Water isotopes for the improvement of low flow modeling

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UNI FREIBURG — HYDROLOGY

Sustainable water management
National Research Programme NRP 61
DROUGHT-CH

Workpackage 3: *Analysis of critical low-flow conditions and storage characteristics of Swiss catchments*

Selection of 20 Research Catchments

Ergolz 261 km²
mean elevation 590 m (a.s.l.)
Alluvium, Marl, Limestone
Forest, pastures, arable land

Isotope data
1 Hydrometric station: bi-weekly, started in July 2010
Precipitation: NAQUA

Murg 78 km²
mean elevation 650 m (a.s.l.)
51.6 % pastures, 30.6 % forest
Tertiary Molasse, Moraine, fluvioglacial sediments
69.7 % Cambisol, 16.9 % Regosol

Isotope data
1 Hydrometric station: bi-weekly, started in July 2010
2 Observation wells: monthly, started in February 2011
Precipitation: NAQUA

Emme 177 km², mean elevation 1189 m (a.s.l.)
Tertiary Molasse, Alluvium, Flysch
forest, pastures, bare rocks

Isotope data
2 Hydrometric stations: bi-weekly, started in June 2010
1 Observation well: irregularly, started in October 2010
Precipitation: NAQUA and 2 local gauges (bi-weekly)

Alp 46.6 km², mean elevation 1155 m (a.s.l.)
Tertiary Molasse, Flysch, Limestone
48.5 % forest, 30.6 % pastures, 9.9 % arable land
47.6 % Regosol, 27.5 % Cambisol, 20.8 % Gleysol

Isotope data
4 Hydrometric stations: bi-weekly, started in June 2010
1 Observation well: monthly, started in February/March 2011
Precipitation: NAQUA and local gauge (bi-weekly)

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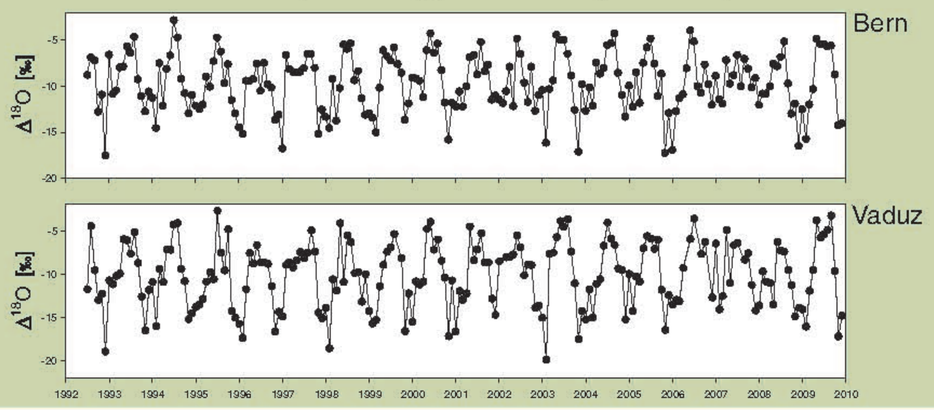
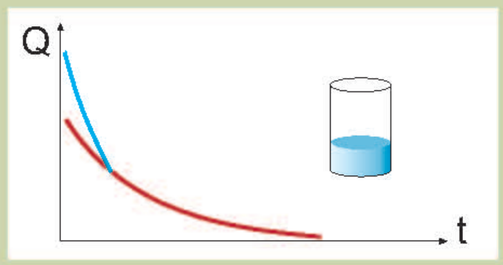
Conceptional modeling of streamflow and water transit time

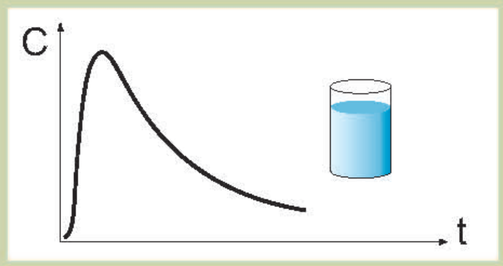
Stable isotope signal in precipitation



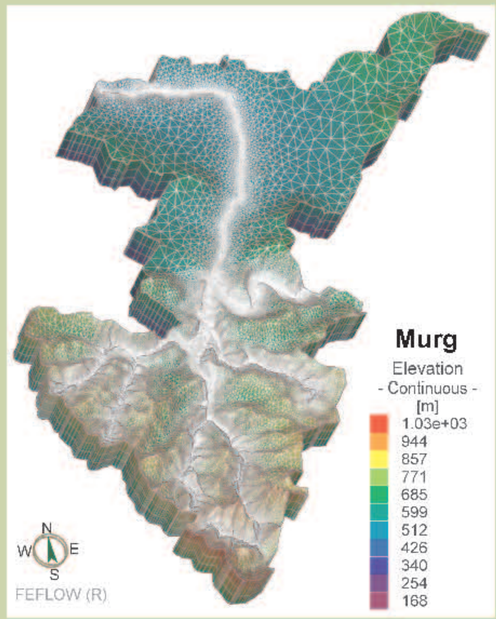
Surface and groundwater modeling of water flow and transport

Storage discharge





Groundwater model

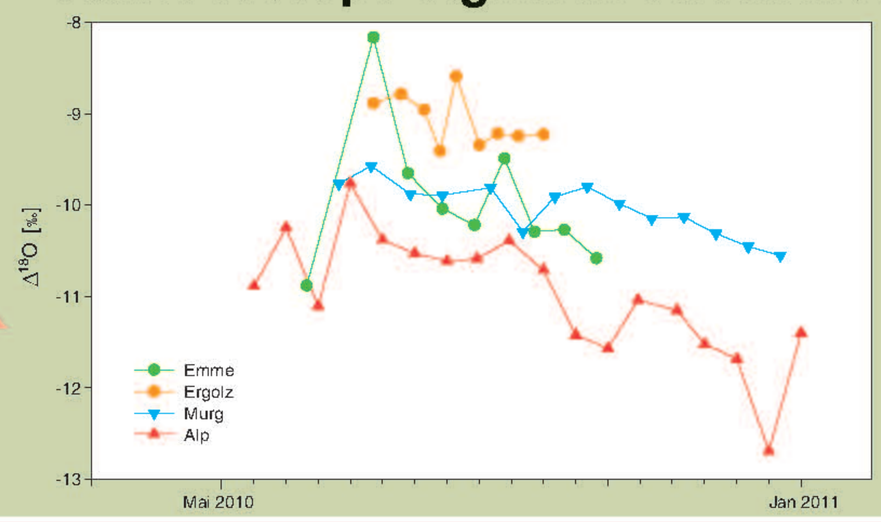


OBJECTIVES

Problem: During times of critical low flow, streamflow is fed by groundwater discharge to the stream.

Main objectives of workpackage 3
- to improve the understanding and modeling of groundwater discharge and hence baseflow
- to characterize the vulnerability of a variety of different catchments to drought

Stable isotope signal in streamflow



Conceptionally lumped simulation (transfer function) of isotope signals

Spatial temporal explicit simulation of isotope signals

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