International Commission for the Hydrology of the Rhine basin (CHR)

Content

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History of CHR

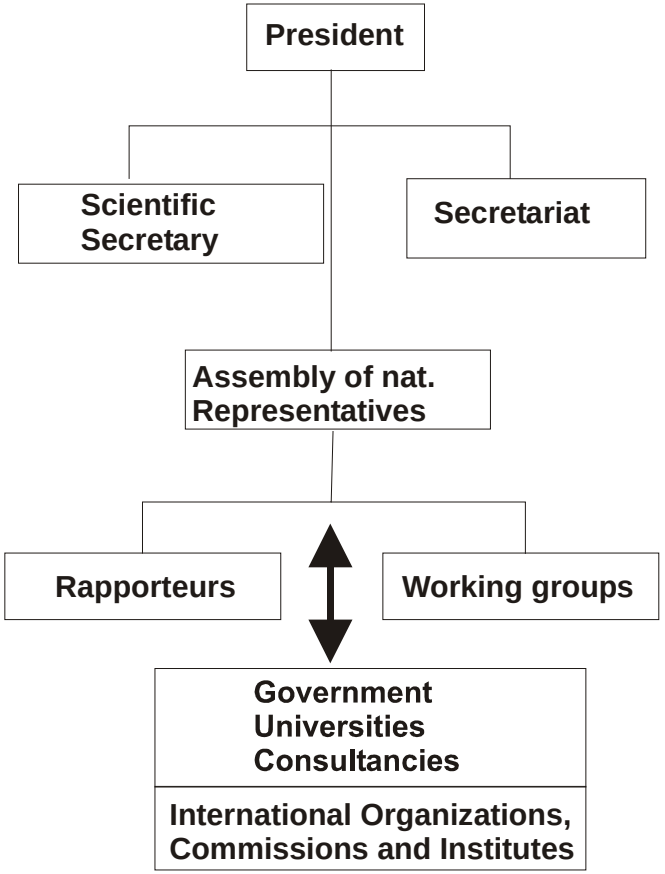
- Founded in 1970 the framework of the International Hydrological Decade of UNESCO
- Co-operation on the basis of a memorandum of understanding (‘Note Verbale’) between the Ministries of Foreign Affairs of the member states
- Since 1975 co-operation in the framework of the International Hydrological Program (IHP) of UNESCO and the Hydrological Water Resources Program (HWRP), of WMO

Mission and tasks

- Extension of knowledge about the hydrology of the Rhine basin
- Contribution to solving cross-border hydrological problems
- CHR initiates and carries out hydrological studies for sustainable development of the Rhine basin and makes the results of these studies available to responsible authorities in the Rhine riparian states and to the EU. This way CHR tries to contribute to the development and evaluation of water management strategies.

Organization (1)

- CHR is a permanent, independent, international commission with the entire Rhine basin as study area
- CHR is a foundation, registered in The Netherlands

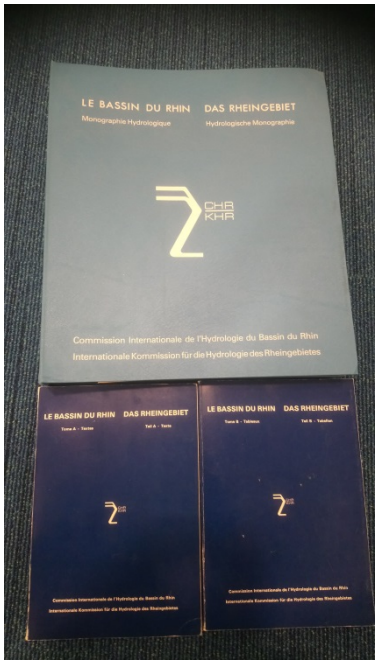


Organization (2)

- **Co-operating institutes**
  - Switzerland
    - Federal Office for the Environment (FOEN), Berne
  - Austria
    - Hydrological Bureau, Vienna
    - Hydrological Service of the federal state Vorarlberg, Bregenz
  - Germany
    - Federal Institute of Hydrology (BfG), Koblenz
    - German National IHP/HWRP Committee, Koblenz
    - State Institute for Environment and Geology of the federal state Hessen, Wiesbaden
  - France
    - IRSTEA, Paris
    - IFSTTAR, Nantes
  - Luxembourg
    - National Water Management Service, Esch-sur-Alzette
  - Netherlands
    - Rijkswaterstaat, Lelystad
    - Deltares, Delft

Completed projects (1)

- 1978: Monograph of the Rhine basin
  - Description of geography, geology, climatology, hydrological regime, extreme events, hydrological models
  - Book of tables with meteorological and hydrological time series
  - Maps (A2-format)

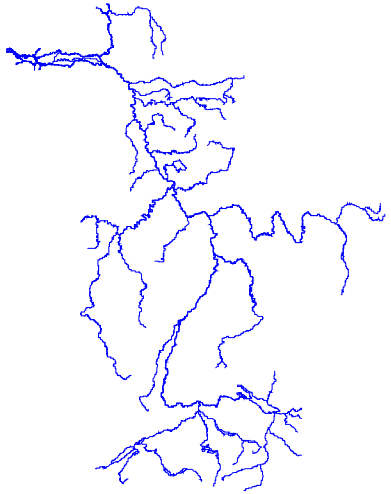


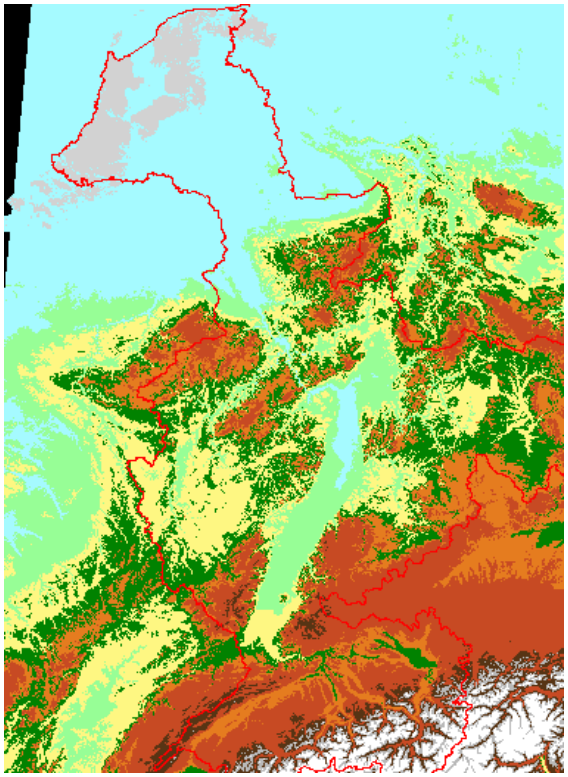
Completed projects (2)

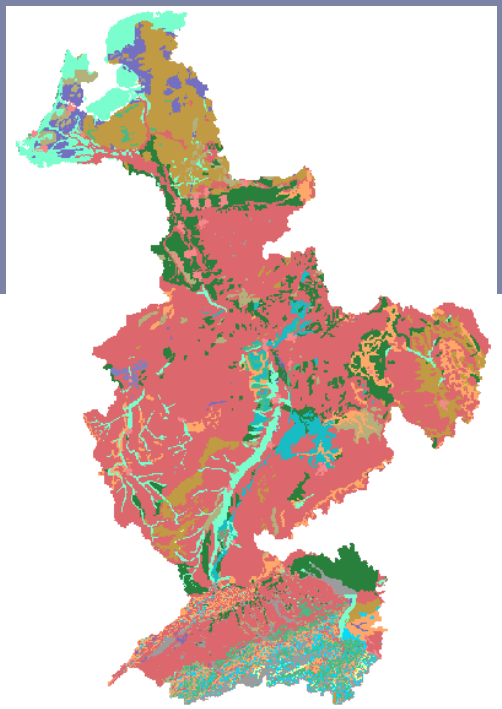
After 1978: descriptive hydrological studies

- Quantitative precipitation analysis
- Quantitative discharge analysis
- Description of hydrological forecasting models
- **Compilation of a geographical information system for the Rhine basin**
- Probabilities of floods and droughts
- Survey of hydrological distribution functions
- Description of anthropogenic influences in the Rhine basin
- **Effects of climate change on the discharge regime**
- Effects of land use changes on the discharge regime
- Comparison of hydrological models for water balance simulation
- **Several projects concerning the Rhine Alarm Model**
- Description of existing flood warning systems
- Description of methods for the estimation of extreme discharges
- Development of methods for the analysis of effects of flood reduction measures
- **From the source to the mouth – Compilation of a sediment balance from the source of the Rhine to the mouth in the North Sea**
- **Lake Constance as flood and drought retention basin – a literature study**

Geographical Information System (GIS)







Station	ID	Date	Quality le	Coverage (	Rel humidi	Vapour pre	Air temper	Air pressu	Windspee	Air tempe	Air temper	Air temper	windspee	Precipitat	Precipitati	Sun shine	Snow heig	eor
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Impact of climate change on hydrology


Internationale Kommission für die Hydrologie des Rheingebietes

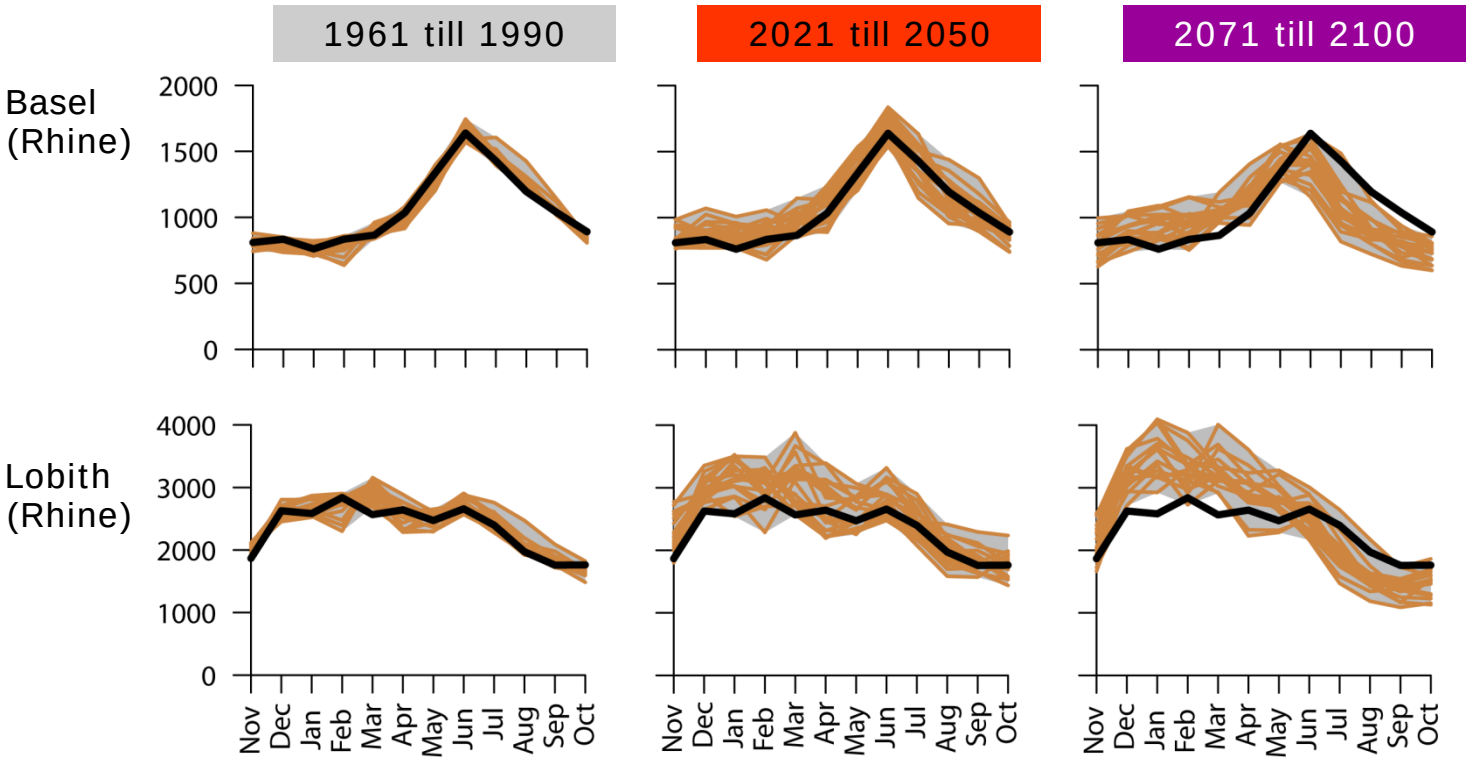
International Commission for the Hydrology of the Rhine Basin

Assessment of Climate Change Impacts on Discharge in the Rhine River Basin:

Results of the RheinBlick2050 Project

Impact of climate change on hydrology

MQ [m³/s], 30-year long term mean monthly discharge



More rain in wi
less snowpack /
-storage
shift to pluvial
regime

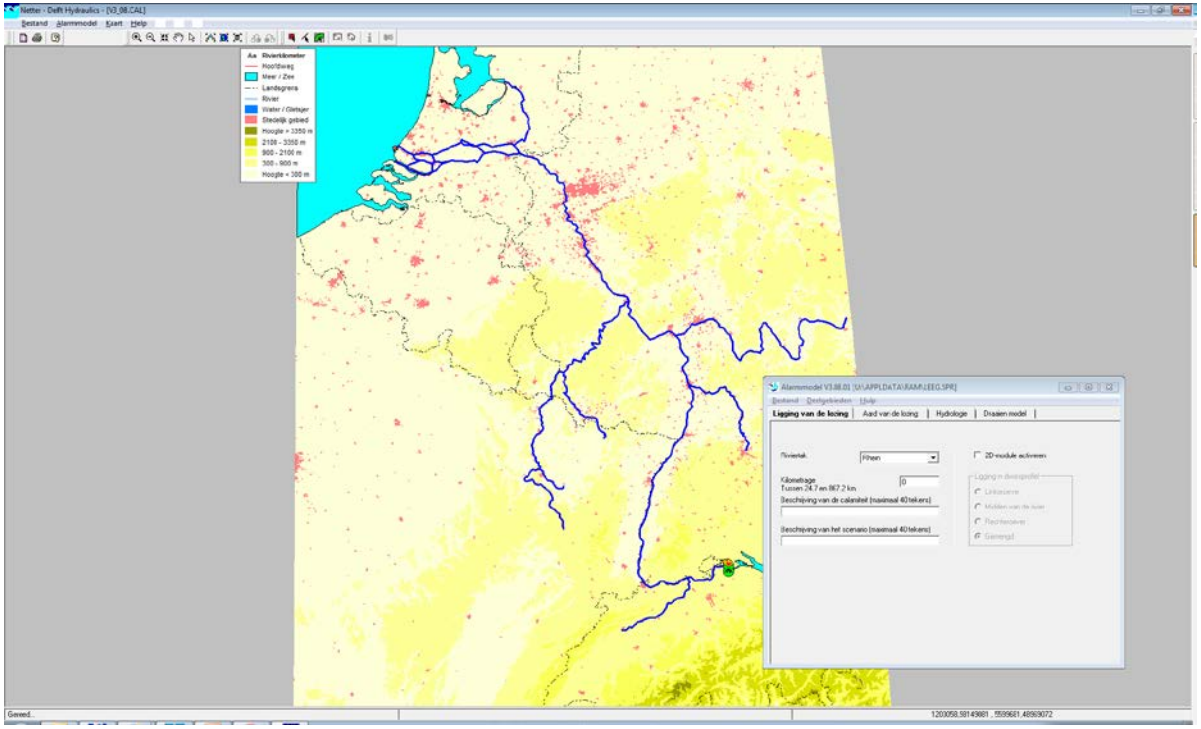
More rain in wi
less rain in su

Impact is evident

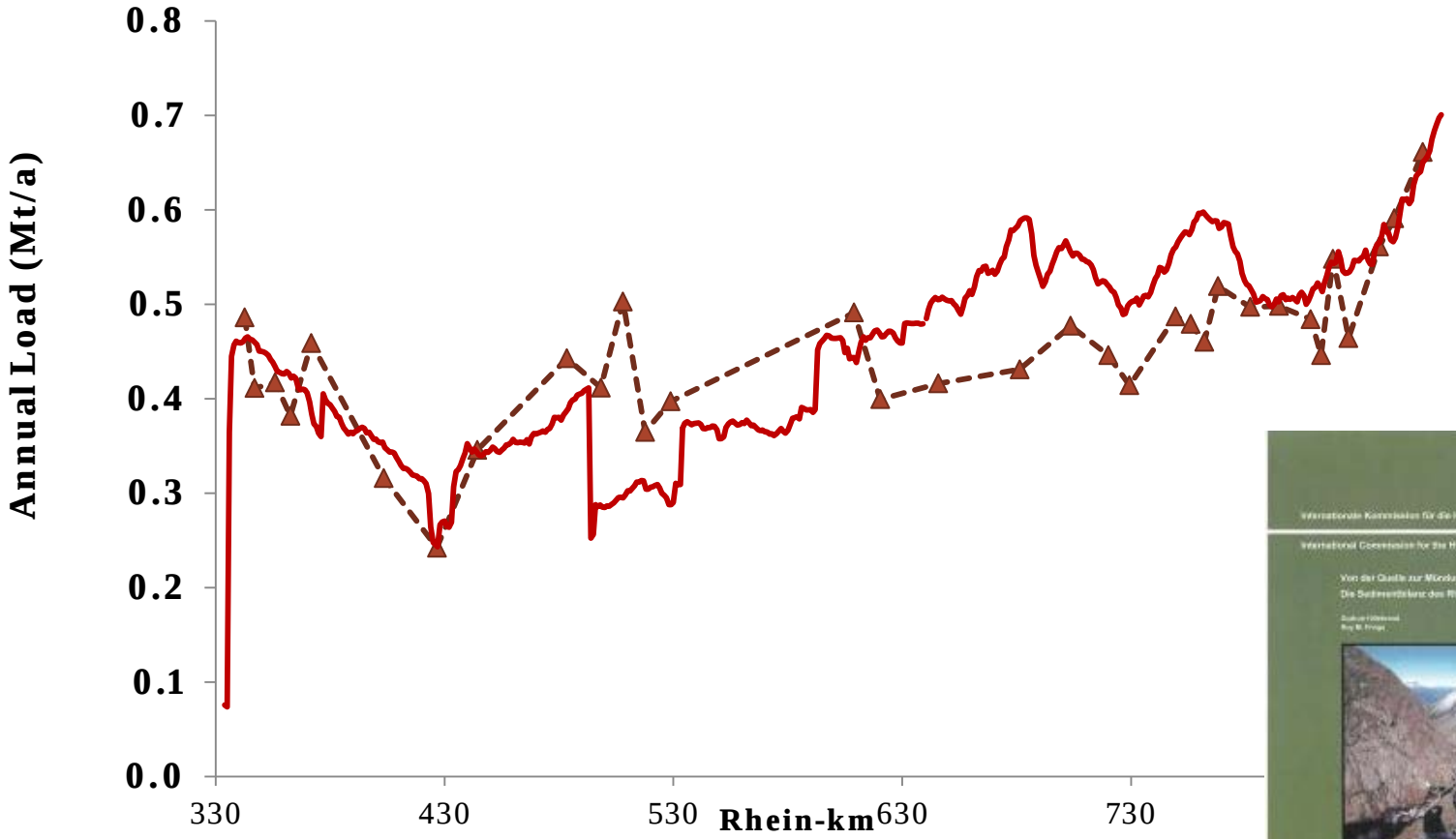
Rhine Alarm Model

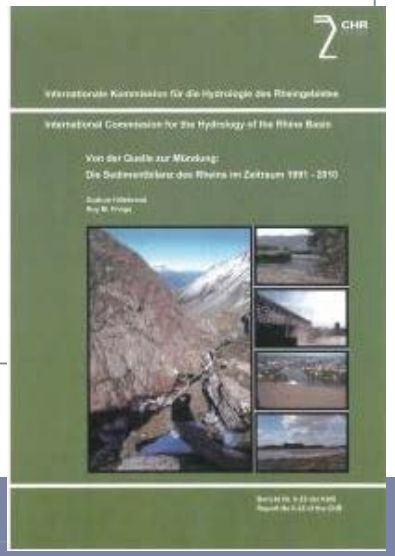
- Example of cooperation with ICPR
- As a result of the fire in the Sandoz chemical factory in 1986
- Assignment of the Minister Conference of the Rhine riparian states to ICPR and CHR to develop a model for the estimation of concentration development and transportation time of accidental spills
- Working group of national institutes and universities
- Present: version 3 of the model operational at all river centers and at several drinking water companies
- Approach also applied for Rivers Meuse and Danube

Rhine Alarm Model



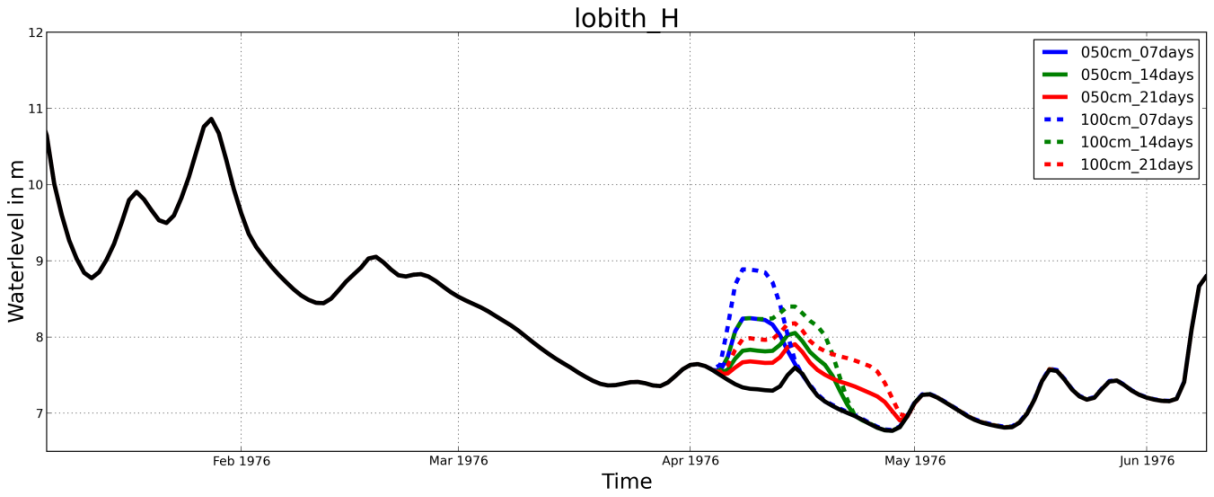
Sand and gravel load (Source: Frings et al 2015)

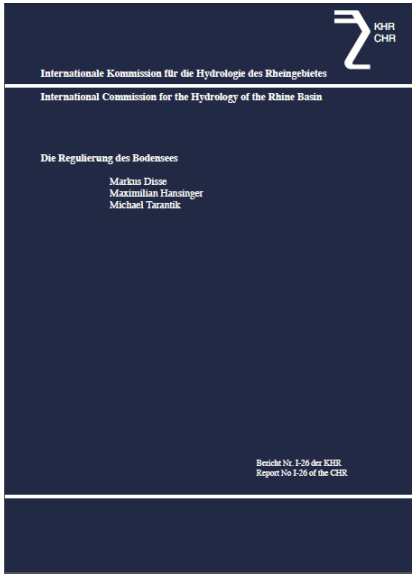




Potential of lake Constance for low flow retention

Water level increase in cm	Surface in km2	Volume in 1E6 m3	Constant additional discharge if released in # days in m3/s		
			7 days	14 days	21 days
+ 50	500*	250	413	207	138
+ 100	500*	500	827	413	276



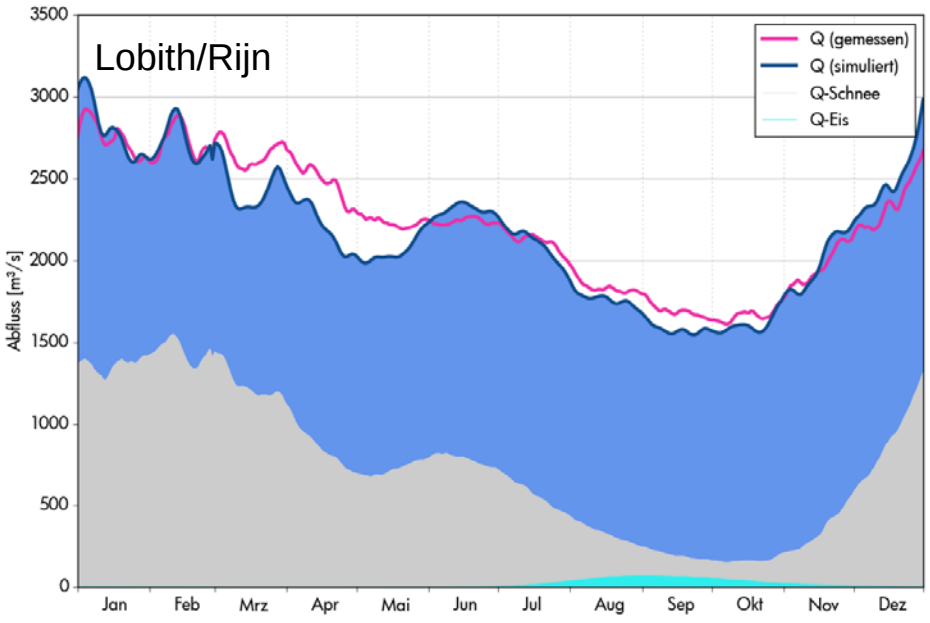


Current projects

- ASG-Rhine – Influence of snow and glacial melts on the discharge of the River Rhine
  Phase 1 completed / Phase 2 in progress
- SES-Rhine - Socio-Economic-Scenarios and their impact on the discharge regime of the Rhine

ASG-Rhine – Impact of snow and glacier melt on the discharge of the Rhine (1)

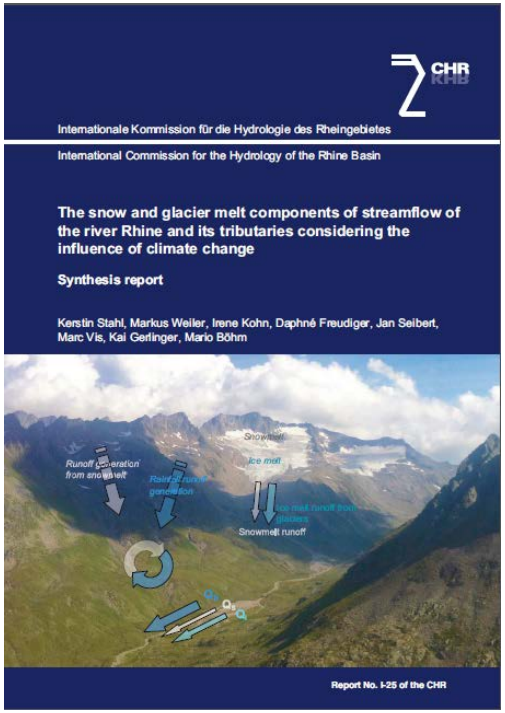
Discharge regime 1901-2006 [m³/s]



MQ: 2171 m³/s

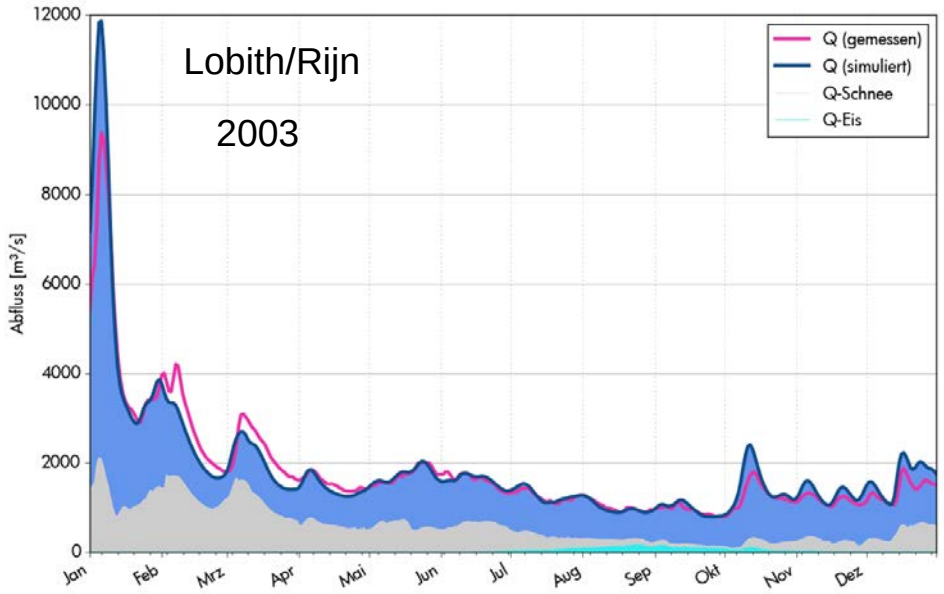
Q_{snow}: 31,2 %

Q_{ice}: 1,3 %



ASG-Rhine – Impact of snow and glacier melt on the discharge of the Rhine (2)

Discharge low flow year 2003 [m³/s]



Q_{snow}: 32,7 %
Q_{ice}: 2,9 %

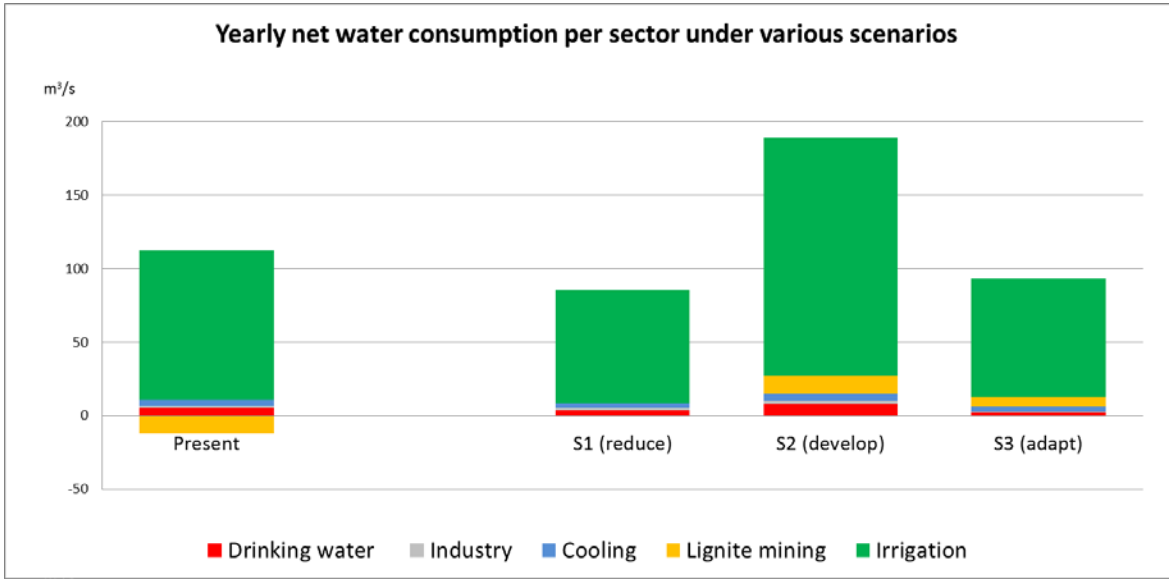
$Q_{ice\ August}$: 13,7 %
$Q_{ice\ September}$: 11,3 %
$Q_{ice\ October}$: 3,9 %
$Q_{ice\ daily\ max}$: 28 %

Q without ice Lobith decrease lowest discharges with 20%

Socio economic developments: Water availability

- Temperature increases
- No major changes in precipitation
- Glaciers will disappear almost completely
- Snow storage decreases
- Discharge: increase in winter, decrease in summer
- Drought problems will occur more frequently in late summer
- Flood season will be prolonged
- Temporary more melt water from glaciers

Socio economic developments: Water availability

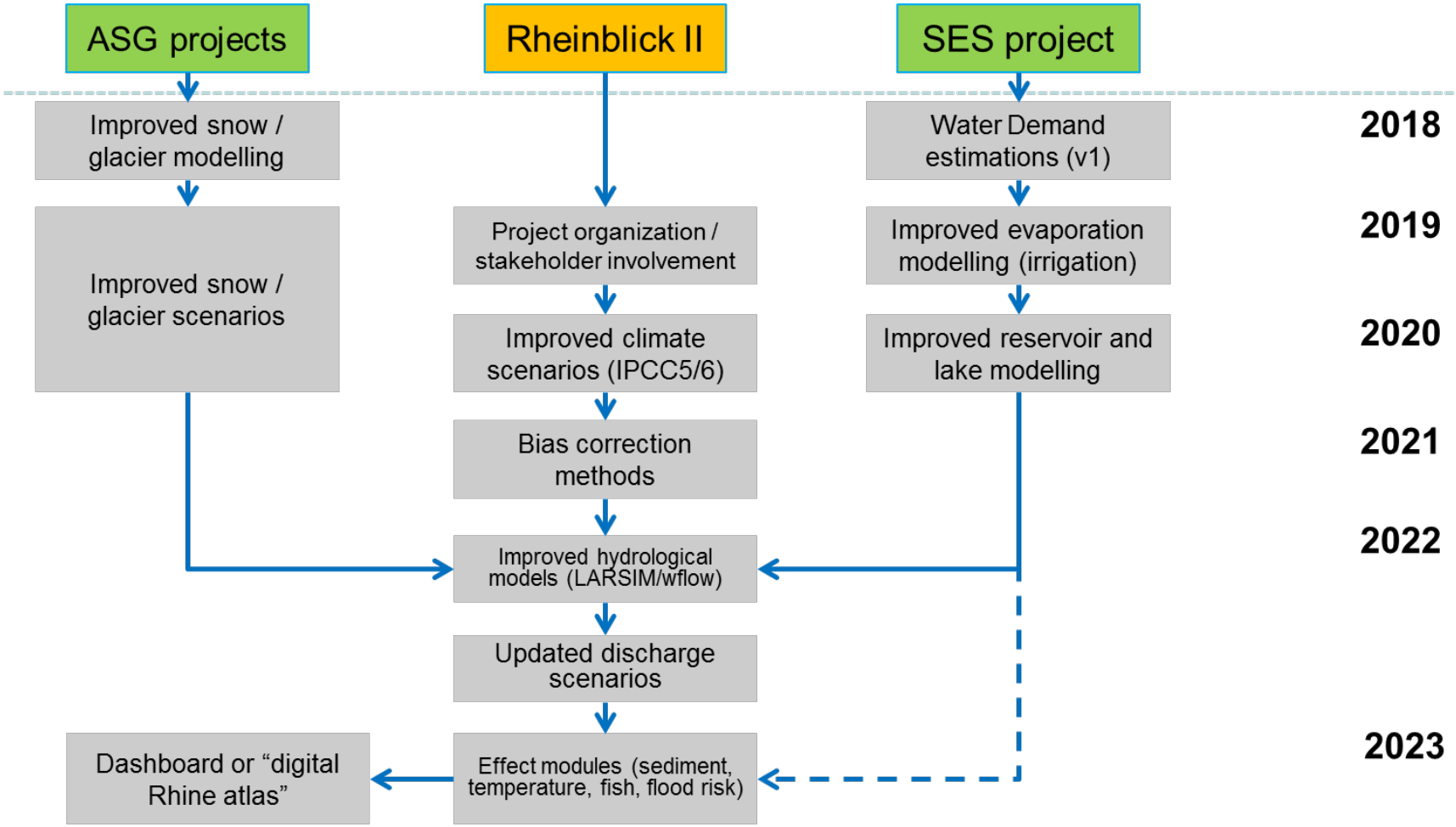


- Detect most important socio economic factors for water consumption
- Develop scenarios for water consumption
- Calculate the effects of these scenarios on the discharge of the Rhine

Future projects within CHR

- Hydrological Memory of the Rhine:
  Location, collection and processing of historical relevant data.
  Analysis, categorizing and evaluation of these data.
  Sustainable digital storage and access to the collected data.
- New project on sediment transport with focus on suspended loads and sand.
- Continuation of investigations into the impact of climate change on the discharge of the Rhine:
  Based on new climate scenarios that become available in different countries, investigations must be carried out, whether these scenarios provide a better understanding of the effects on future discharges of the Rhine. These investigations should concentrate on floods, low flows, water temperature and morphology.

Future projects within CHR



CHR as organizer of scientific events

- 2003: Workshop on climate change and the effects on hydrology and water management in the Rhine basin
- 2005: Workshop estimation of extreme discharges
- 2006: Workshop ensemble predictions and uncertainty in flood forecasting
- 2007: Workshop morphology
- 2007: Workshop low flows and droughts
- 2008: Workshop erosion, transport and deposition of sediment
- 2010: Workshop advances in flood forecasting and the implications for risk management
- 2010: RheinBlick 2050 Final Colloquium
- 2011: Workshop inter-comparison of flood forecasting models
- 2014: Seminar socio-economic influences on the discharge of the Rhine
- 2015: 'From the source to the mouth – a sediment balance of the Rhine' Final Colloquium
- 2016: Symposium human observations of singular hydrological events
- 2017: Low flows in the Rhine basin – International scientific symposium "Science meets Practise"
- 2020: Symposium on socio economic impacts on the future discharge of the Rhine
- 2020: 50 years CHR – Looking back and looking to the future

Cooperation with other river basin organizations

- WMO – Commission of Hydrology, Hydrological Forum
  A representative of WMO is invited to the CHR meetings. Several CHR members participate in hydrological committees of WMO
- IHP (UNESCO)
- ICPR: observer status in both commissions
- ICPMS: exchange of information
- Central Commission for the Navigation of the Rhine: observer status in both commissions
- Danube Commission: exchange of information through CHR members (AU and D)
- Mekong River Commission (Laos): 2014 – Joint Rhine-Mekong-Workshop at the BfG in Koblenz. Theme: Climate change impact
  2016: Workshop Water Diplomacy (CHR participation)
- Huaihe River Commission (China): 2017 – Joint Rhine-Huaihe-Workshop in Bengbu/China with participation of FOEN, BfG, RWS and Deltares. Themes: Flood risk management, Modelling and forecasting, socio-economic impacts on the discharge regime and water availability (incl. climate change and low flows)
  Return visit in October 2017 with visit to RWS, Deltares and BfG
  Letter of Intent between CHR and HRC has been signed

Thank you for your attention.....

More information on
www.chr-khr.org