

# **GROUNDWATER STORAGE DYNAMICS AND RIVER DISCHARGE IN ALPINE CATCHMENT**

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## CONTEXT AND OBJECTIVES

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- Snow plays an important role for the hydrology of Switzerland
- 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, little is known yet about how dynamic groundwater storage in Alpine catchments could influences discharge regime changes
- **Key question:**
  - **Do catchments with contrasting amounts of dynamic groundwater storage show a different response to climate change?**

## RESEARCH APPROACH

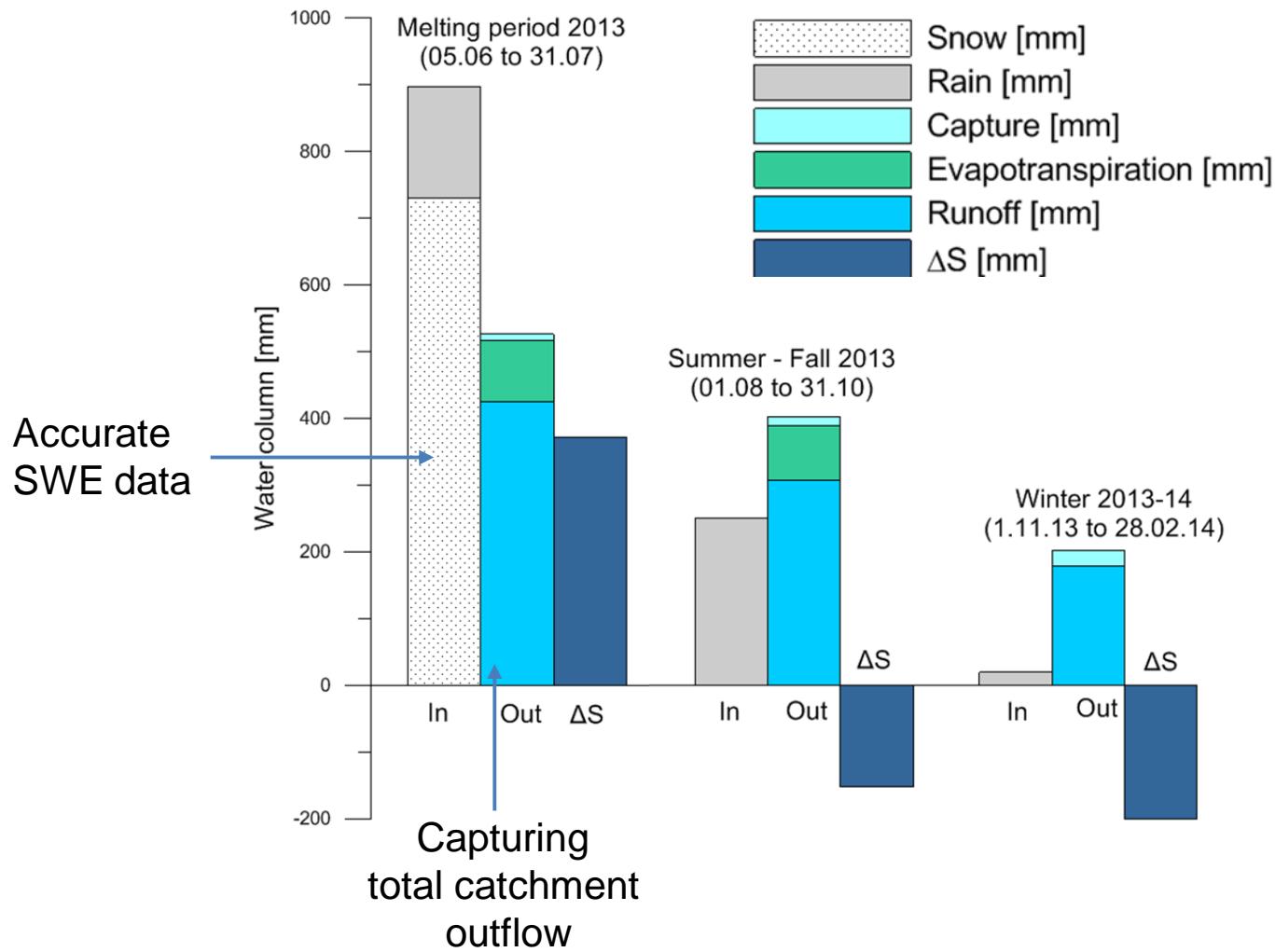
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- **WP1:** Develop and testing of a data-based methodology to quantify dynamic groundwater storage in Alpine catchments
- **WP2:** Evaluate relationship between dynamic groundwater storage and geology/hydrogeology
- **WP3:** Evaluate how the magnitude of dynamic groundwater storage influences the catchment response to climate change
- **WP4:** Extrapolation to other regions and conclusions for monitoring

- Water balance approach taking account groundwater information where available
  - $\Delta S = \text{Melt} + \text{Prec} - \text{Total Outflow} - \text{ET} - \text{Sublim} - \text{Use}$



# WP1: METHODOLOGY TO QUANTIFY DYNAMIC GROUNDWATER STORAGE AND TEST CASES

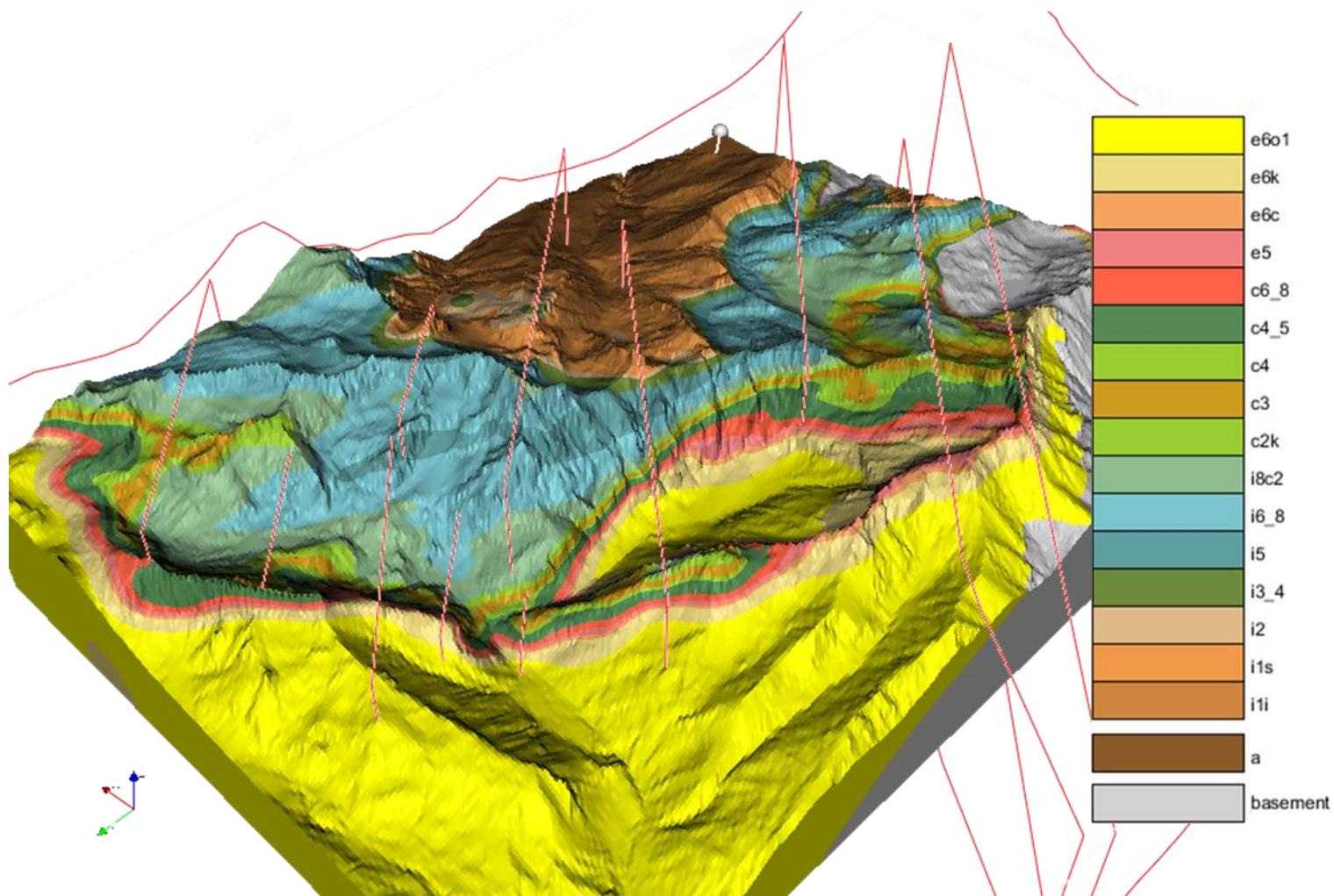


- **Application of methodology to around 10 catchments with**
  - Varying geological/hydrogeological conditions
  - Sufficient data to establish reliable water balances
- **Two research catchments and around eight other catchments**
  - Vallon de Rechy: Research site of Interreg Project STRADA (collaboration with Canton of Valais and CREALP)
  - Vallon de Nant: Research site of SNF Interdisciplinary project INTEGRALP and of various other UNIL projects

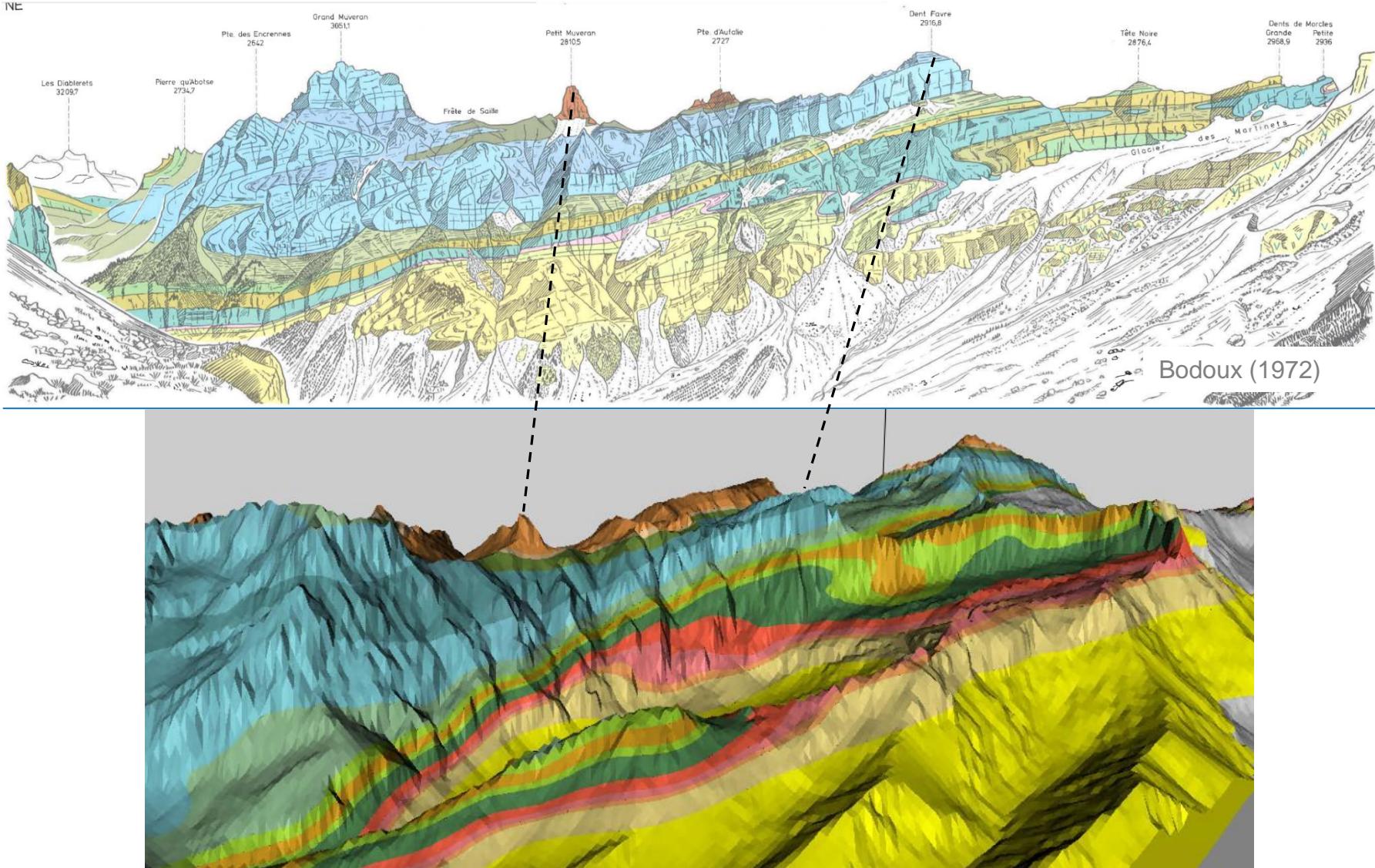
## VALLON DE NANT



# INTEGRALP: 3D GEOLOGICAL MODEL

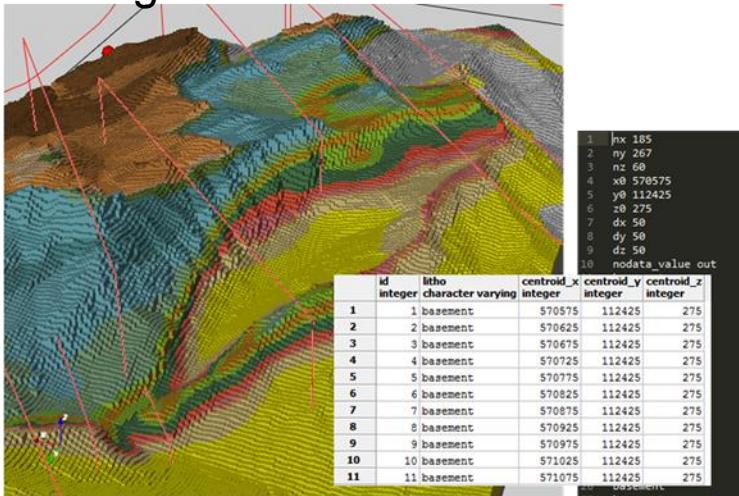


# INTEGRALP: 3D GEOLOGICAL MODEL

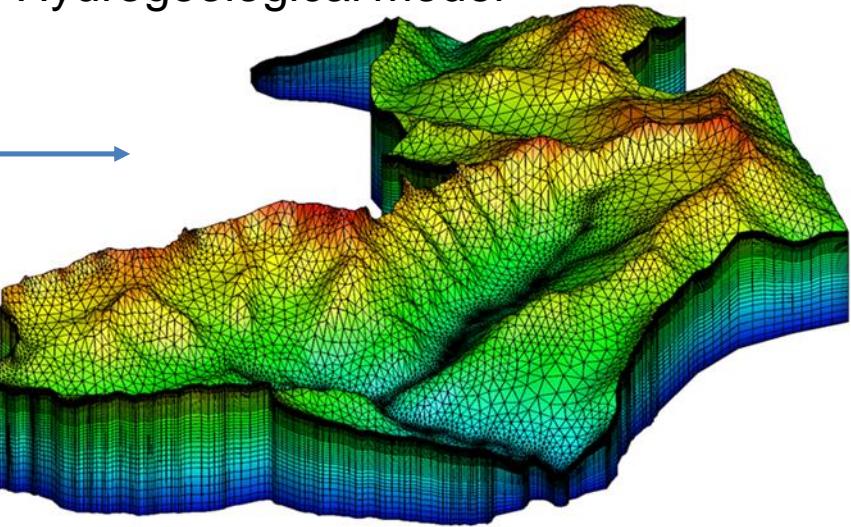


# FROM THE GEOLOGICAL TO THE HYDROGEOLOGICAL MODEL

Geological model



Hydrogeological model



Evaluation of impact of changes  
in snow dynamics

- **Selection of around five catchments with contrasting groundwater storage dynamics**
- **Evaluation of catchment response to CH2018 climate scenarios**
  - Fully coupled hydrological-hydrogeological model
  - Conceptual hydrological model

- **Extrapolation to other regions**
  - WP2: Geology/hydrogeology <-> Dynamic groundwater storage
  - WP3: Dynamic groundwater storage <-> Climate change response
  - Expected trends in other regions with similar geological/hydrogeological conditions
- **Conclusions for monitoring**
  - Needs for groundwater monitoring in alpine areas
  - Needs for SWE monitoring and integration into other monitoring programs

## COLLABORATION

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- **Centre for Hydrogeology and Geothermics CHYN, UNINE**
  - Daniel Hunkeler and Philip Brunner
- **University of Lausanne**
  - Bettina Schäfli
- **WSL**
  - Tobias Jonas
- **University of Zürich**
  - Jan Seibert
- **Activities at research catchments**
  - Other groups of UNIL
  - Canton of Valais
  - CREALP

**THANK YOU FOR YOUR ATTENTION**



**Neuchâtel**

## WP1: WATER BALANCE APPROACH

