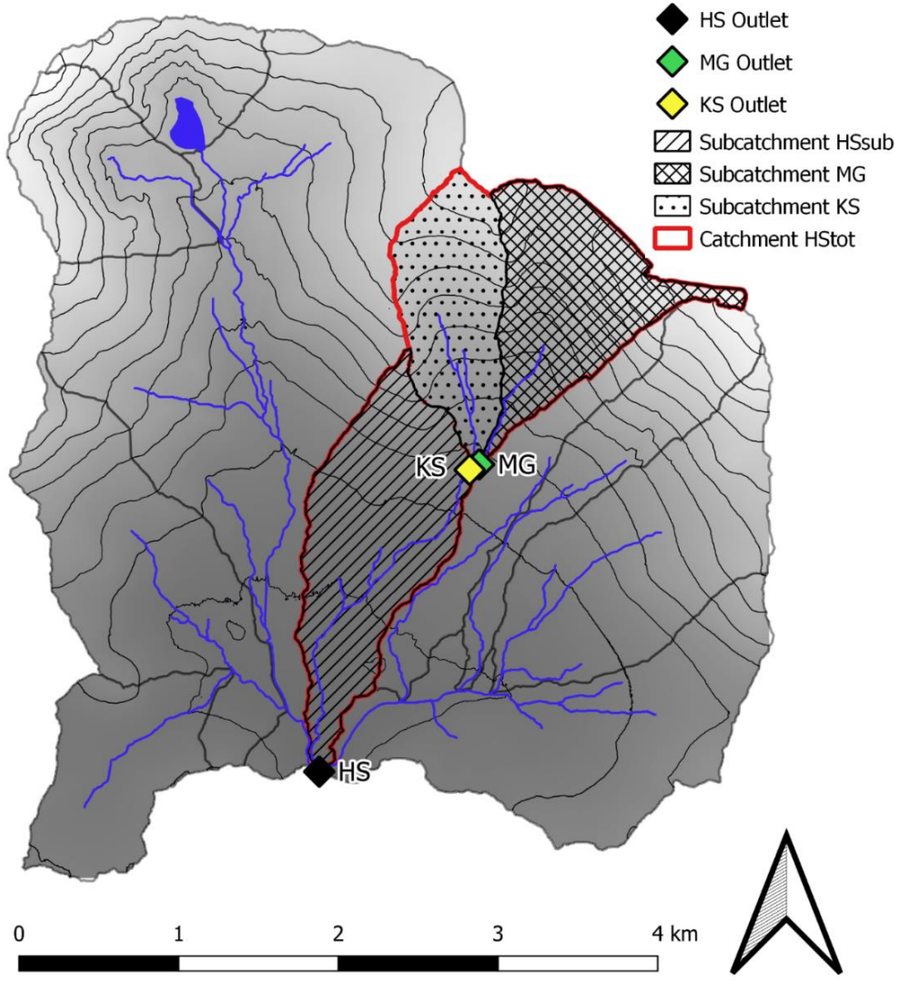
High-resolution DOC measurements indicate seasonal differences of the contribution of sub-catchments to DOC export

Katharina Blaurock[1], Burkhard Beudert[2], Benjamin S. Gilfedder[1], Jan H. Fleckenstein[3,4], Stefan Peiffer[1], Luisa Hopp[1]

[1] Department of Hydrology, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Germany
[2] Department of Nature Conservation and Research, Bavarian Forest National Park, Grafenau, Germany
[3] Hydrological Modelling Unit, Bayreuth Center of Ecology and Environmental Research (BayCEER), University of Bayreuth, Germany
[4] Deparment of Hydrogeology, Helmholtz Centre for Environmental Research (UFZ), Leipzig, Germany

Study Site



	MG	KS	HS_{sub}
Area (km^2)	1.1	0.9	1.5
Elevation (m a.s.l.)	876 - 1373	877 - 1279	771 - 1085
Slope (°)	15.8	14.5	7.4
Soils	Cambisols (55 %) Podzols (34 %)	Cambisols (79 %) Podzols (16 %)	Cambisols (65 %) Hydromorphic soils (35 %)
Vegetation	Rejuvenation (57 %) Deciduous forest (29 %) Mixed forest (15 %)	Deciduous forest (53 %) Rejuvenation (28 %) Mixed forest (17 %)	Deciduous forest (42 %) Rejuvenation (21 %) Coniferous forest (17%)

Methods

- In-stream UV-VIS-spectrometry → absorption

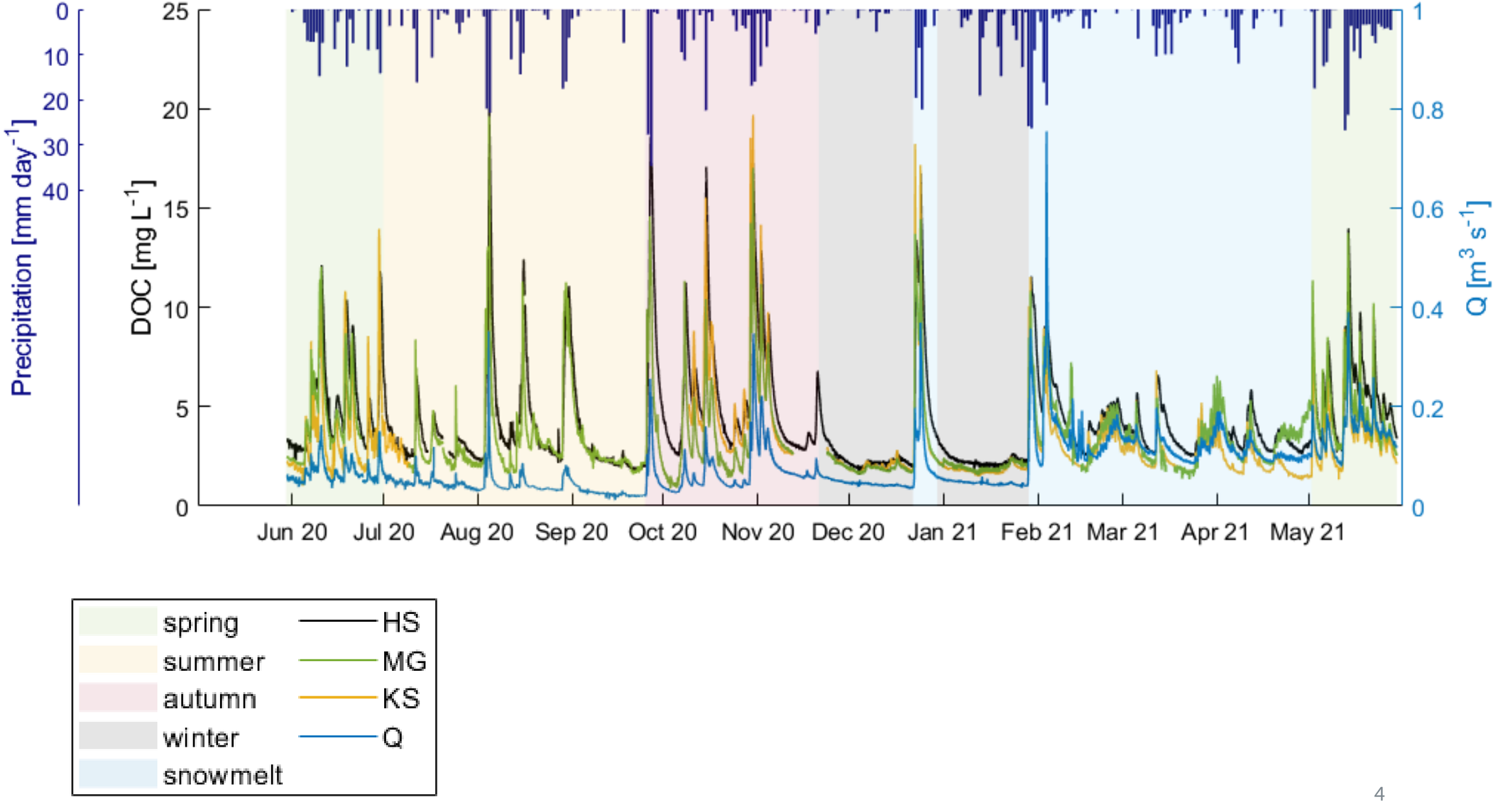
→ **DOC concentrations** at a 15 minutes intervall at the outlets of the three subcatchments

- **Discharge** measurements

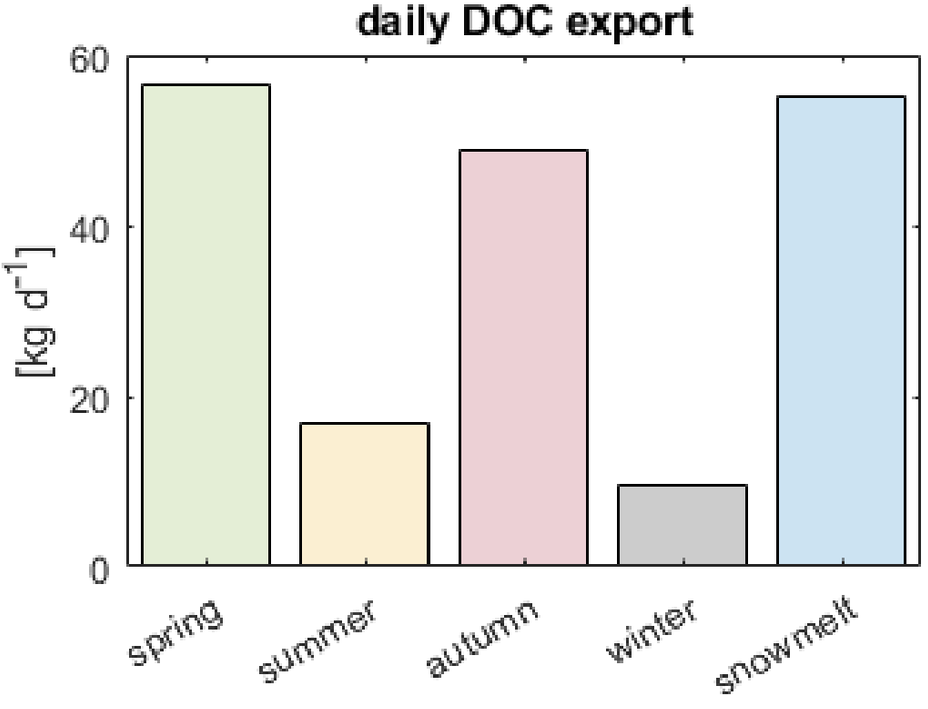
- Calculation of **DOC export** of the three subcatchments during five seasons over one year

- Delineation of **five seasons** in terms of precipitation pattern: winter, snowmelt, spring, summer, autumn

One year of measurements



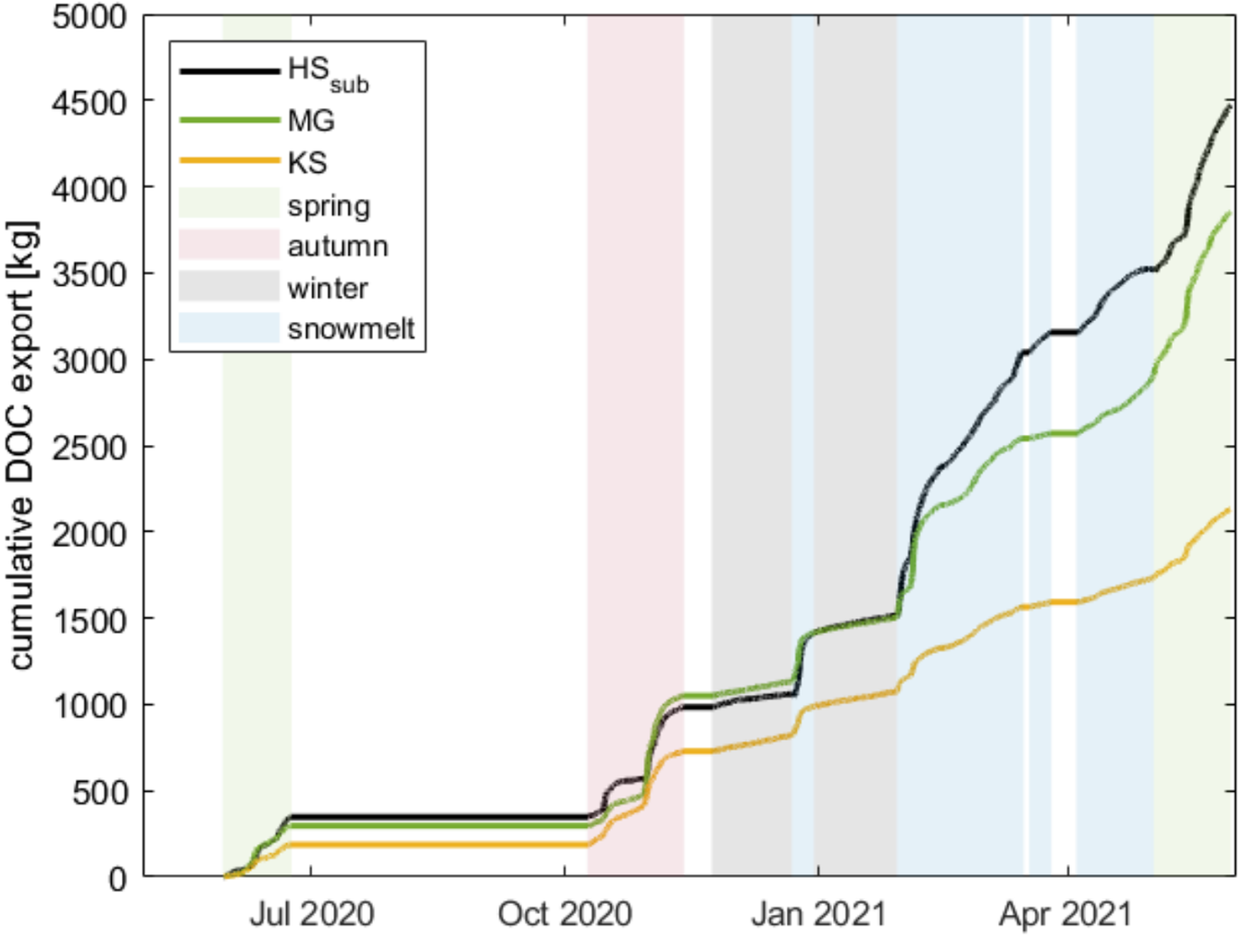
Total annual DOC export



- Total annual DOC export: 13760 kg or 3931 kg km^{-2}
- DOC production and hydrological connectivity influence seasonal DOC export

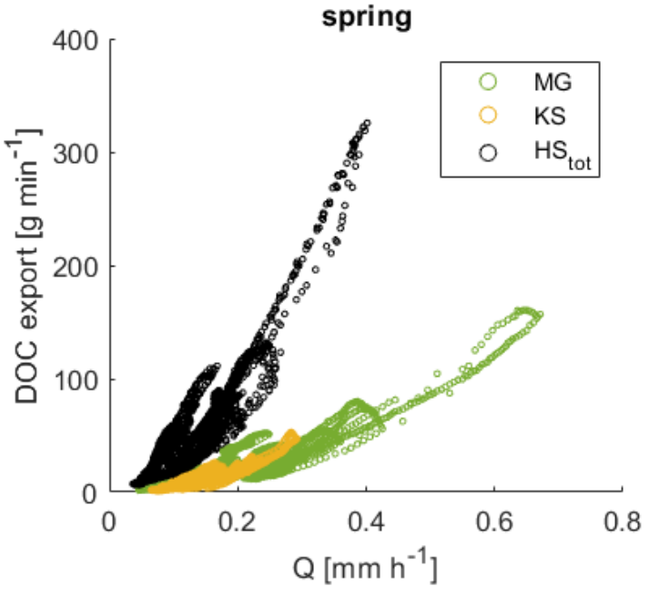
→ Are not only seasonal differences but also differences between the subcatchments?

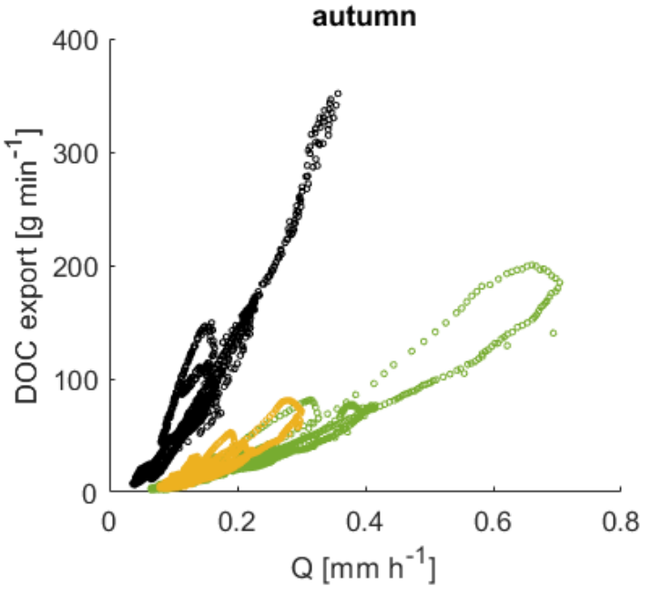
Cumulative DOC export of subcatchments

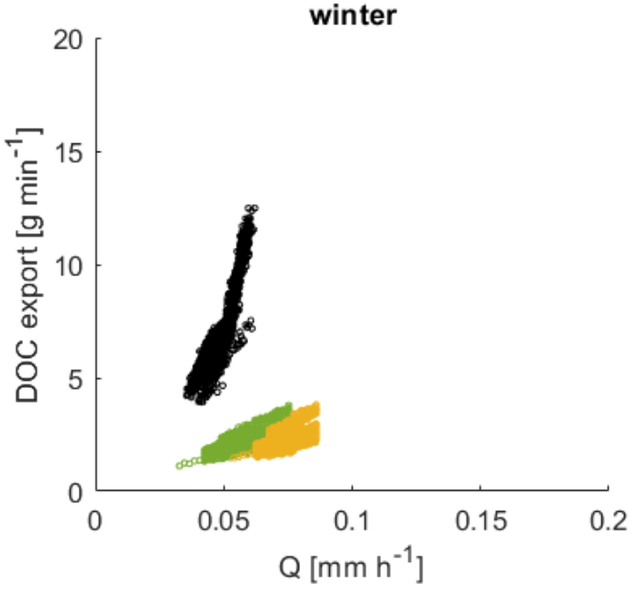


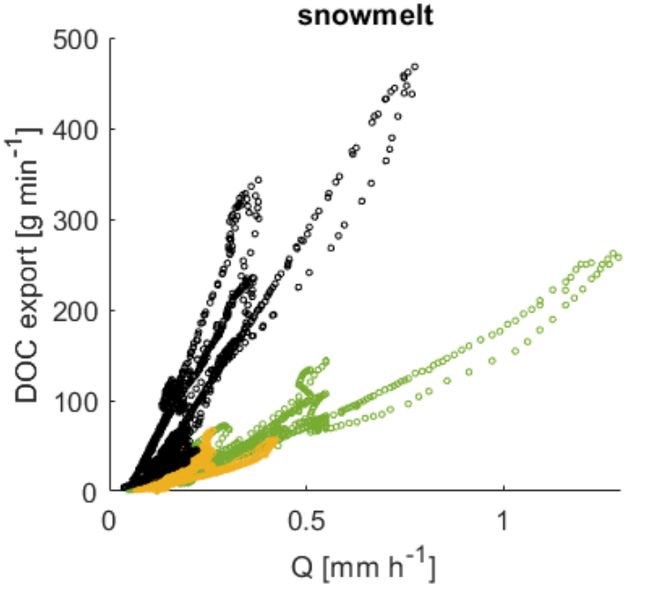
- Similar pattern of HS and MG
- Lower export of KS
- Snowmelt: HS overtakes MG
- Largest increase of DOC export during events in spring and autumn and at the beginning of snowmelt

DOC export rates



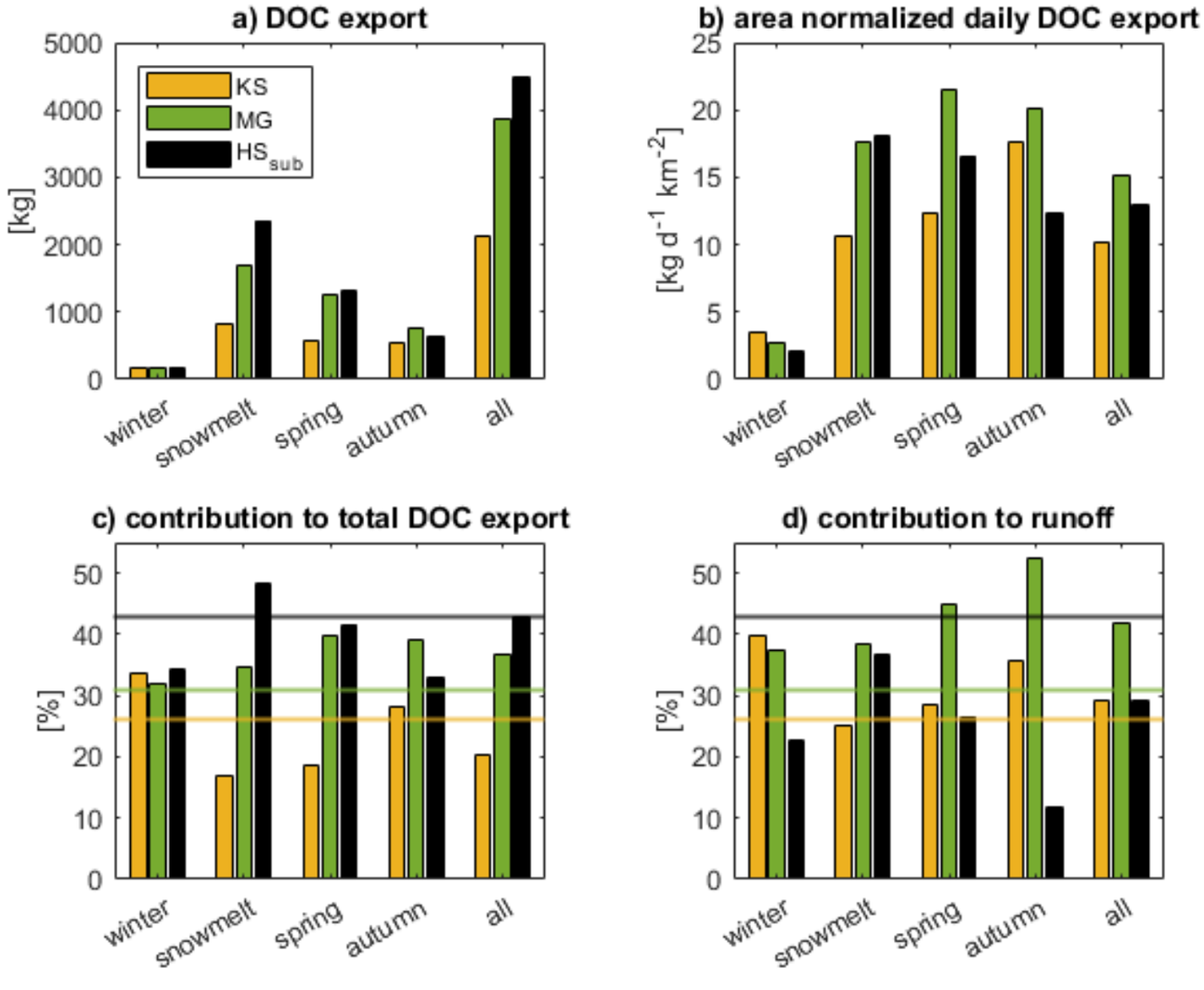






- Highest DOC export rates during snowmelt
- Similar slopes of MG and KS
- Highest runoff generation at MG

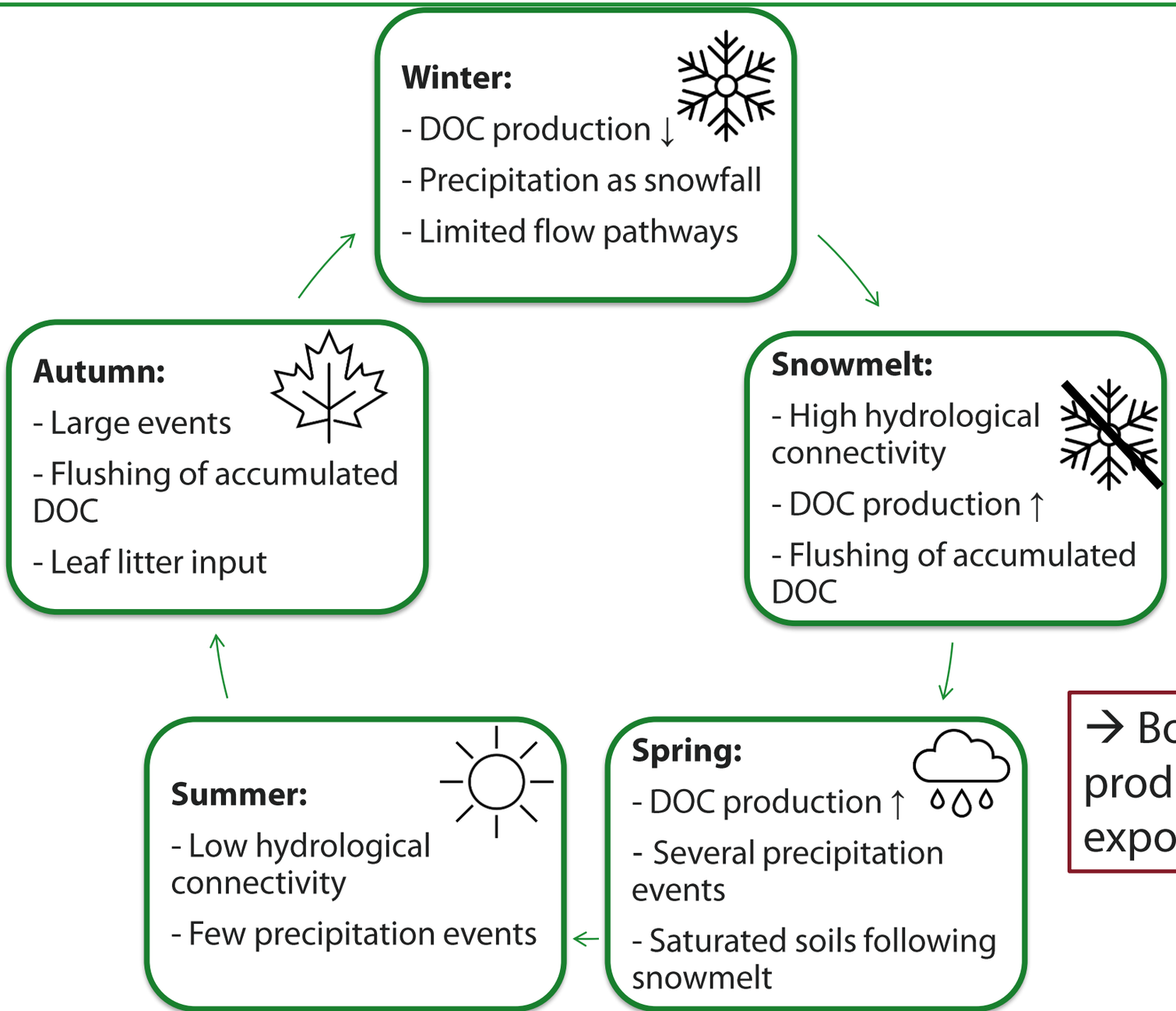
Seasonal contribution of subcatchments to total DOC export



- MG exported more than expected during all seasons
- HS exported less than expected during almost all seasons
- KS exported more during autumn and winter and less during snowmelt and spring

Horizontal lines refer to area percentage of entire catchment

Summary: Seasonal differences



→ Both water fluxes and DOC production drive the DOC export

Summary:
Differences between subcatchments

- During snowmelt and spring: Contribution close to expected values

→ high **hydrological connectivity**

- KS becomes important in autumn and winter

→ **litter fall** from decidous trees

- Generally higher contribution of MG

→ high **runoff generation** due to topography

- Generally lower contribution of HS

→ dependent on **hydrological connectivity**

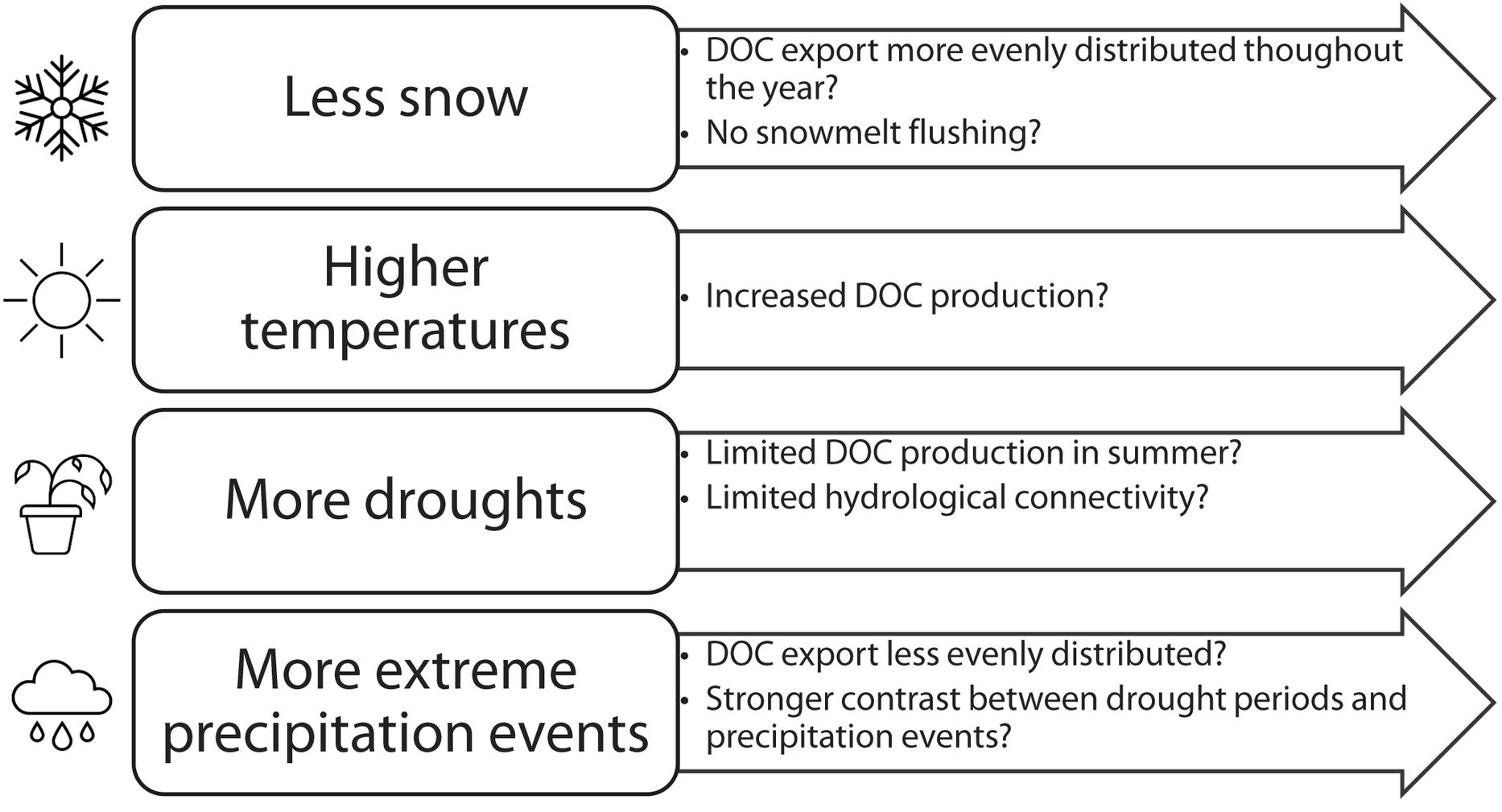
→ Differences in

1. vegetation
2. topography and
3. hydrological connectivity

influence the contribution to total DOC export.

Implications for the future

Climate change could lead to …



Nationalpark Bayerischer Wald

University of Bayreuth
Department of Hydrology

UFZ HELMHOLTZ Centre for Environmental Research

Bayceer
Bayreuth Center of Ecology and Environmental Research

UNIVERSITÄT BAYREUTH

Take Home Message

- Seasonal DOC export is influenced by DOC production & hydrological connectivity
- The contribution of the subcatchments to total DOC export is influenced by topography, hydrological connectivity & vegetation