

# Climate change impact on Swiss hydropower production



Synthesis Report, November 2019

Specific contributions of SCCER SoE

Important messages

Way forward

Personal remarks

Acknowledgement

SCCER SoE  
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Synthesis Report

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## Climate change impact on Swiss hydropower production



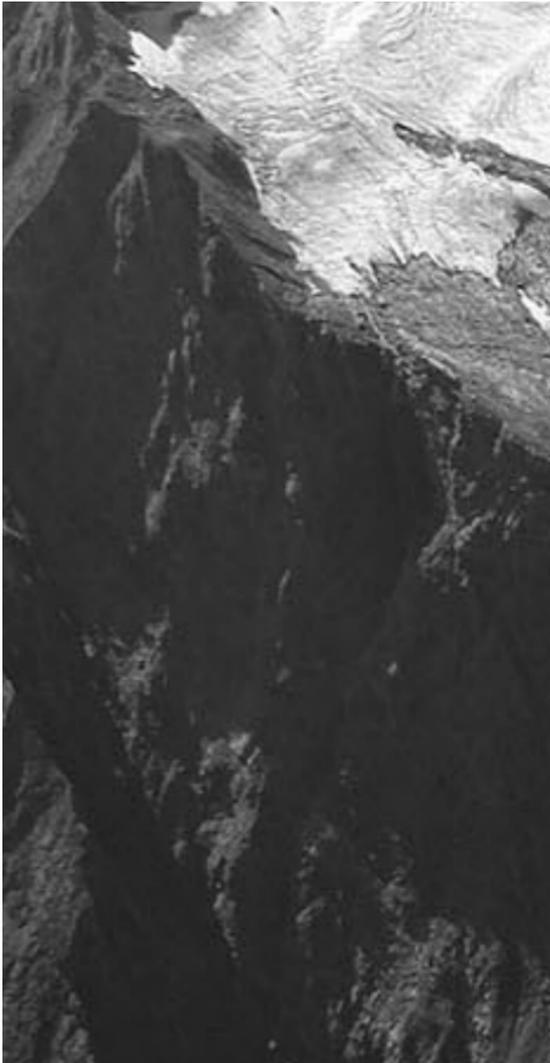
### Synthesis Report

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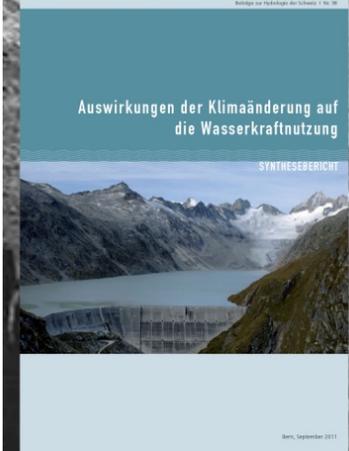
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# Auswirkungen der Klimaänderung auf die Wasserkraftnutzung

SYNTHESEBERICHT



Bern, September 2011

NFP 61 – Thematische Synthese 1  
im Rahmen des Nationalen Forschungsprogramms NFP 61  
«Nachhaltige Wassernutzung»

## Wasserressourcen der Schweiz Dargebot und Nutzung – heute und morgen

Astrid Björnsen Gurung und Manfred Stähli



 Nachhaltige Wassernutzung  
Nationales Forschungsprogramm NFP 61



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Nationales Forschungsprogramm NFP 61

 SNSF  
SCHWEIZERISCHER NATIONALFONDS  
ZUR FÖRDERUNG DER WISSENSCHAFTLICHEN FORSCHUNG

Auswi  
auf die



Kapitel 6

atistische Synthese 1  
s Nationalen Forschungsprogramms NFP 61  
Wassernutzung»

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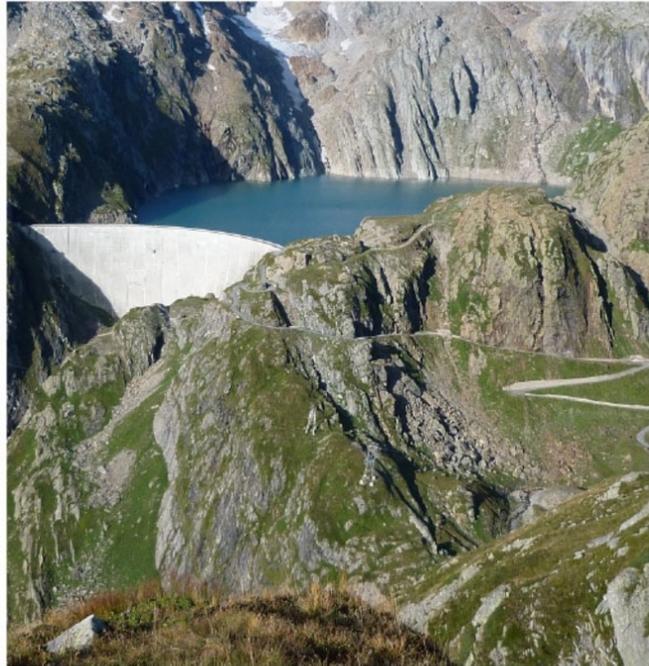
Verantwortung und Manfred Stähli



im NFP 61

WISSENSCHAFTLICHE FORSCHUNG

### Auswirkungen des Klimawandels auf die Wasserwirtschaft der Schweiz



Kapitel 6 **Wasserkraft**

International water affairs

Eine Studie  
im Rahmen des NCCS Themenschwerpunktes  
**Hydrologische Grundlagen zum Klimawandel**  
des National Centre For Climate Services

Klaus Lanz, Tobias Wehster



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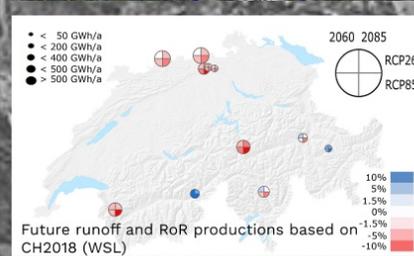
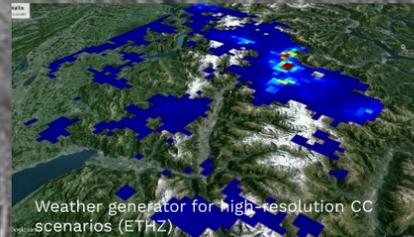
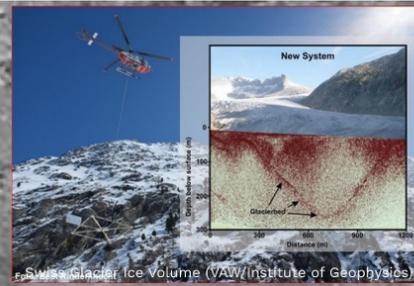
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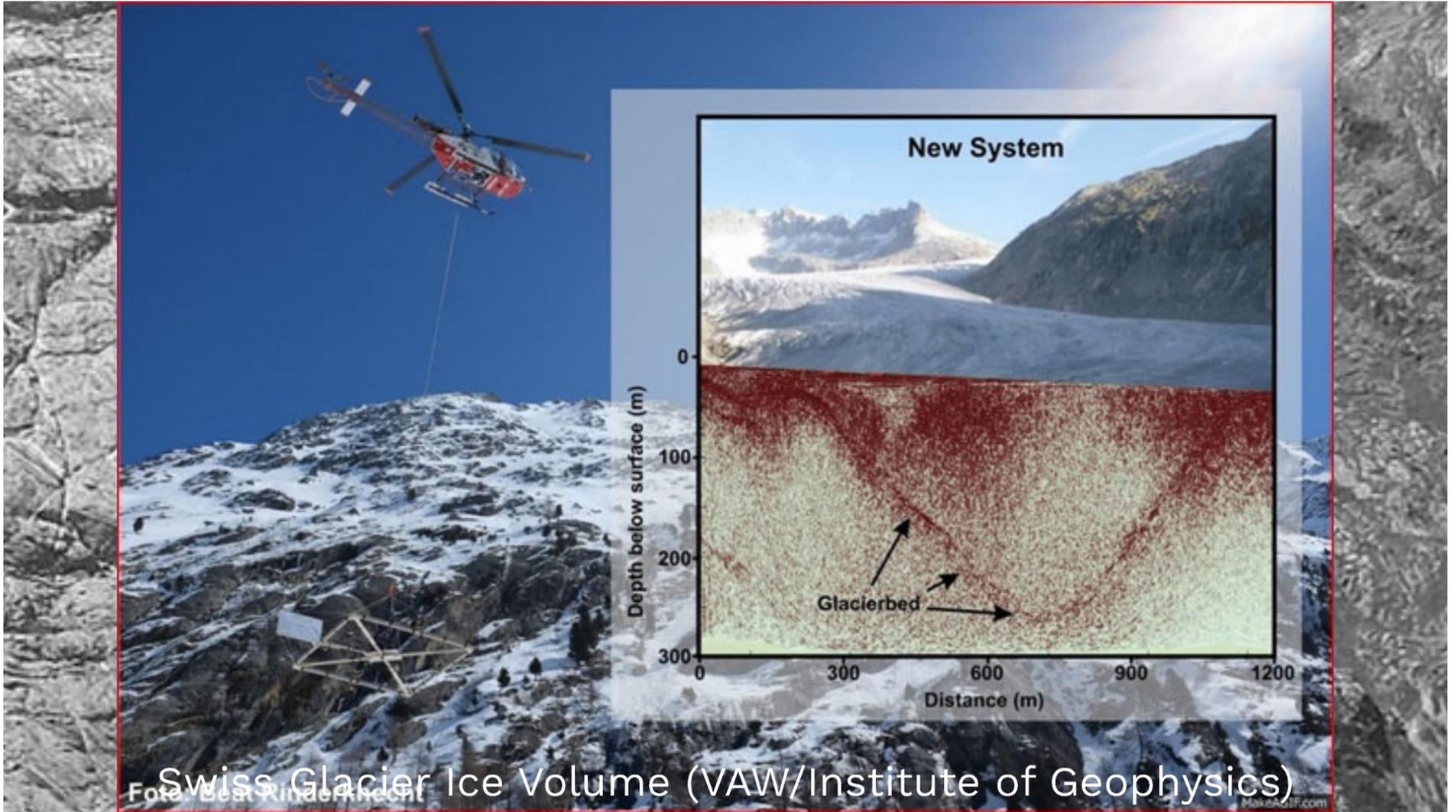
Aspekte der Klimawandlung auf die Wasserkraftleistung

Wasserkraftwerke der Schweiz  
Wasserkraftleistung - Was ist möglich?

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# Specific contributions of SCCER SoE

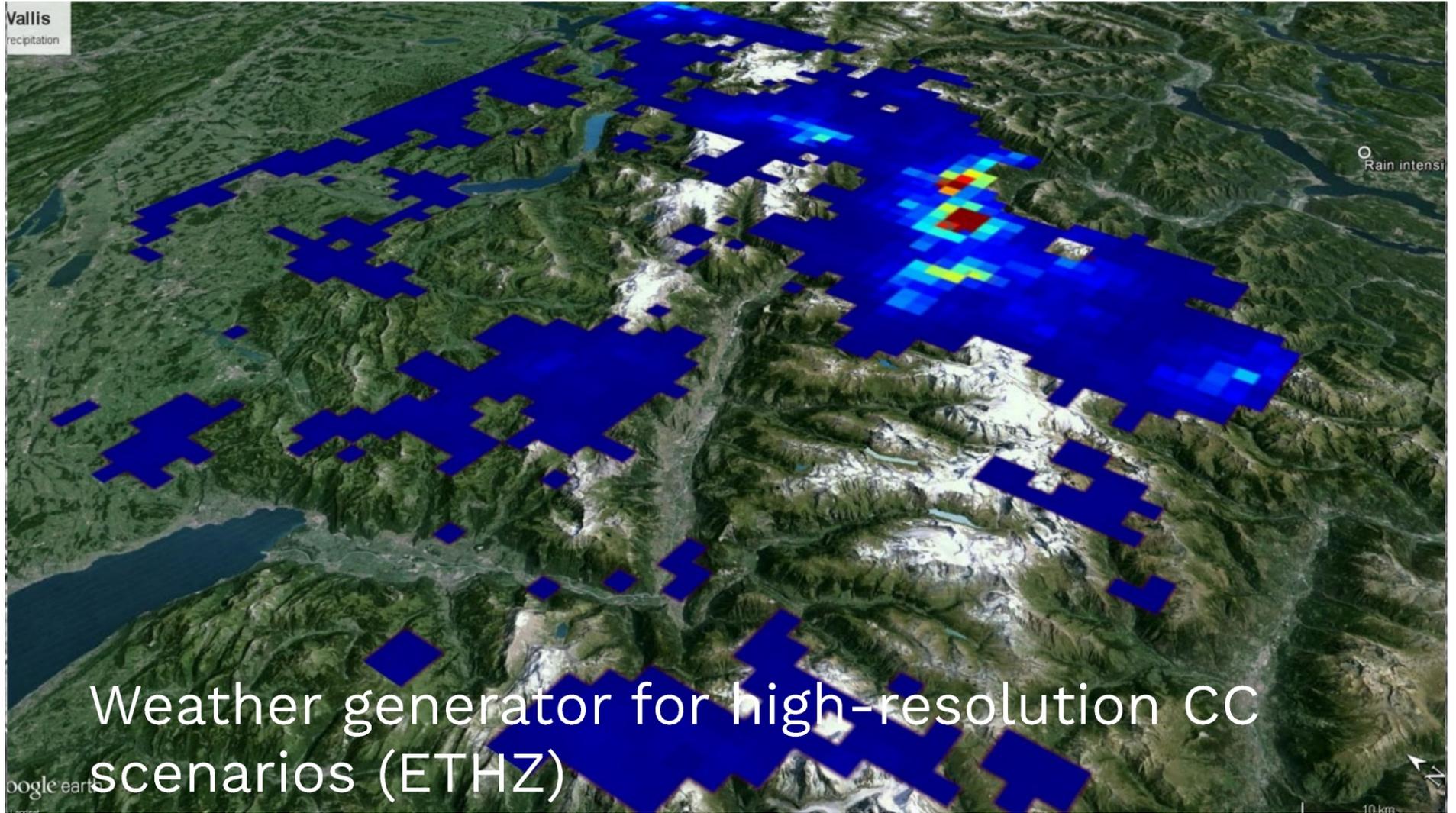




Swiss Glacier Ice Volume (VAW/Institute of Geophysics)

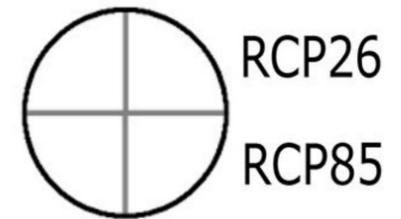


Sediment measurements at KW Solis (WSL)



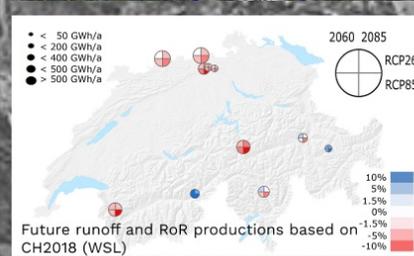
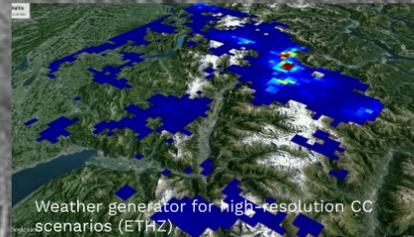
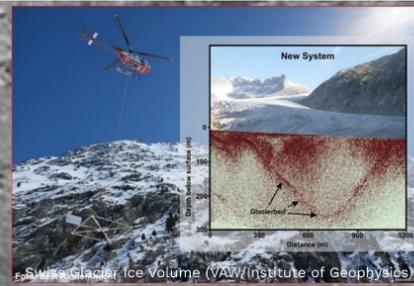
- < 50 GWh/a
- < 200 GWh/a
- < 400 GWh/a
- < 500 GWh/a
- > 500 GWh/a

2060 2085



Future runoff and RoR productions based on CH2018 (WSL)

# Specific contributions of SCCER SoE



# Important messages (1)

Important messages (2)



Swiss glaciers will lose 76% to 98% of their current ice volume by 2100.

HP production is expected to fall by 0.56 TWh/a (1 TWh/a) by mid-century (end of century), owing to reduced ice melt.

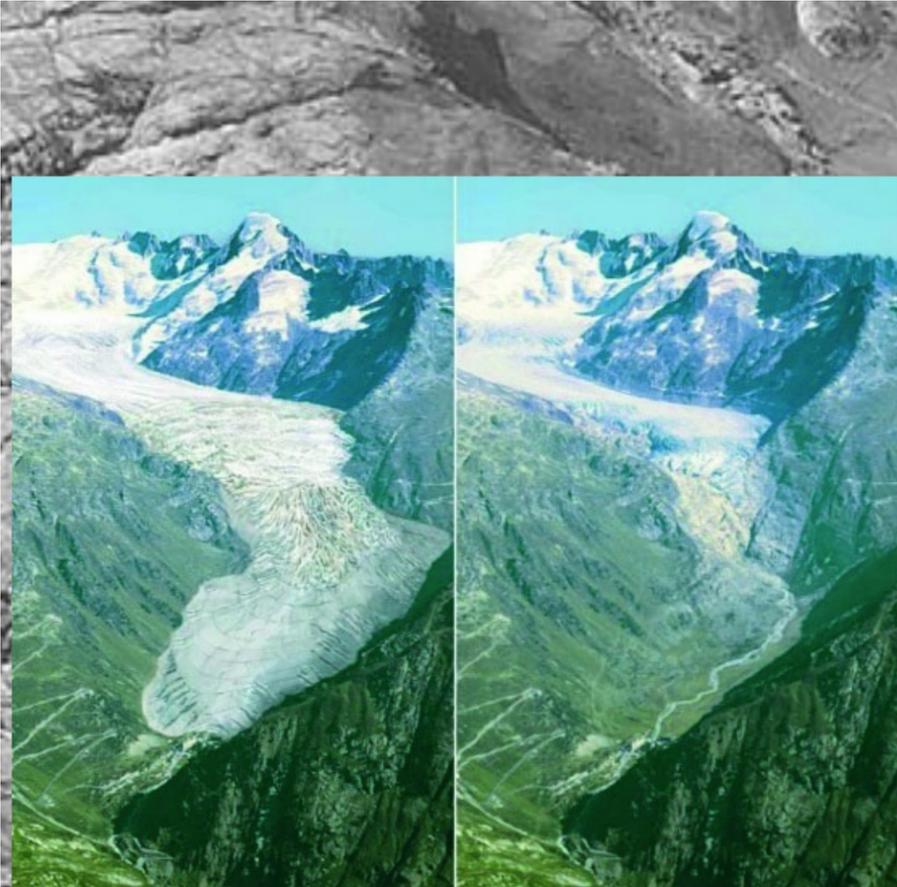


Due to a changing snow accumulation and melt, run-of-river **winter**-production is expected to increase by over 30 % above 1400 m a.s.l.



Sediment availability: +  
Sediment transport: -  
Extreme runoff events will be decisive

In Switzerland, 0.2 % of the annual storage capacity lost through continuing sedimentation.



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## Important messages (2)



Change in run-of-river (RoR) power production due to runoff-**regime** change:

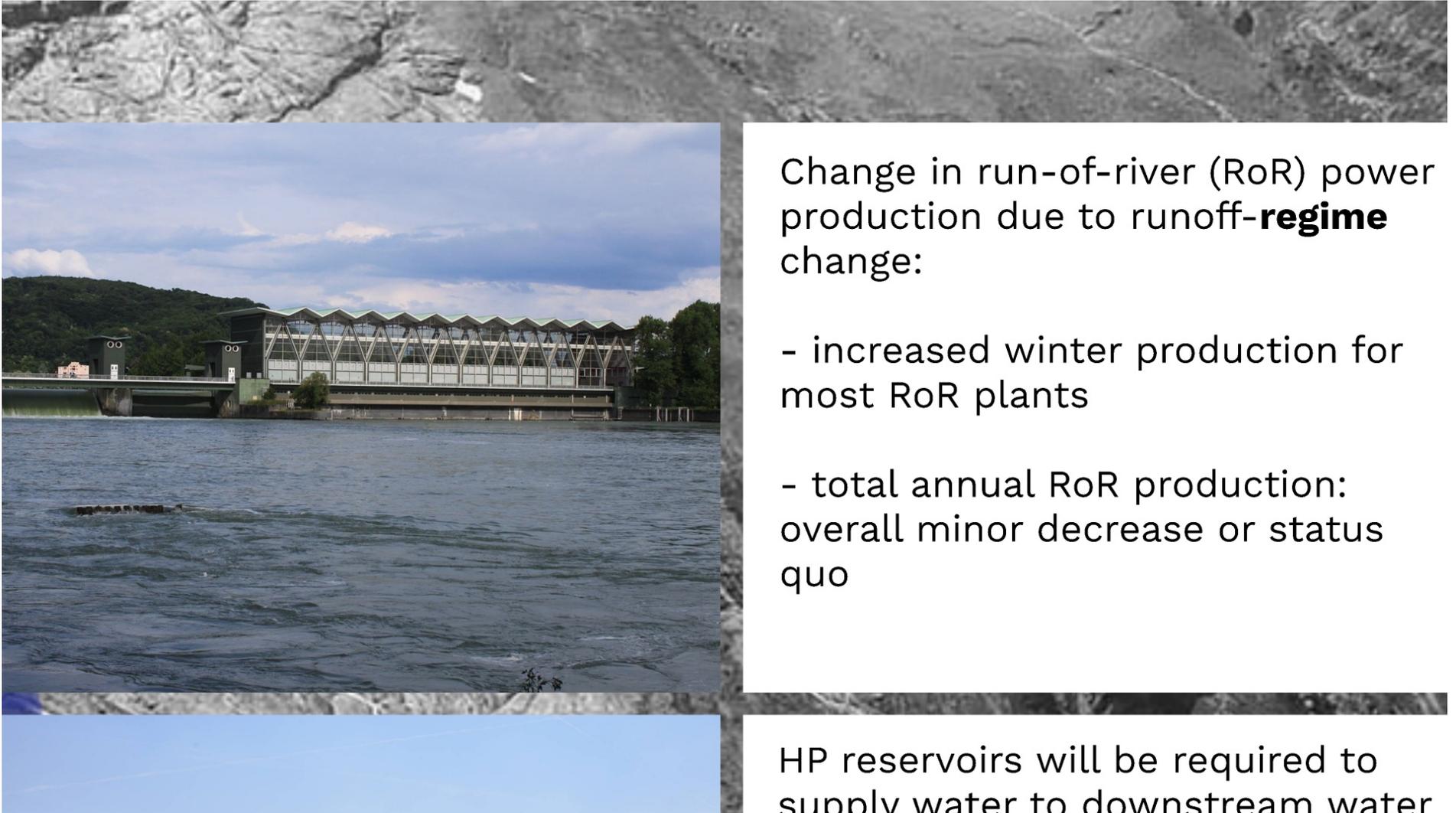
- increased winter production for most RoR plants
- total annual RoR production: overall minor decrease or status quo



HP reservoirs will be required to supply water to downstream water users as dry periods with temporal water shortage will occur more often.

This can enforce an adaptation in the production pattern.

Foto: S. Hartmann/Aargauer Zeitung



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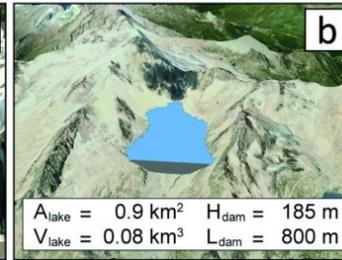
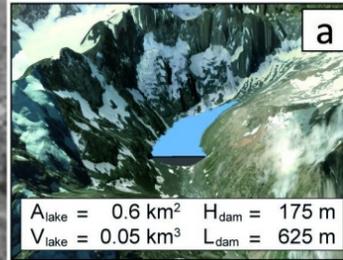
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This can enforce an adaptation in the production pattern.

An aerial photograph of a rugged, mountainous landscape. The terrain is characterized by steep, rocky slopes and deep, narrow valleys. A prominent blue brushstroke overlay is positioned on the left side of the image, containing the text "Way forward" in white, bold, sans-serif font.

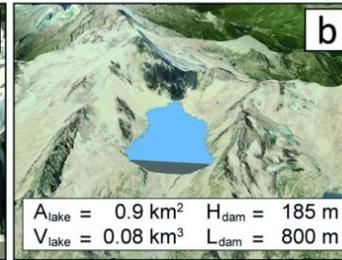
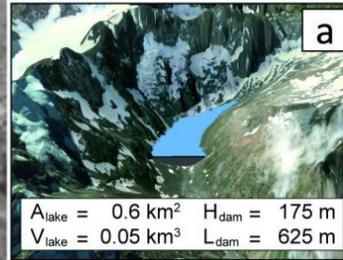
**Way forward**

# Way forward



New HP dams in periglacial areas will be a key-point of discussion with respect to future energy and water supply.

# Way forward

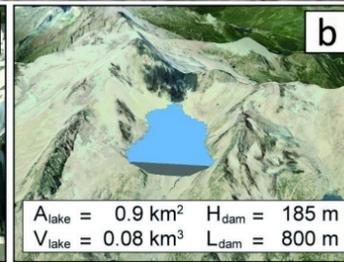
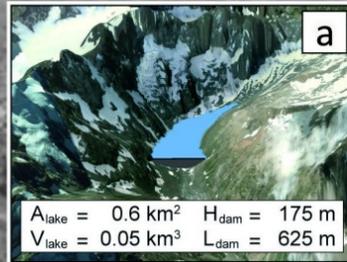


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Renewal of HP infrastructure in consideration of climate change and with exploitation of efficiency potentials enabled by modified flow regime.

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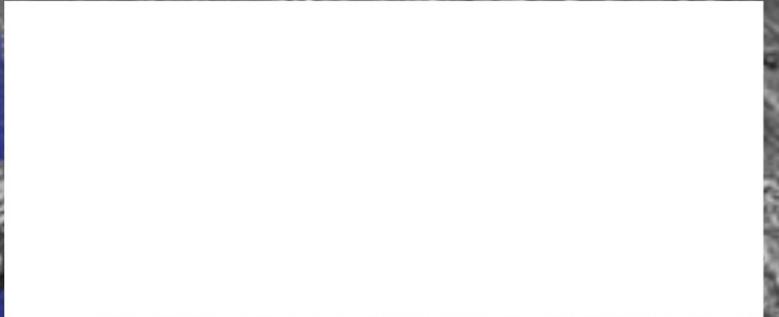
Renewal of HP infrastructure in consideration of climate change and with exploitation of efficiency potentials enabled by modified flow regime.



At renewal of concessions, higher water demand of other sectors downstream due to temporal water shortage must be considered. This also offers economic opportunities.



# Personal remarks and conclusions





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- too much focus on the mean annual HP production
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- too much focus on the mean annual HP production
- seasonal changes will be more pronounced and important

- climate change impacts cannot be assessed only from a water resources point of view
- strong link to the ecological debate

- extreme events (droughts, catastrophic mass movements, floods) will be much more important than the mean change

# Acknowledgement

## Collaboration



**ETH** zürich

**u<sup>b</sup>**

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