



The International Commission for the Hydrology of the Rhine basin

# Opening and Welcome by CHR President

Prof. Dr. Helmut Habersack, University of Natural Resources and  
Life Sciences Vienna

CHR Symposium 1./2.6.2022, Olten



Schweizerische Eidgenossenschaft  
Confédération suisse  
Confederazione Svizzera  
Confederaziun svizra

Bundesamt für Umwelt BAFU  
Office fédéral de l'environnement OFEV  
Ufficio federale dell'ambiente UFAM  
Uffizi federal d'ambient UFAM

# Welcome by Switzerland

Dr. Carlo Scapozza, Federal Office for the Environment

CHR Symposium 1./2.6.2022, Olten



# Hydrological scenarios in Switzerland (Hydro-CH2018)



## Changes in runoff

Snow and glaciers will lose importance in Switzerland's water balance.

## Water shortages in summer

Drought in summer and autumn will lead to more water scarcity in some regions.

## Growing hazard potential

Natural hazards such as highwater levels, flooding and landslides will increase.

## Aquatic life at risk

The rise in water temperatures will threaten biodiversity in and around water bodies.



#### **NCCS Webplattform**

Allgemeine Informationen zum Klimawandel, Klimaszenarien und Anpassung. Zentraler Zugang zu den Daten via Webatlas und zu allen Produkten und Publikationen aus Hydro-CH2018.  
<https://www.nccs.admin.ch>



#### **Wissenschaftlicher Synthesebericht**

Auswirkungen des Klimawandels auf die Schweizer Gewässer. Hydrologie, Gewässerökologie und Wasserwirtschaft, Bundesamt für Umwelt BAFU, Bern. Umwelt-Wissen Nr. 2101: 135 S.  
[www.nccs.admin.ch/hydro\\_de](http://www.nccs.admin.ch/hydro_de)



#### **Hydrologischer Atlas der Schweiz**

Zugang zu Daten, Grafiken und Indikatoren aus Hydro-CH2018. Daten auch verfügbar auf dem Datenportal des Bundes.  
[www.hydromapscc.ch](http://www.hydromapscc.ch)



**#HydroCH2018**



The International Commission for the Hydrology of the Rhine basin

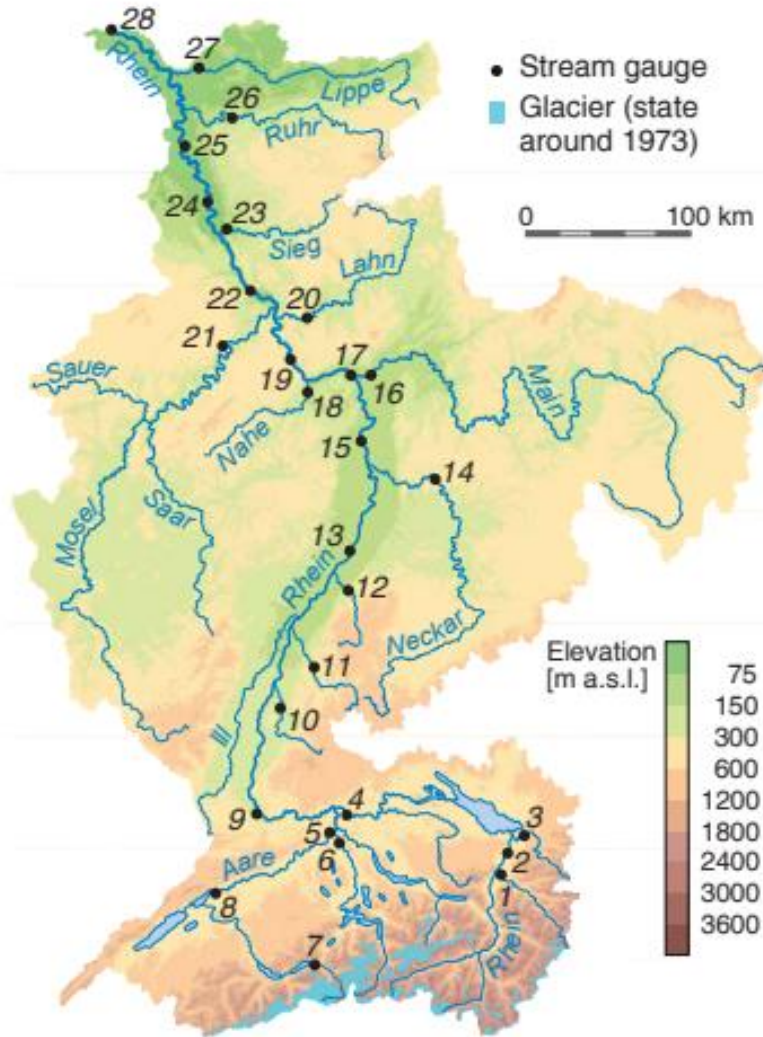
# The ideas behind the ASG Project

Dr. Petra Schmocker-Fackel, Federal Office for the Environment  
ASG project manager

CHR Symposium 1./2.6.2022, Olten



# The River Rhine: Key facts



The River Rhine ...

- originates in the Swiss Alps and flows over a **distance of 1,233 km** into the North Sea
- Its catchment area spans **nine countries**
- Around **58 million people** live in its basin area
- Its water is used as **drinking water, power generation, irrigation, industrial production, transportation**
- Is one of the **most intensively-utilized rivers** in Europe
- Is an **important habitat for wildlife and plants**



# CHR Strategy

## THE CHR'S MISSION

The CHR provides a scientific knowledge base for the hydrology of the Rhine catchment area

### Thematic focus 2020-2030

(2) The effects of climate change, land and water-use, and socio-economic changes within the riverine system



# More frequent droughts?

2003



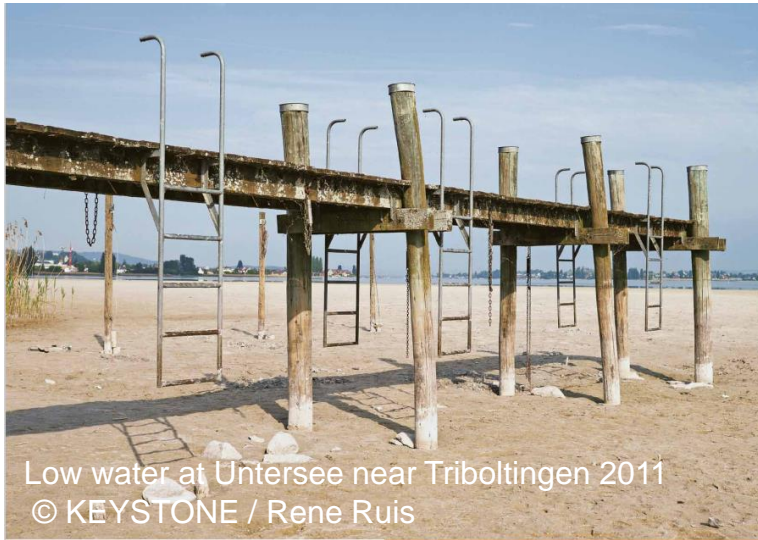
Töss, 28. August 2003, Bild: C. Schär

2018



Frachtschiff mit halber Ladung bei St. Goarshausen am Mittelrhein, Nov. 2018 Andreas Rentz / Getty Images

2011



Low water at Untersee near Triboltingen 2011 © KEYSTONE / Rene Ruis

2015



Das Sürther Bootshaus hat kaum noch eine Handbreit Wasser und Schwimmkörpern (August 2015). Foto: Worring © IPCC AR6



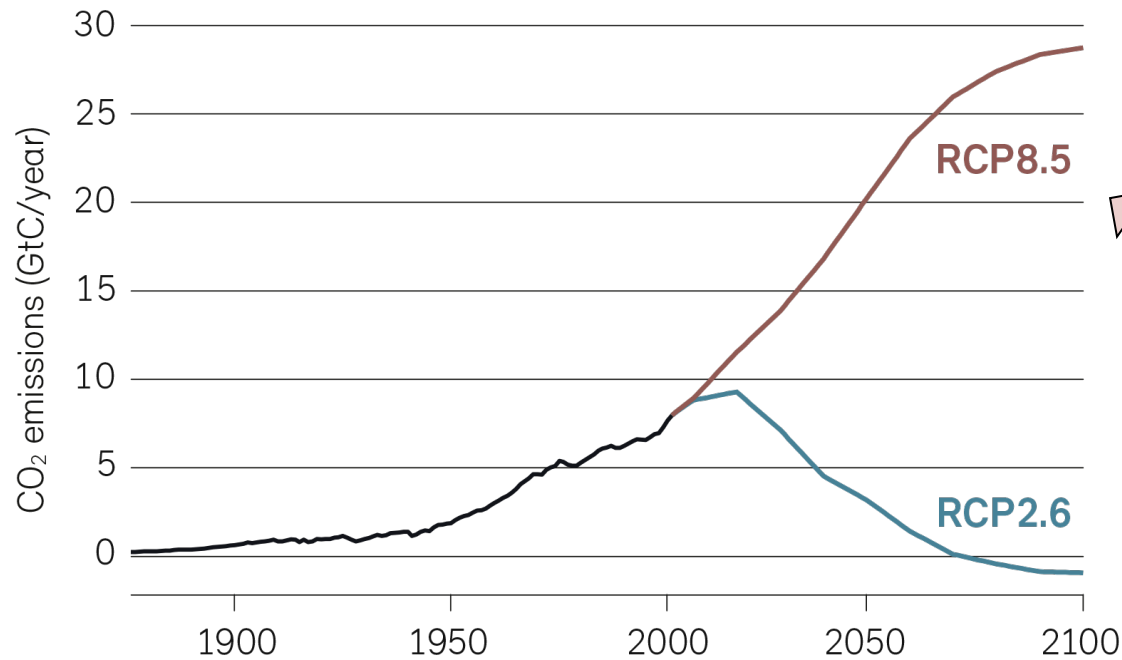


# What will our future climate be like?

## Emission scenarios

Global net CO<sub>2</sub> emissions from fossil and industrial sources.

Source: Adapted from IPCC 2013/WGI/Box 1.1/Figure 3b



Without climate change mitigation  
(Business as usual)

Worst-case scenario  
used in ASG (RCP8.5)

With climate change mitigation  
(Paris agreement)

- With climate change mitigation RCP2.6
- Without climate change mitigation RCP8.5



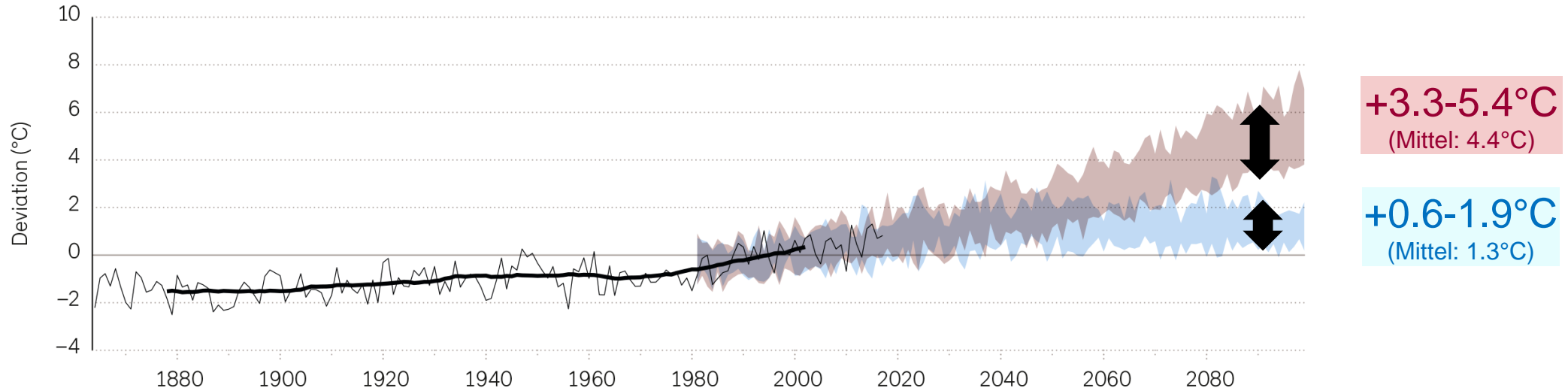
# Larger temperature increase in the Alps

## Temperature

### Deviation from norm periode 1981-2010

Switzerland Annual mean

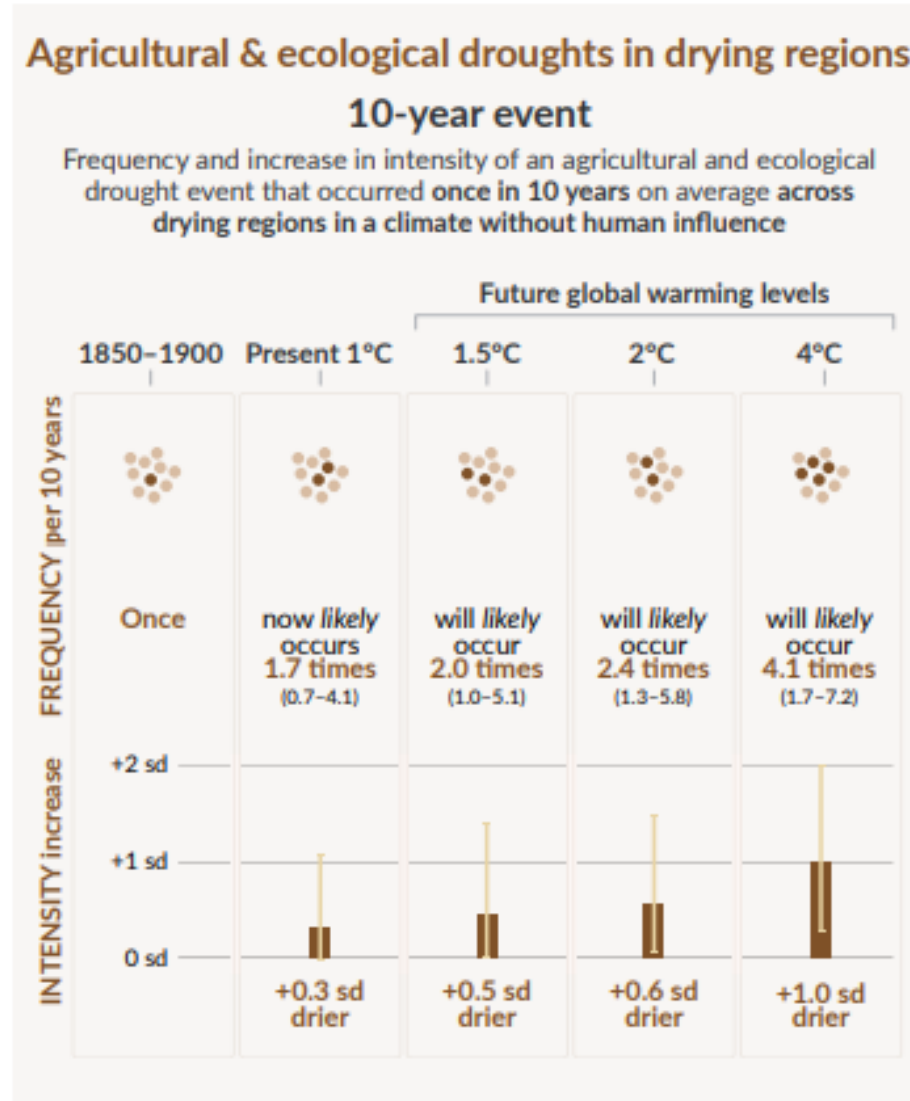
- Observations
- 30-year moving average
- With climate change mitigation RCP2.6
- Without climate change mitigation RCP8.5



Bildnachweis: NCCS (2018)

# IPCC AR 6: Newest Assessment

## Increase in droughts



© IPCC AR6



# What are the consequences of these changes on the streamflow of the Rhine?

How much has (low flow) runoff in the river Rhine changed in the last century?

ASG 1

How much have snow and glacier melt contributed to runoff especially during low flow?

How will the runoff in the river Rhine change in a future climate (focus on low flow)?

ASG 2

How much will the contribution of snow and glacier melt to runoff and especially low-flow change in a future climate?



# We are looking forward to hear from the results!



Internationale Kommission für die Hydrologie des Rheingebietes  
International Commission for the Hydrology of the Rhine Basin


**Abflussanteile aus Schnee- und Gletscherschmelze im Rhein und seinen Zuflüssen vor dem Hintergrund des Klimawandels**

**Synthesebericht**

Kerstin Stahl, Markus Weiler, Irene Kohn, Daphné Freudiger, Jan Seibert, Marc Vis, Kai Gerlinger, Mario Böhm



Bericht Nr. I-25 der KHR




Internationale Kommission für die Hydrologie des Rheingebietes  
International Commission for the Hydrology of the Rhine Basin

**Impact of climate change on the rain, snow and glacier melt components of streamflow of the river Rhine and its tributaries**

**Synthesis report**

Kerstin Stahl, Markus Weiler, Marit van Tiel, Irene Kohn, Andreas Hänsler, Daphné Freudiger, Jan Seibert, Kai Gerlinger, Greta Moretti



Report No. I-28 of the CHR



# Thanks to

## Financing Institutions in CHR

Bundesamt für Umwelt BAFU, Switzerland

Bundesanstalt für Gewässerkunde BFG, Germany

Bundesministerium für Landwirtschaft, Regionen und Tourismus BMRLT, Austria

Rijswaterstaat RWS, Netherlands

## Project committee CHR

Jörg Belz (CHR project leader ASG1) and Peter Krahe, BFG

Gabriele Müller, BMRLT

Petra Schmocker-Fackel (CHR project leader ASG2), BAFU

Eric Sprokkereef and Roel Burgers, RWS



# Thanks to

## **Steering committees ASG 1 and ASG 2**

Dr. Vincent Beijk (RWS, NL)

Dr. Jules Bersma (KNMI, NL)

Dr. Gerhard Brahmer (Land Hessen, D)

Dr. Manfred Bremicker und (LUBW Baden-Württemberg, D)

Prof. Dr. Hans-Peter Nachtnebel (Universität für Bodenkultur Wien, A)

Dr. Felix Naef (ETH Zürich, CH)

Manuela Nied (LUBW Baden-Württemberg, D)

Dr. Bruno Schädler (Universität Bern, CH)

Prof. Dr. Wolfgang Schöner (Universität Graz, A)

Dr. ir. Frederiek Sperna Weiland (Deltares, NL)

Dr. Judith ter Maat (Deltares, NL)

## **Organising committee**

Dr. Fabia Hüsler (BAFU, CH)

Ute Menke and Roel Burgers (RWS and CHR Secretariat, NL)



<b>Programm</b>		<b>Convenor</b>
<b>Session 1</b>	<b>Modelling climate change in the Rhine basin: the big picture</b>	Eric Sprokereef
<b>Session 2</b>	<b>Climate change impact on hydrology: challenges in modelling the cryosphere</b>	Gabriele Müller
<b>Session 3</b>	<b>Climate change impact on hydrology of large river basins: upstream-downstream linkages</b>	Jörg Belz
<b>Session 4</b>	<b>Implications of climate change on water bodies and water management</b>	Carlo Scapozza
<b>Moderated roundtable discussion on implications and future needs with CHR representatives or major stakeholder delegates</b>		Helmut Habersack





# 14:00 – 15:00 Session 1

## Session 1 : Modelling climate change in the Rhine basin: the big picture

Chair: Eric Sprokkereef

Current and future challenges in climate modelling and implications for future research in hydrology	Dr. Sven Kotlarski ( <a href="#">MeteoSwiss CH</a> )
ASG: Bi-and multi-variate bias correction: effect on compound climate indices and specifically on snow/rain partitioning for hydrological impact modelling	Dr. Andreas <a href="#">Hänsler</a> (Uni Freiburg D)
Future changes in weather patterns and implications for low flow	PD Dr. Christoph Beck (Uni Augsburg D)



# 15:30 – 16:50 Session 2

Session 2: Climate change impact on hydrology: challenges in modelling the cryosphere      Chair: Gabriele Müller

Glacier change in the Alps	Prof. D. Farinotti (ETHZ/WSL CH)
Snow trends/changes in snowpack: how well are these simulated with models?	Prof. W. Schöner (Uni Graz A)
ASG $Q_{ice}$ , $Q_{snow}$ , $Q_{rain}$ : modelling streamflow components in the Rhine's headwaters with a modified HBV	Dr. Daphné Freudiger (Uni Zürich CH und Freiburg D)
ASG: Modelling future streamflow components along the Rhine (LARSIM)	Dr. Kai Gerlinger (Hydron AG D)

## 16:50 – 17:20 Discussion Session 1&2

## 17:20 – 17:30 Synthesis Day 1 and closing



# 8:30 – 9:30 Session 3

Session 3: Climate change impact on hydrology  
of large river basins: upstream-downstream linkages

Chair: Jörg Belz

ASG: Project results for low flows and examples of specific water use thresholds	Prof. Dr. Markus Weiler (Uni Freiburg D)
ASG: Combining climate scenario and stresstest modelling to understand upstream contributions to downstream low flows	Dr. Marit van Tiel (Uni Freiburg D)
Assessing the impacts of climate change and climate variability on hydro-meteorological extreme events - results and lessons learned from the ClimEx-projects in the Upper Danube and Main river basins	Dr. Raul Wood (LMU München D)

## 9:30 – 9:50 Discussion Session 3

## 9:50 – 10:10 Coffee Break



# 10:10 – 11:30 Session 4

**Session 4: Implications of climate change on water bodies and water management**

**Chair: Carlo Scapozza**

How is the climate changing in rivers and lakes?	Dr. M. Schmid (Eawag CH)
Climate change and its implications for hydropower.	Dr. Christian Dupraz (Bundesamt für Energie CH)
Tracking climate impact chains across sectors in Germany - The case of low flow situations of the River Rhine.	Dr. Enno Nilson (Bundesanstalt für Gewässerkunde D)
Implications of climate change on water management in the Netherlands.	Vincent Beijik (Rijkswaterstaat NL)



# 11:30 – 12:15 Roundtable Discussion & Closing

Moderated roundtable discussion on implications and future needs with  
CHR representatives or major stakeholder delegates

*Moderator: Prof. Dr. H. Habersack*

*Panel:*

- *Dr. Petra Herzog (Bundesanstalt für Gewässerkunde, D)*
- *Prof. Dr. Kerstin Stahl (Universität Freiburg, D)*
- *Adrian Schmid-Breton (IKSR)*
- *Vincent Beijk (Rijkswaterstaat, NL)*
- *Dr. Christian Dupraz (Bundesamt für Energie, CH)*

## 12:40 Adjourn