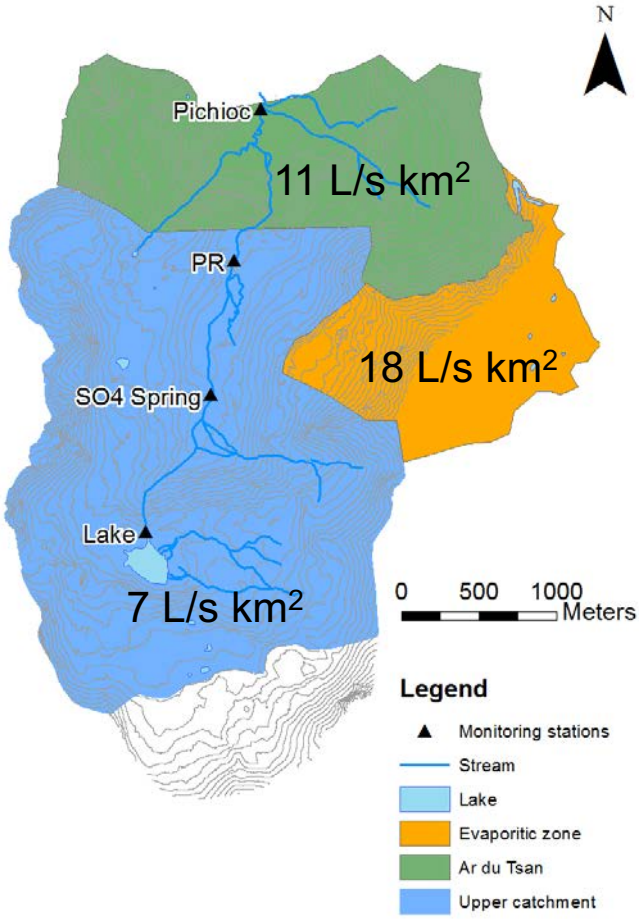
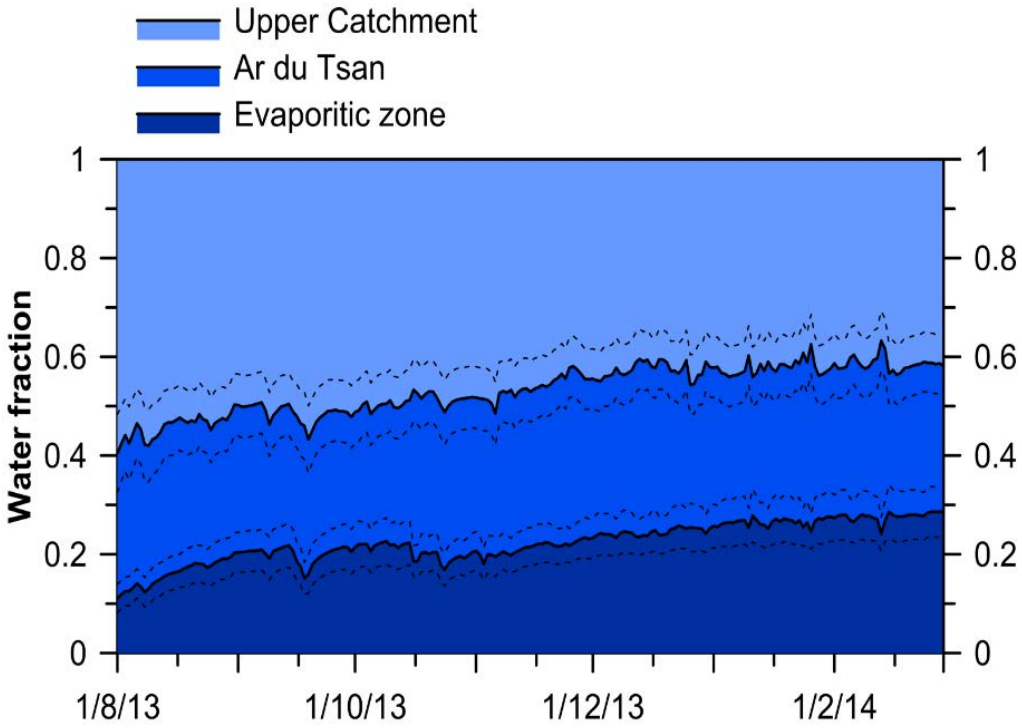


CONTRIBUTION OF DIFFERENT ZONES





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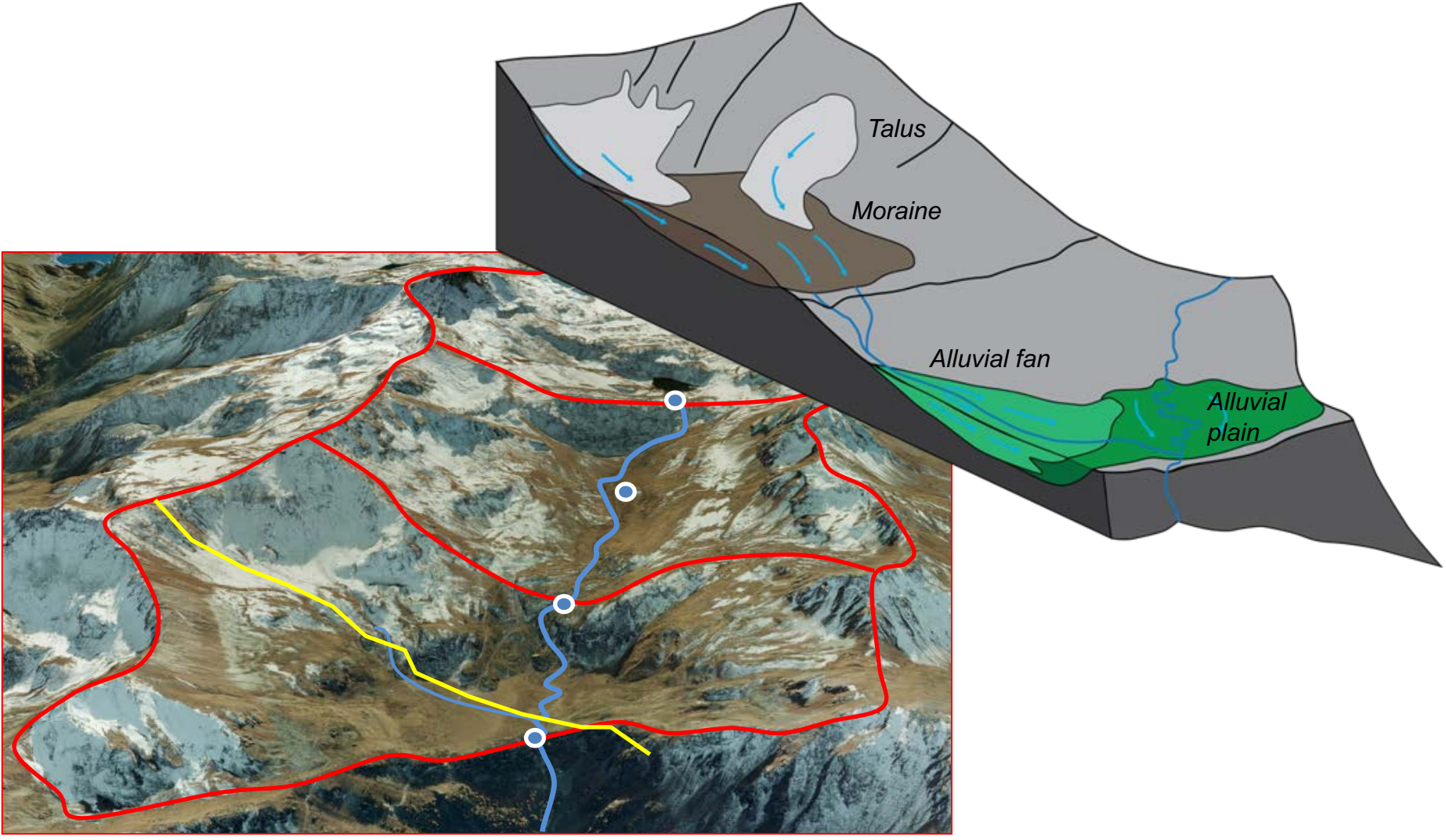
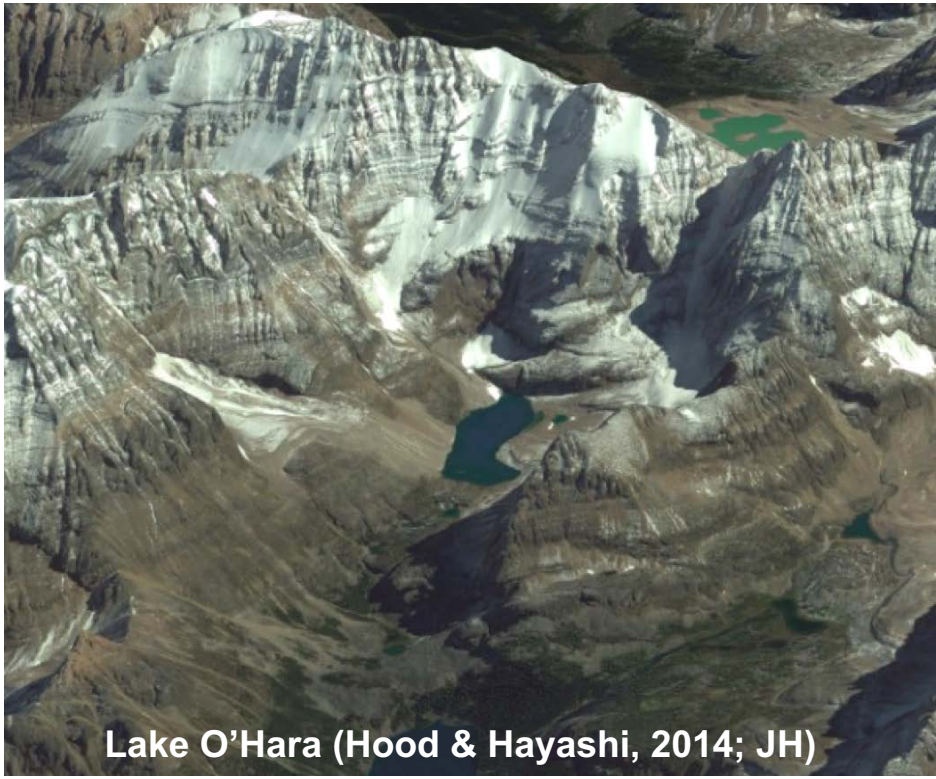


COMPARISON OF TWO CATCHMENTS


Vallon de Réchy


Lake O'Hara (Hood & Hayashi, 2014; JH)

Geology	Quartzite, Gneiss, Evaporites, Calcschists	Quartzite and quartzose sandstone
Pre-melt SWE	**695 mm**	**500-600mm**
GW storage	**340 mm (46% of SWE)**	**60-100 mm (10-20% of SWE)**
Winter baseflow	**0.9mm/d**	**0.5mm/d**

CONCLUSION

- **Possible to quantify seasonal groundwater storage with sufficient precision in complex and difficult to access alpine catchments**
- **Substantial amount of melt water can be retained at high altitude with relatively high groundwater ages**
- **Seasonal groundwater storage has a strong effect on discharge regime and flow rates after extended recession periods**
- **Storage volumes and dynamics can be related to geological conditions**

THANK YOU FOR YOUR ATTENTION