

# Hydrologische Modellierung an der Elbe/Labe

## *Hydrological Modelling of the Elbe/Labe*

Stand und Planungen im Rahmen des  
Forschungsprogramms KLIWAS  
*Status and Plans within the research programme KLIWAS*

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- KLIWAS Modellkette  
*KLIWAS model chain*
- Bisherige Arbeiten  
*Previous works*
- Ausblick  
*Outlook*

- „Auswirkungen des Klimawandels auf Wasserstraßen und Schifffahrt“

*„Impacts of Climate Change on Waterways and Navigation“*

- Modellkette  
*model chain*

- Multimodellansatz  
*multi model approach*

→ Bandbreite der  
möglichen Gewässer-  
zustandsentwicklung  
*range of possible developments*

1. Global emission scenarios / future development

2. Projections by global climate models

3. Projections by regional climate models

4. Water balance models / Oceanographic models

5. Sediment and morpho-hydrodynamic models

7. Water quality models

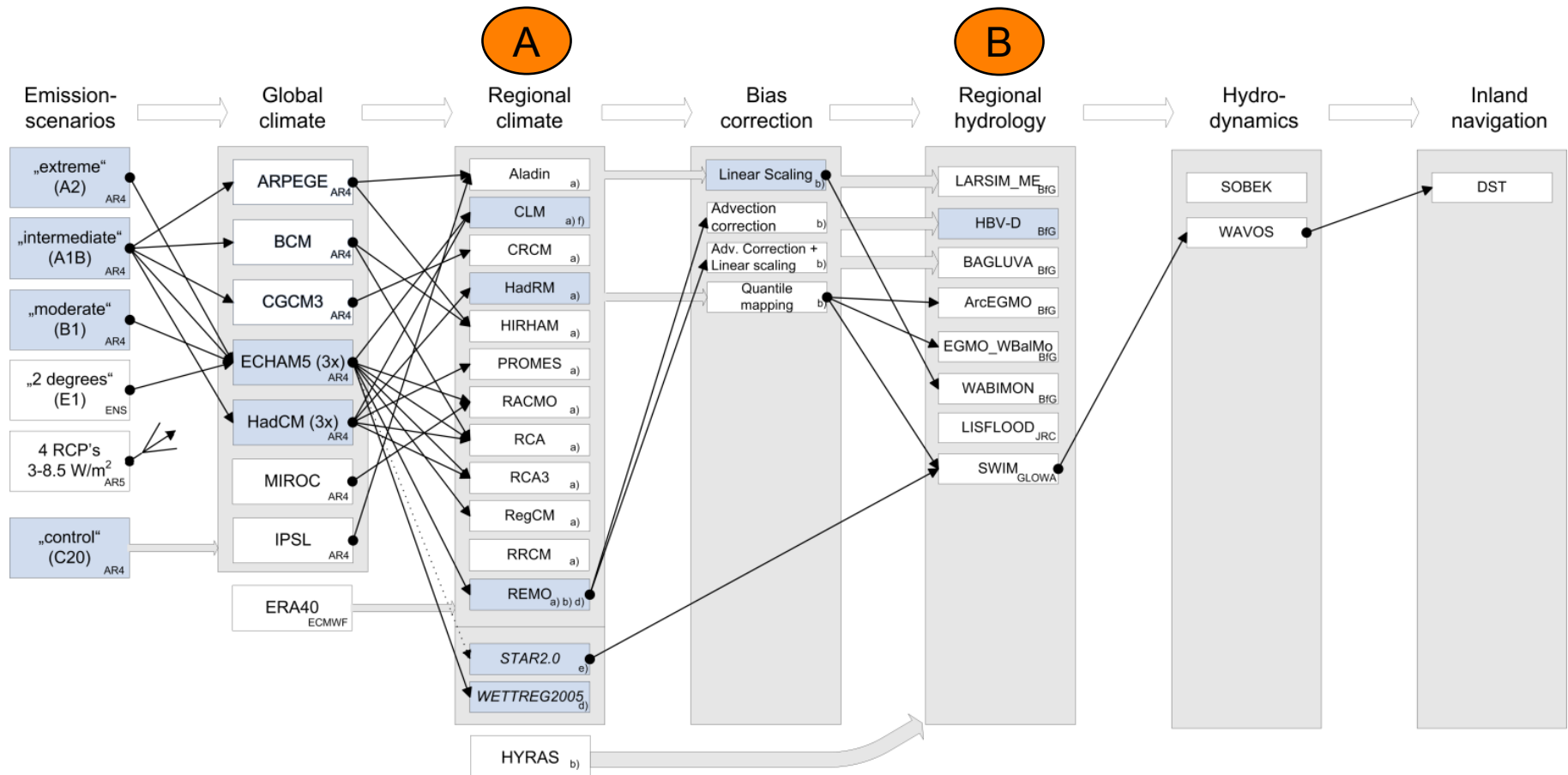
7'. Navigation models

8. Ecosystem models

8'. Economic models

# Teilprojekt 4.01: „Wasserhaushalt, Wasserstand und Transportkapazität“ Datengrundlage und Modelle (Elbe / Labe)

*Project 4.01: „Water balance, water level and transport capacity“ – Data and models (Elbe / Labe)*





# Beobachtete Änderungen

## Observed Change

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1951-2000

- Temperature Change\*  
+1.4°C in Summer, +0.8°C in Winter
- Precipitation Change\*  
-50 mm in Summer, +50 mm in Winter
- Mean flow\*\*  
Decrease in spring (partly in summer, fall)  
Increase in winter (DJF)
- Low flow (NM7Q)  
Tendency to decrease  
not statistically significant

\* Wechsung et al. (2005)

\*\* IKSE (2008)

# Ensemble of 18 RCM runs

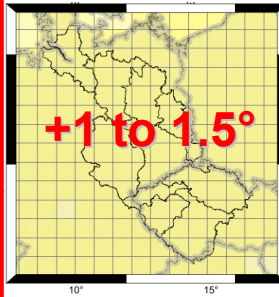
## Air Temperature Change

DJF 2050

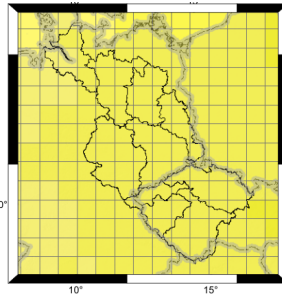
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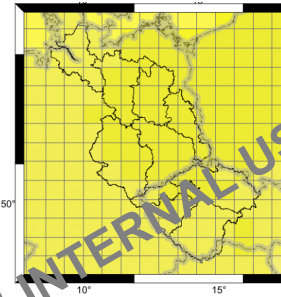


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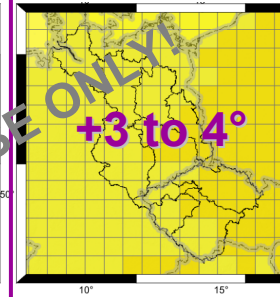


DJF 2100

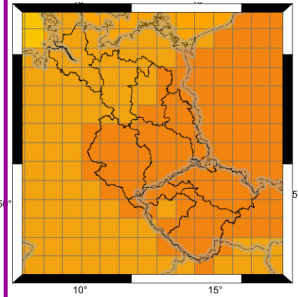
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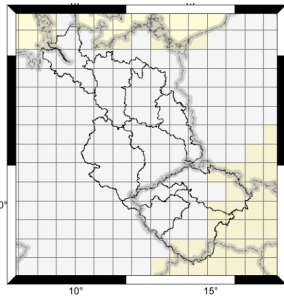


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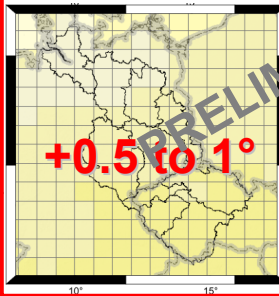


JJA 2050

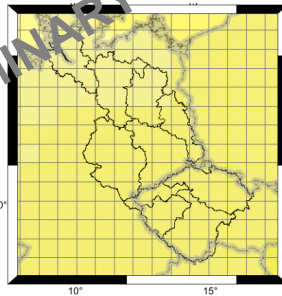
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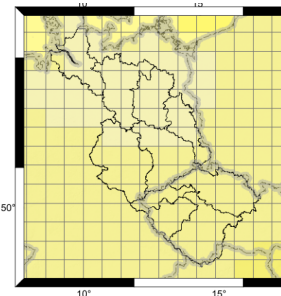


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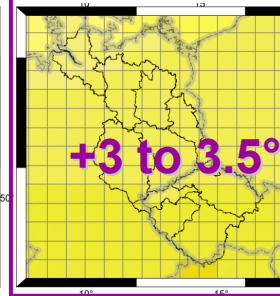


JJA 2100

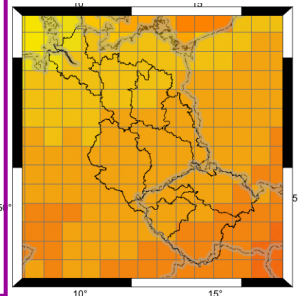
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90 % quantile



Temperature Change [°]



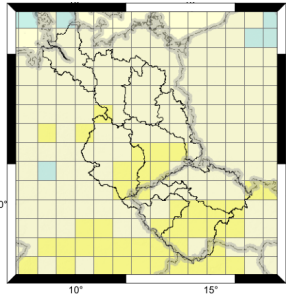
Nilson, 2010

# Ensemble of 18 RCM runs

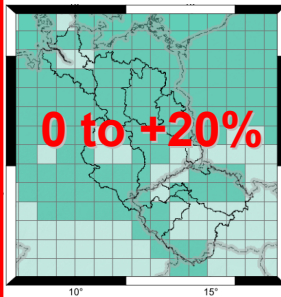
## Precipitation Change

DJF 2050

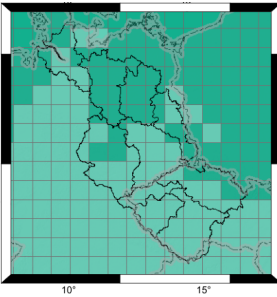
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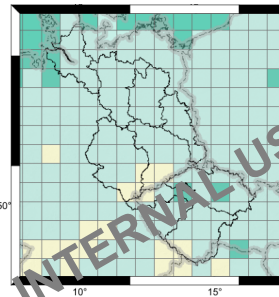


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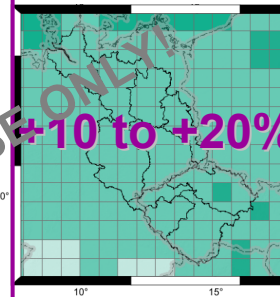


DJF 2100

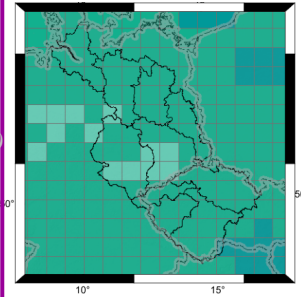
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50 % quantile



90 % quantile

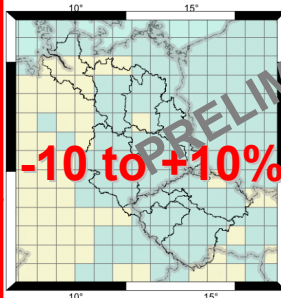


JJA 2050

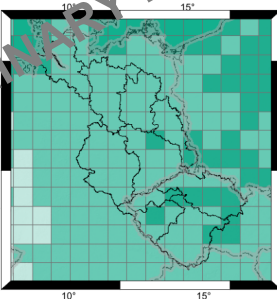
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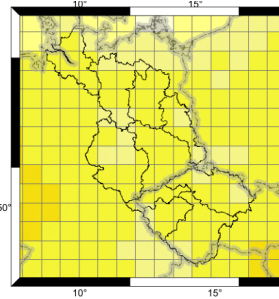


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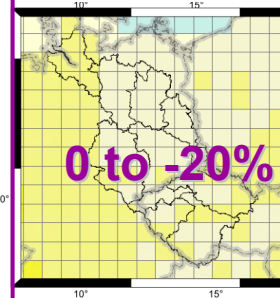


JJA 2100

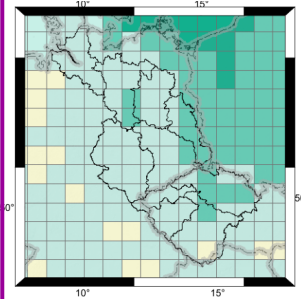
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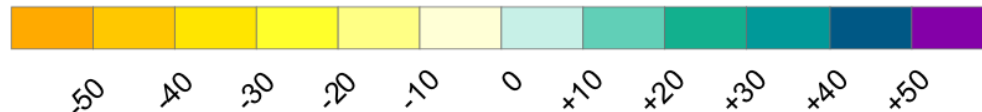
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Precipitation change [%]



Nilson, 2010

# Hydrologische Modelle Labe/Elbe

## *Hydrological Models Elbe / Labe*

### HBV-D

#### INPUT

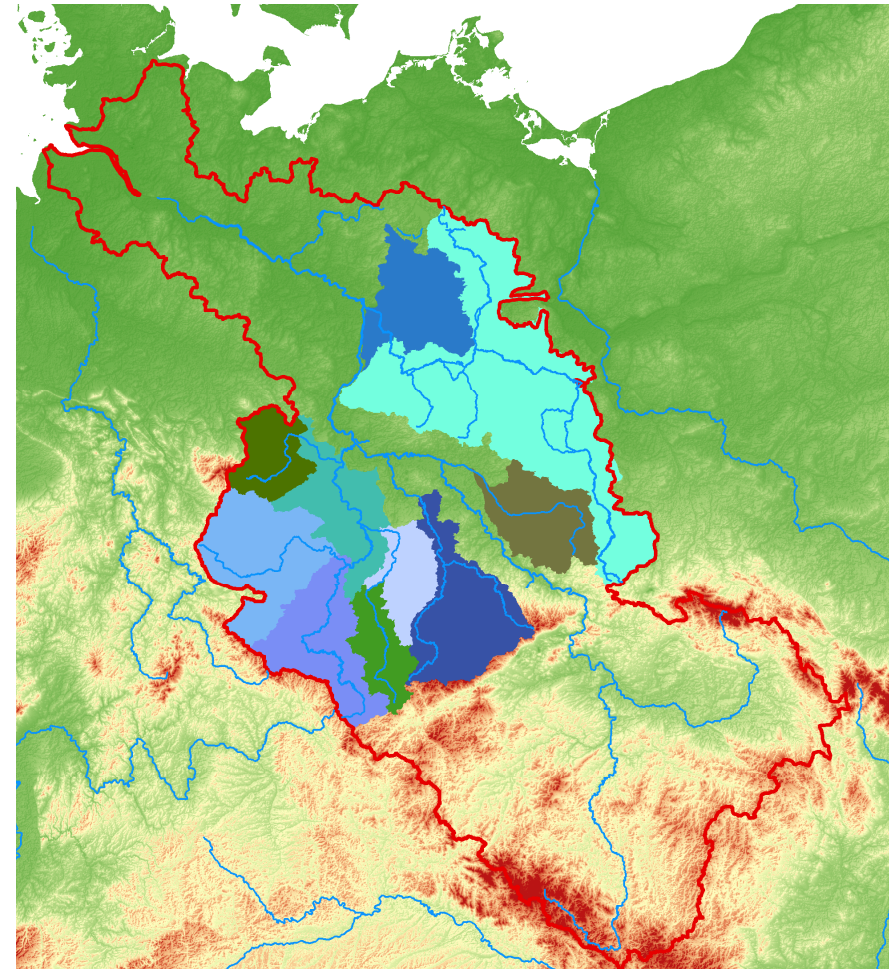
- Precipitation
- Temperature
- (Mean monthly ETP)

#### OUTPUT

- Actual Evapotranspiration
- Runoff Depth (3 components)
- Discharge

#### MAIN CHARACTERISTICS

- Semi-distributed conceptual model
- 10 elevation zones + 15 land cover classes

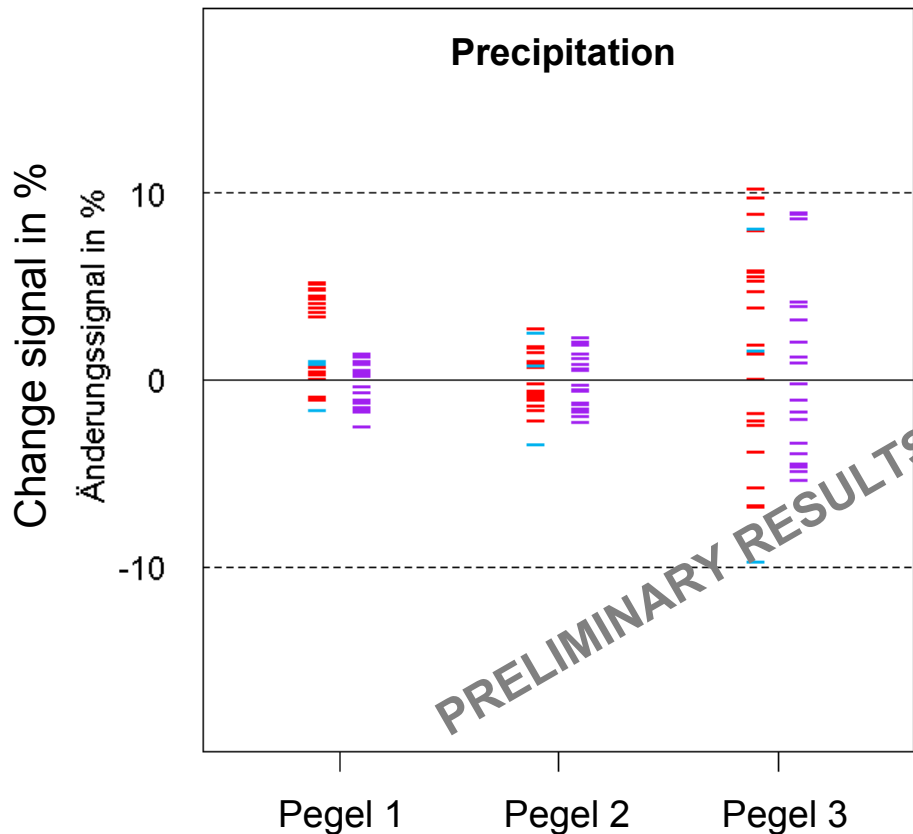




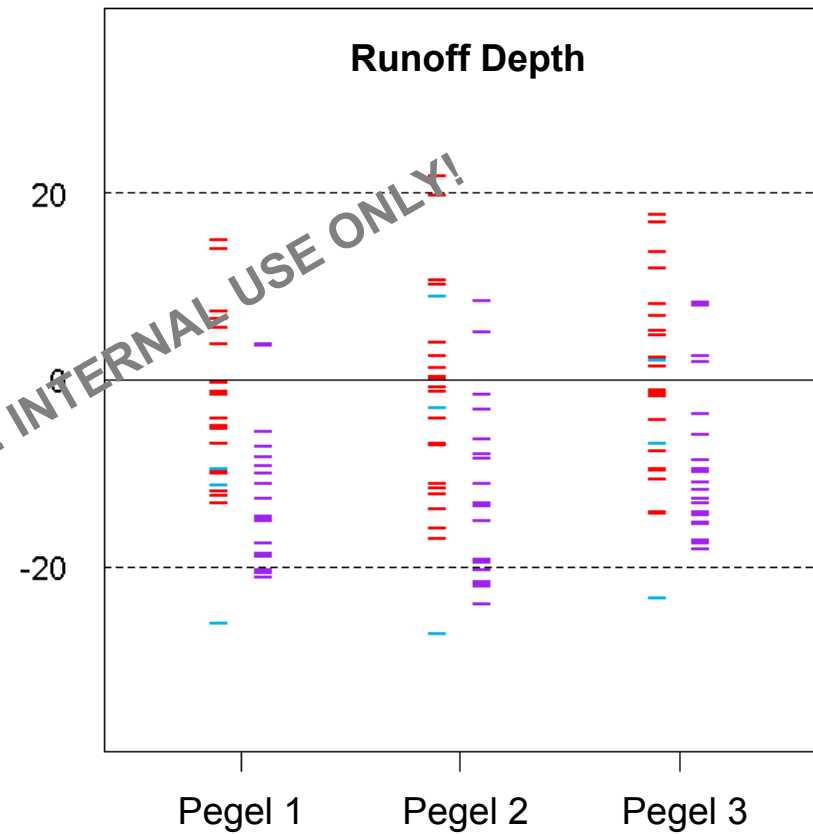
# Hydrologische Modelle Labe/Elbe

## Hydrological Models Elbe / Labe

Niederschlag



Abflusshöhe



SRES: A1B, A2, B1  
GCM: ECHAM5  
RCM: CCLM, REMO-BfG, REMO-UBA, STAR, WettReg  
Hyd: HBV-D

— STAR — 2021/2050 — 2071/2100

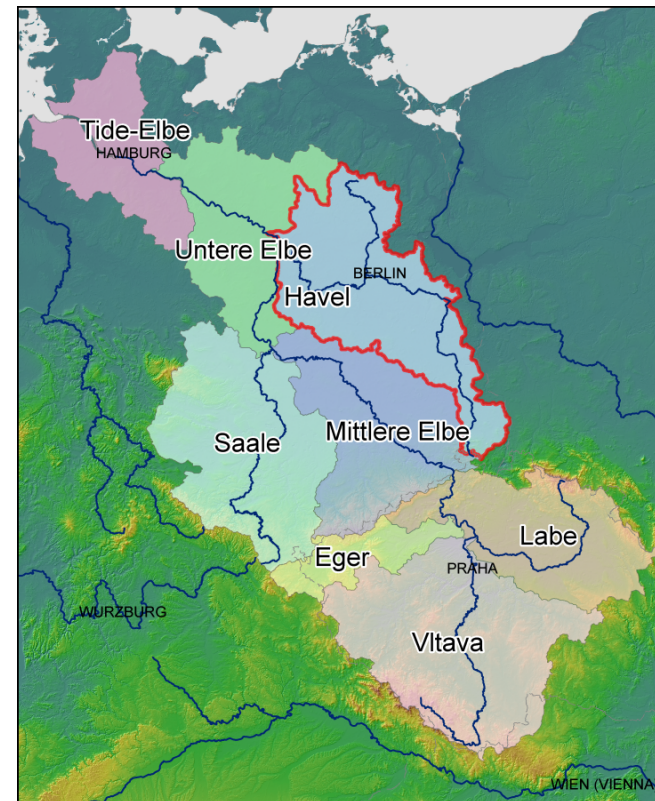
# Vorläufige Ergebnisse

## Preliminary results

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- Results are incomplete!
- A strong decrease of summer precipitation for the mid of the 21<sup>st</sup> century is not obvious from the current multi model ensemble of KLIWAS.
- An increase of Winter precipitation is confirmed by most projections.
- Climate and discharge projections (and scenarios derived from them) based on STAR may be on the dry end of the multi-model ensemble.
- Rising GHG emissions until the end of the 21st century may lead to remarkable changes in hydrometeorological conditions and hydrological impact.

- Additional Climate projections
- hydrological modelling of the complete river (in cooperation with Czech institutions)
- Case Study
  - ArcEGMO
  - EGMO-WBaIMo



Vielen Dank!  
*Thank you!*

**[www.kliwas.de](http://www.kliwas.de)**

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**Ressortforschungsprogramm**

- Deutscher Wetterdienst (DWD)
- Bundesamt für Seeschifffahrt und Hydrographie (BSH)
- Bundesanstalt für Gewässerkunde (BfG)
- Bundesanstalt für Wasserbau (BAW)