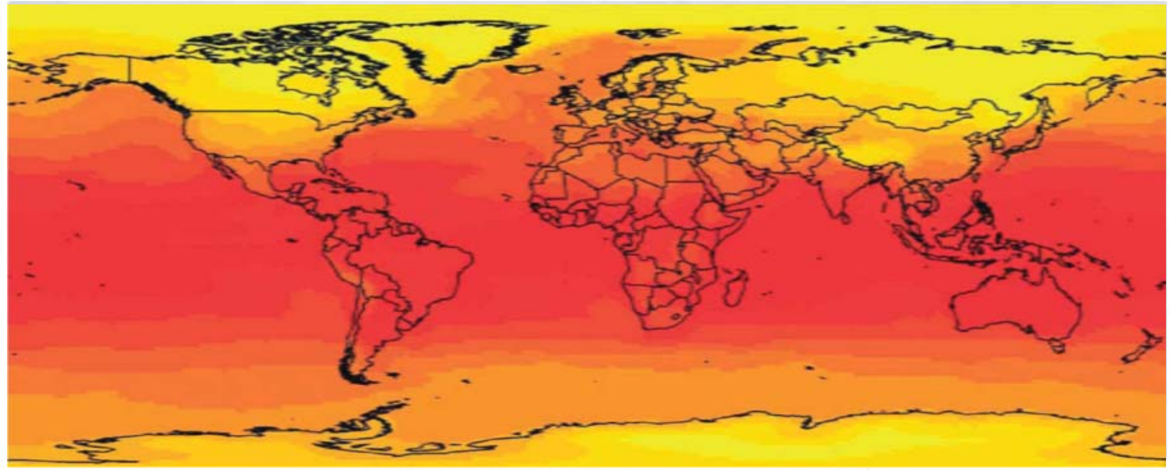


KLIWAS: organisational aspects and current work of BfG on climate change

1st Rhine-Mekong Symposium
"Climate change and its influence on water and related sectors"
8-9 May 2014, Koblenz, Germany

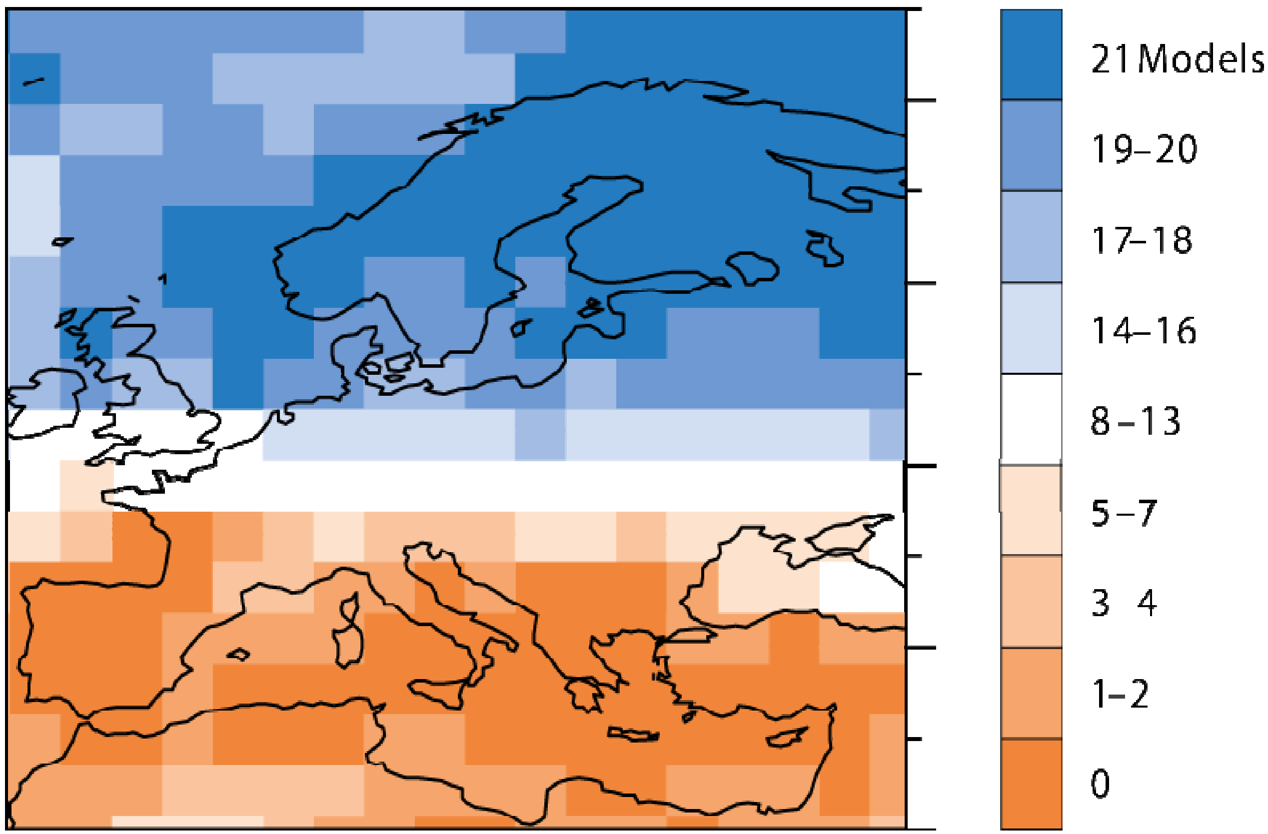
Sebastian Kofalk &
Stefanie Wienhaus, BfG

Drought

Low flow Rhine river 2003

Courtesy: BfG

Uncertainty, global Scale:
Range of GCM: 21 Projections (A1B)



Number of models projecting an increased annual mean precipitation

comparison of the periods 1980–1999 and 2080–2099, Multi-Model Data (MMD)

Figure 1: Number of models projecting an increased annual mean precipitation (comparison of the periods 1980–1999 and 2080–2099, Multi-Model Data (MMD), A1B Scenario)

IPCC, CHRISTENSEN et al. 2007

Reliable supply?

Policy Questions

- How will climate change influence inland and coastal waterways in Germany?
- When will changes occur?
- What is the range of regional potential changes?
- What adaptation measures can help?

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DWD BSH bfg BAW

+

national and international cooperation

30 Projects

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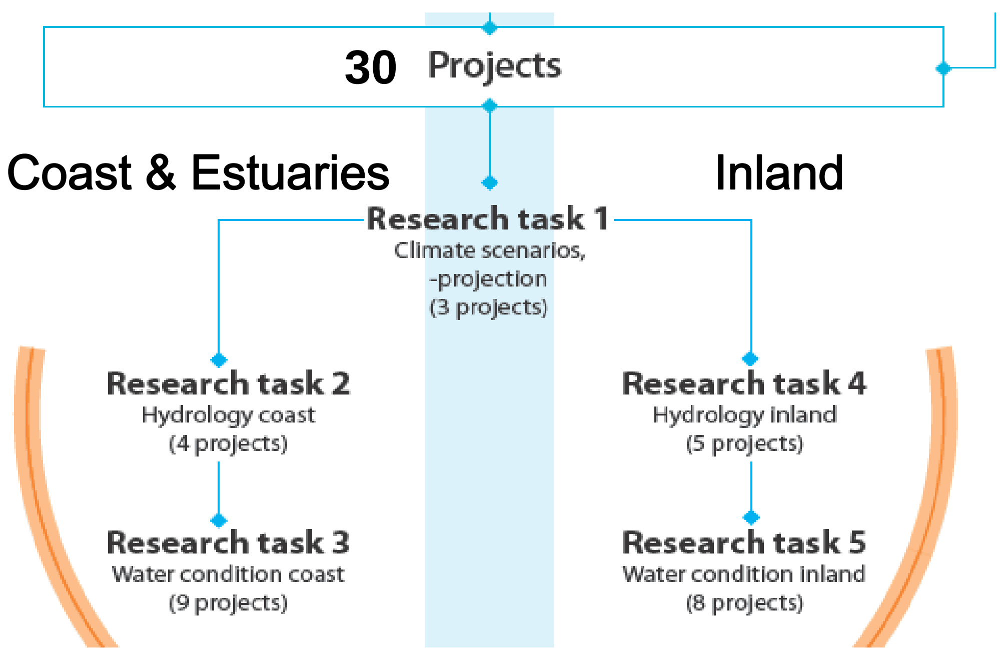
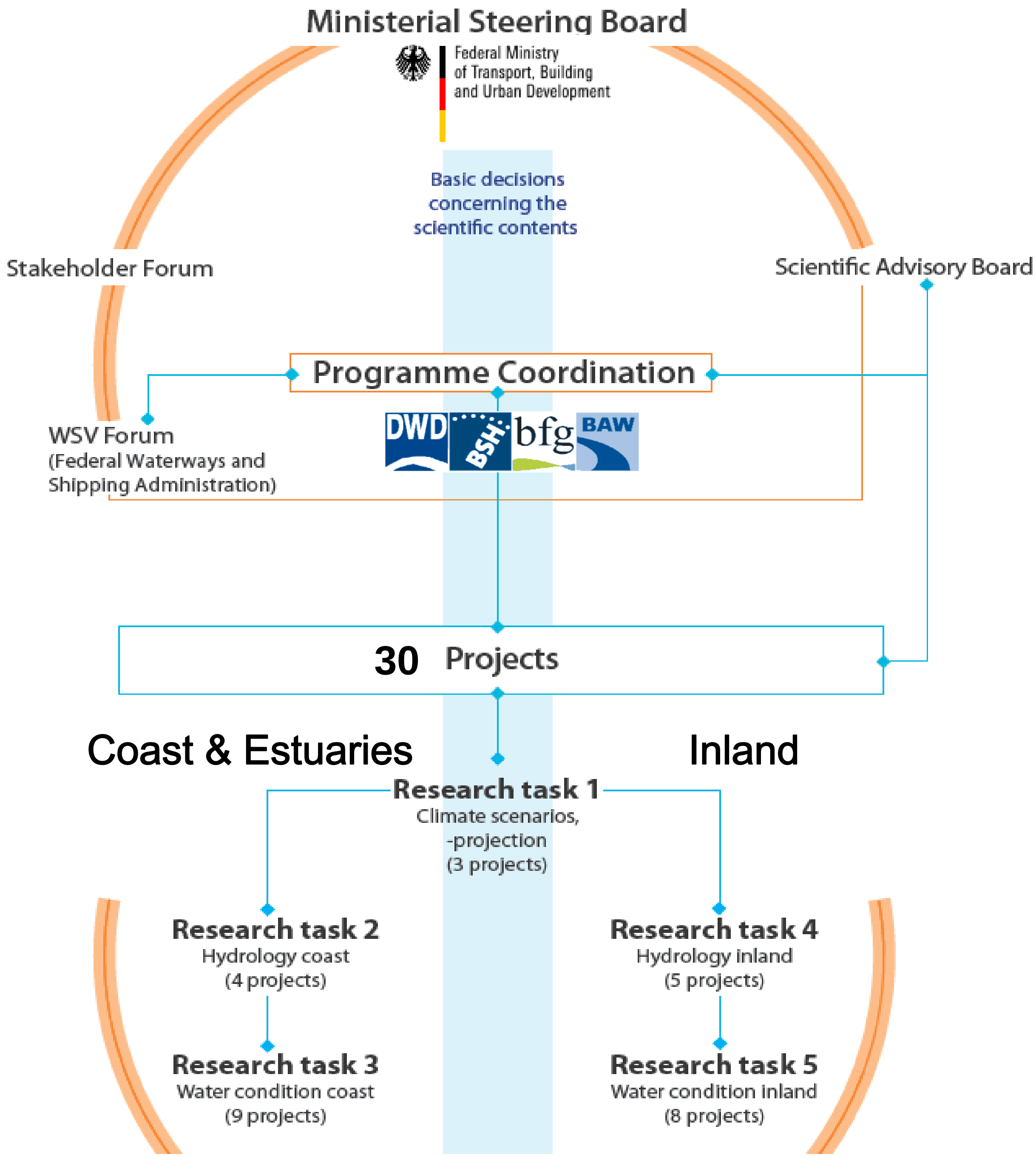
DWD BSH bfg BAW

+

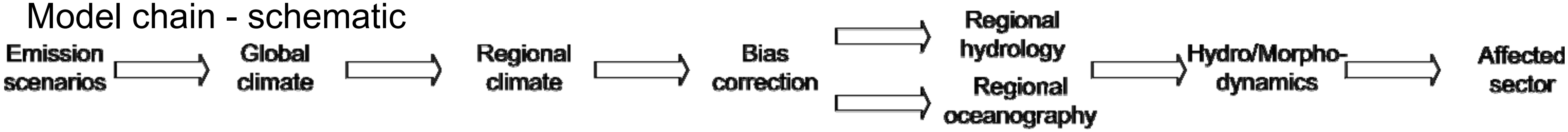
national and international cooperation



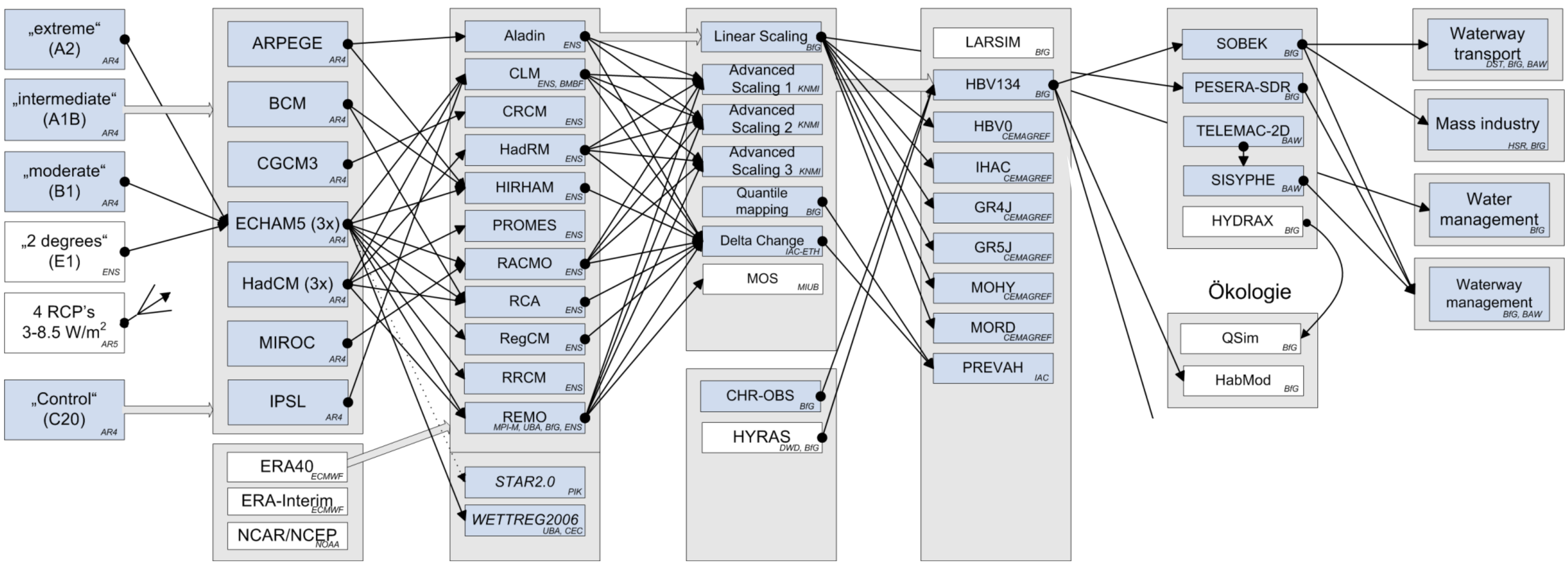

Ministerial Steering Board
Federal Ministry of Transport, Building and Urban Development
Basic decisions concerning the scientific contents
Stakeholder Forum
Scientific Advisory Board
Programme Coordination
WSV Forum
(Federal Waterways and Shipping Administration)
DWD
BSH
bfg
BAW
30 Projects
Coast & Estuaries
Inland
Research task 1
Climate scenarios, -projection
(3 projects)
Research task 2
Hydrology coast
(4 projects)
Research task 3
Water condition coast
(9 projects)
Research task 4
Hydrology inland
(5 projects)
Research task 5
Water condition inland
(8 projects)

Multi model approach

Model chain - schematic



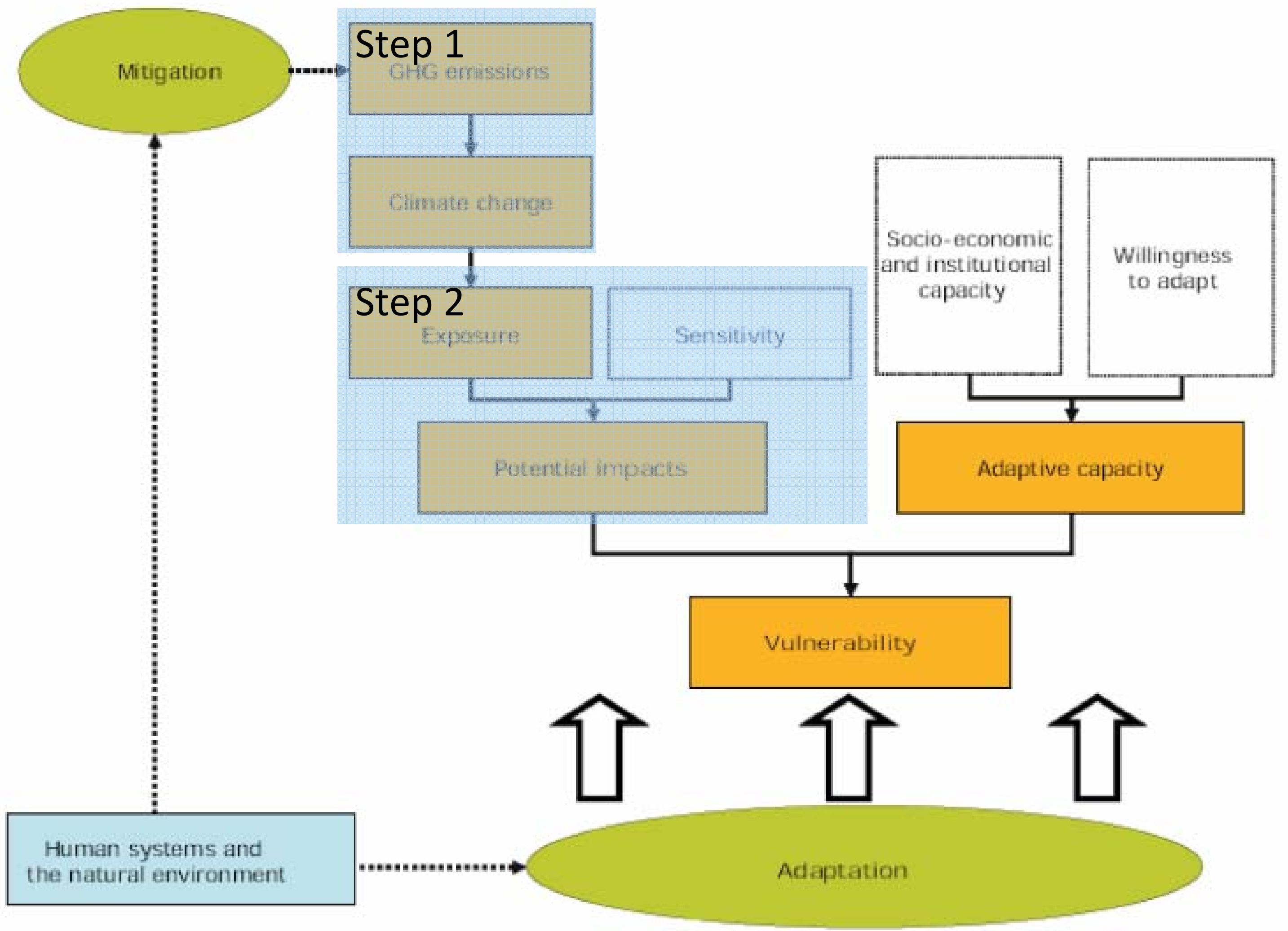
Model chain - data



Selection of relevant indicators

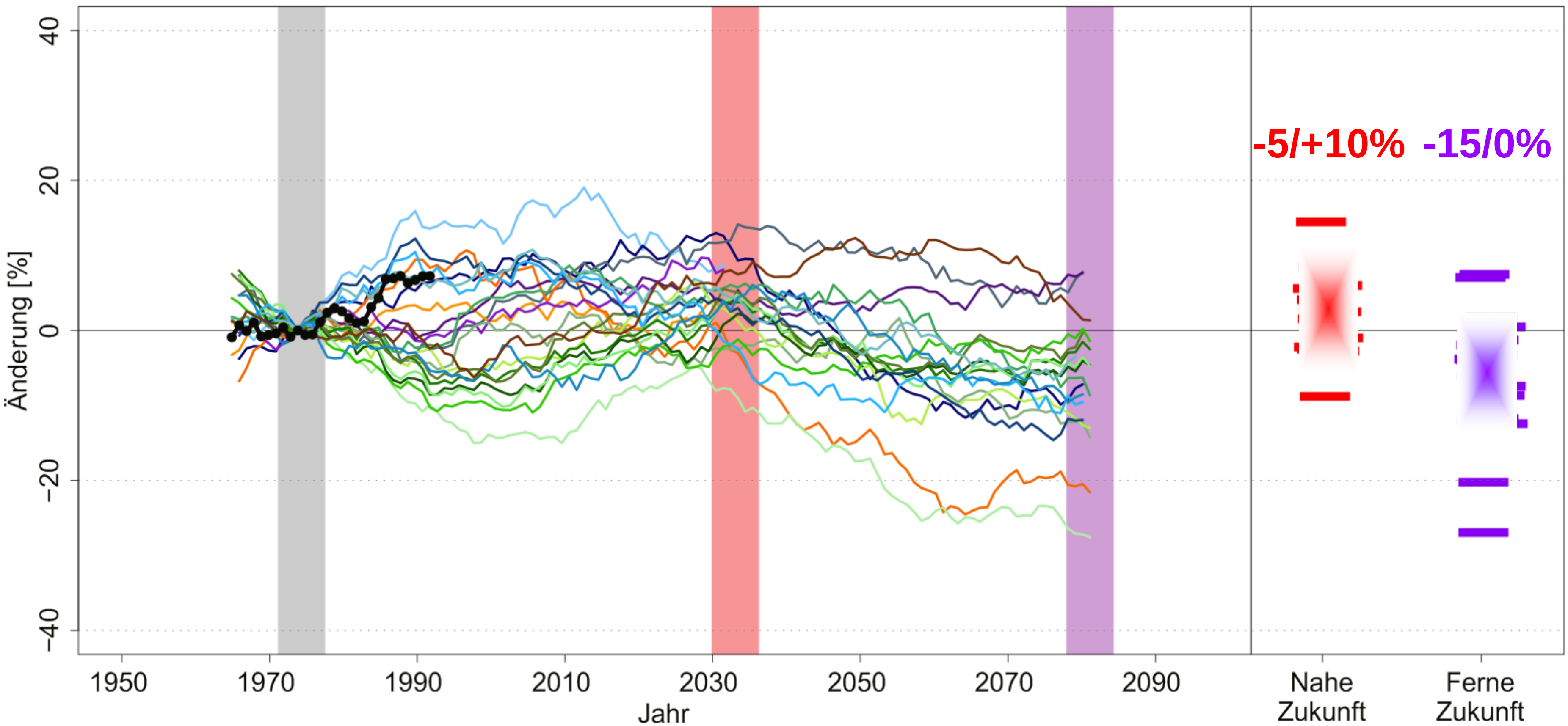
Diagnostics	Notation	Unit	Description and definitions
Average discharge	MQ	m^3/s	**Mean discharge; arithmetic mean of daily mean discharge per time-span** (annual and seasonal, with reference to the hydrological year or hydrological season); averaged to 30- year long-term annual seasonal means; hydrological yearbook primary statistic
Low flow	NM7Q	m^3/s	**Lowest arithmetic mean of discharge during 7 consecutive days**; calculated per hydrological season; averaged to 30- long long-term annual or seasonal means
	FDC_Q90	m^3/s	**Discharge undershot on 10% of all days of a 30- year period** (i.e. the 90th percentile of the flow duration curve representing 10950 days, no leapyears taken into account)
High flow	MHQ	m^3/s	**Mean maximum discharge**; arihtmetic mean of all annual maximum discharges (per hydrological year) per timespan (here: 30- year, 3000- year); hydrological yearbook primary statistic
	HQ10	m^3/s	**Discharge corresponding to a 10- year return period**, i.e. discharge which occurs once every 10 years; calculated from a fitted distribution to the annual (hydrological year) maximum discharge values per timespan in a return level plot; for HQ10 a 30-year time-span is used
	HQ100	m^3/s	**Discharge corresponding to a 100- year return period**; a 3000-year time-span from the rainfall generator is used

vulnerability



[5] European Environment Agency. 2008. Impacts of Europe's changing climate: 2008 indicator based assessment (Ch.6. Adaptation to climate change; figure from Isoard, Grothmann and Zebisch (2008)).

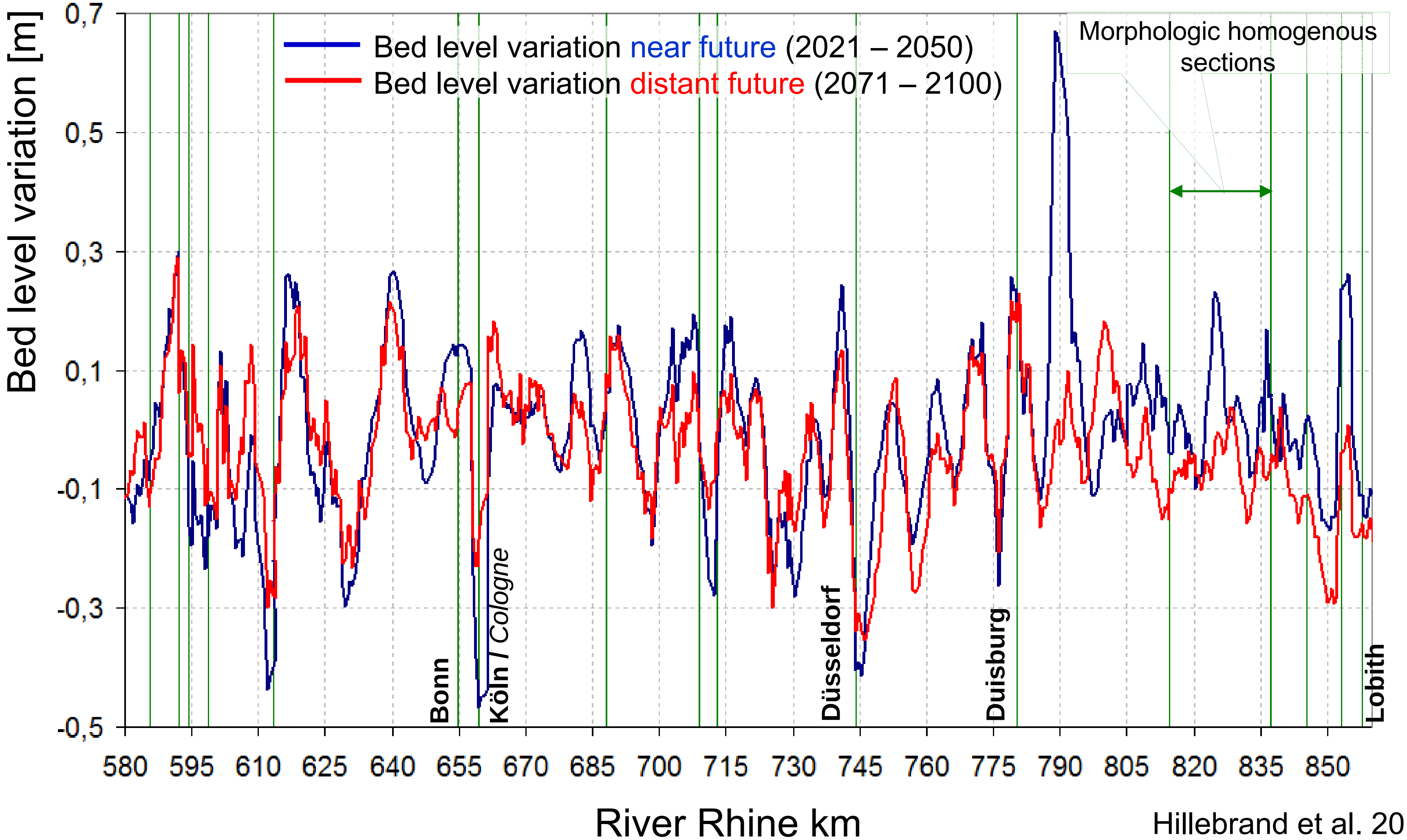
gauge Kaub, Rhine
Change in low flow*



* NM7Q, water year (Apr-Mar), 31 years, moving average

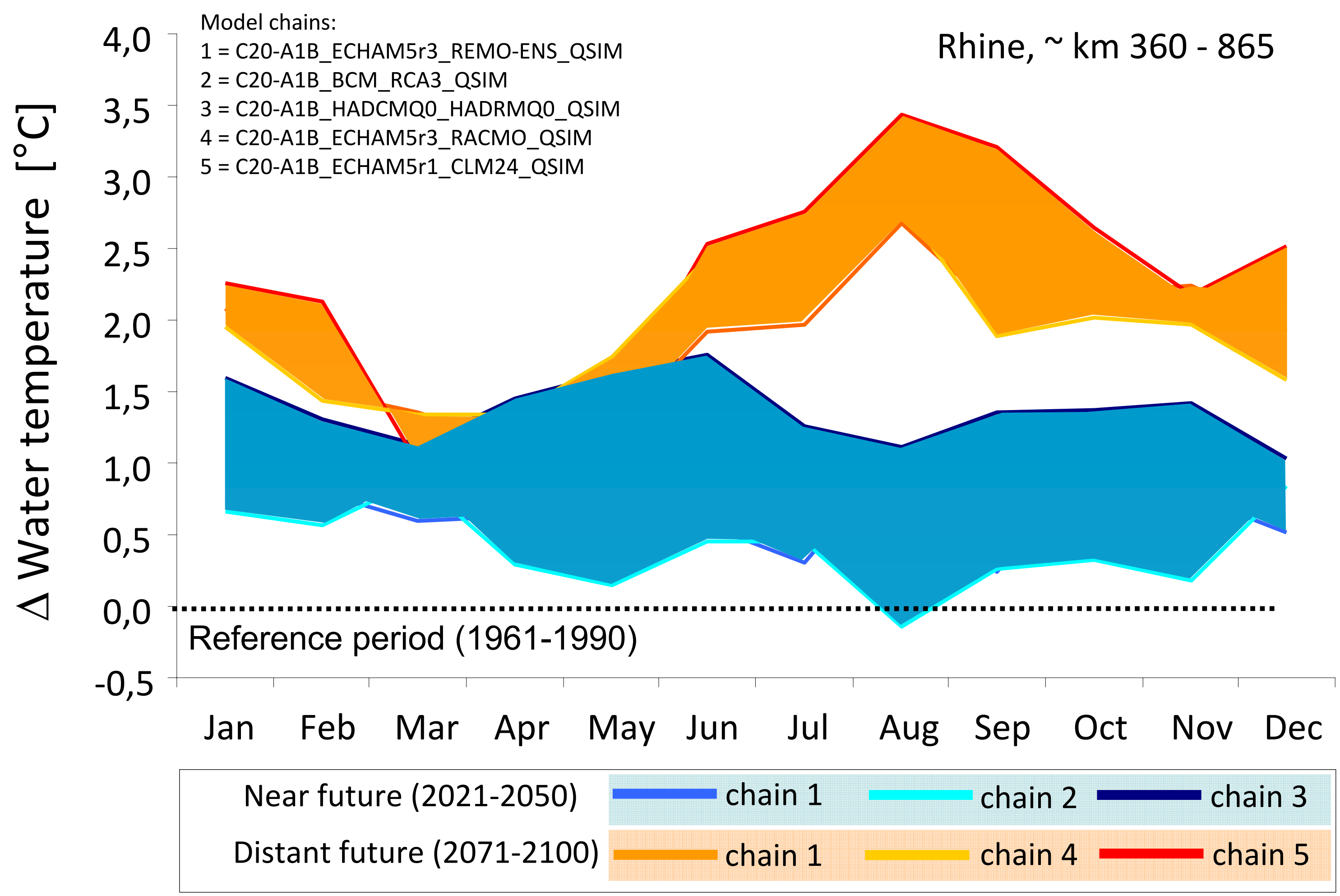
Morphodynamics

River Rhine



Hillebrand et al. 2013

Water temperature

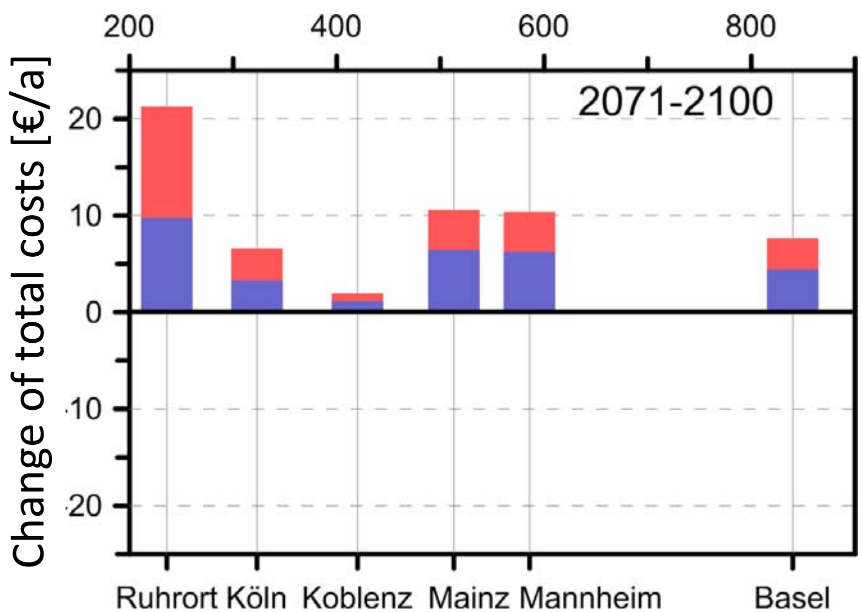


Hardenbicker et al. 2013

Impacts of climate change on annual total transport costs [€ /a]

→ Optimistic and pessimistic discharge scenario

Distant future

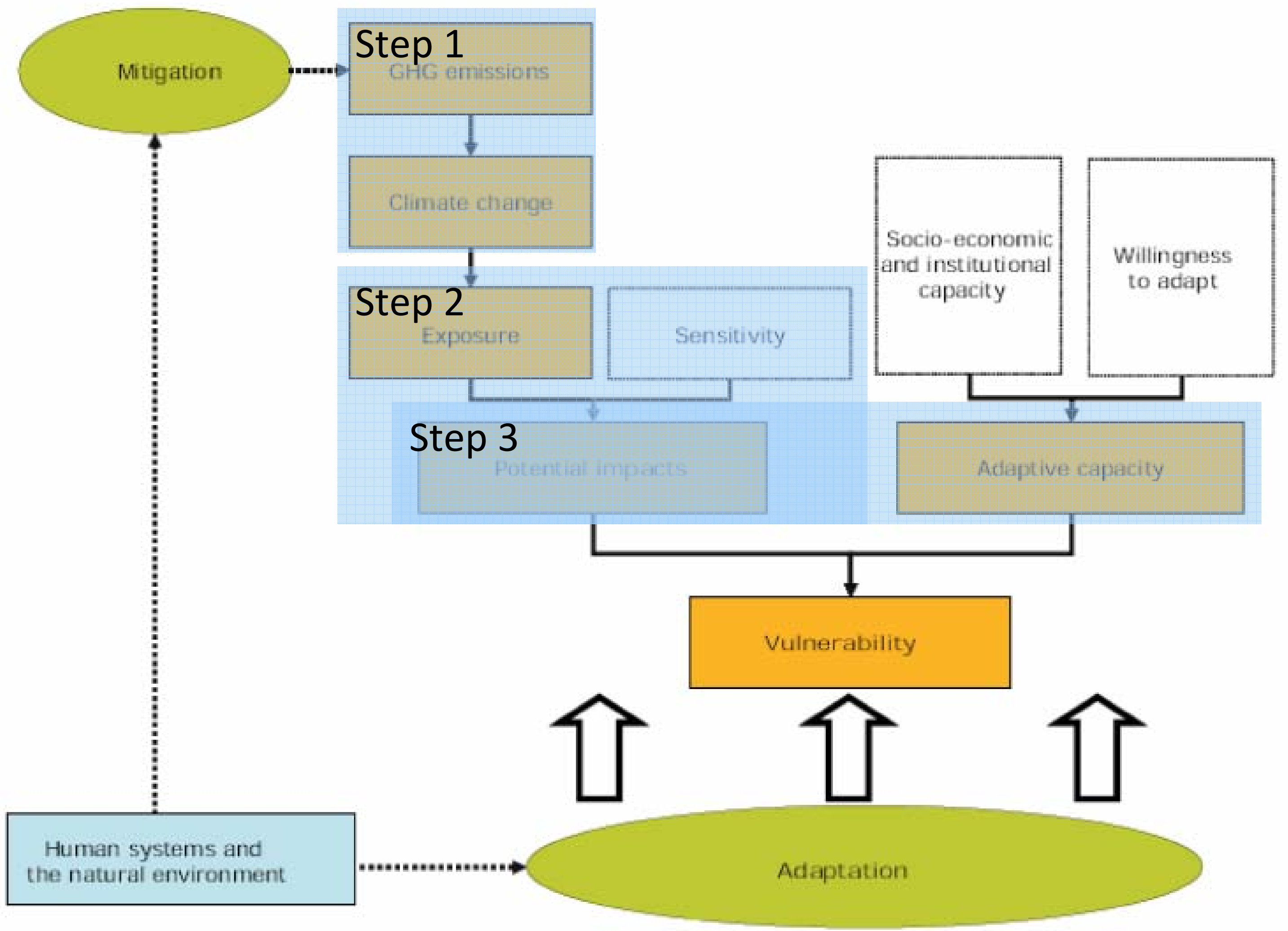


Cost rise
~30 Mio. EUR/a ~ 5%

Cost rise
~60 Mio. EUR/a ~ 9%

Quelle: Nilson et al. (2013)

vulnerability



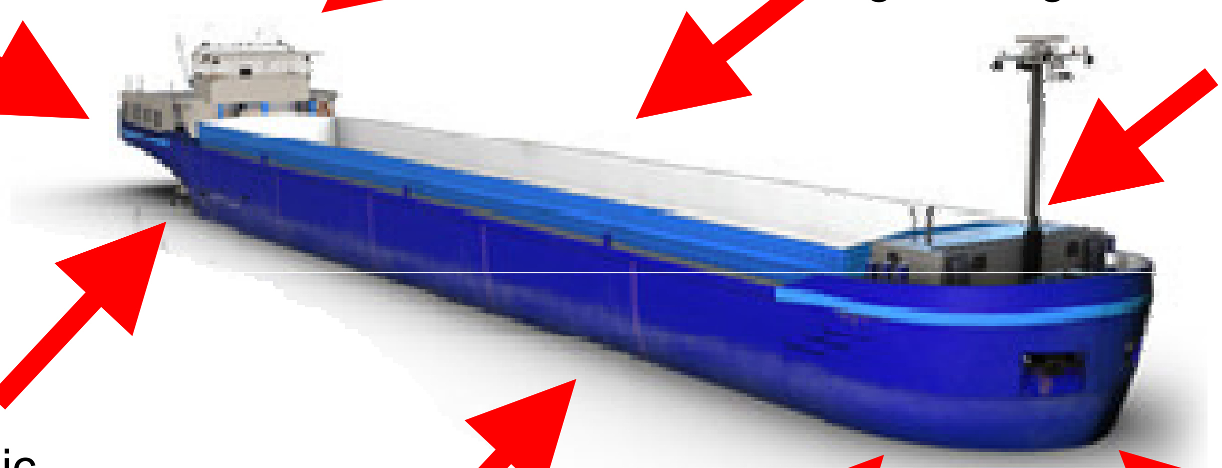
[5] European Environment Agency. 2008. Impacts of Europe's changing climate: 2008 indicator based assessment (Ch.6. Adaptation to climate change; figure from Isoard, Grothmann and Zebisch (2008)).

Science + responsibility

KLIWAS

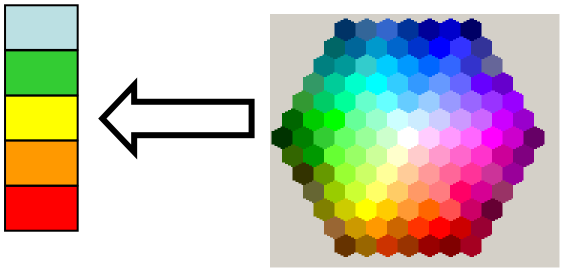
Uses/functions depending on	Parameters	Need for action with view to		Assessment of information	
		River basin/ waterway	Period	Signal intensity	Confid-ence
Water supply (e.g. water abstractions)	**MQ** (mean river discharge), hydrological year (Nov.-Oct.)	Rhine	-	**0**	**+**
		Elbe	Since 2050	**++**	**+**
		Danube	Since 2050	**++**	**+**
Summer flow (e.g. water resources management)	**MQ** (mean river discharge), hydrological summer (May-Oct.)	Rhine°	Since 2050	**++**	**++**
		Elbe	At once	**+**	**++**
		Danube°	At once	**+**	**++**
Minimum water volume (e.g. fish migration, navigability)	**NM7Q** (lowest mean discharge in a period of 7 days) or **NMoMQ** (lowest mean monthly discharge), water year (Apr.-March)	Rhine°	Since 2050	**+**	**++**
		Elbe	Since 2050	**++**	**+**
		Danube°	At once	**+**	**++**

Technical and operational adaptation options



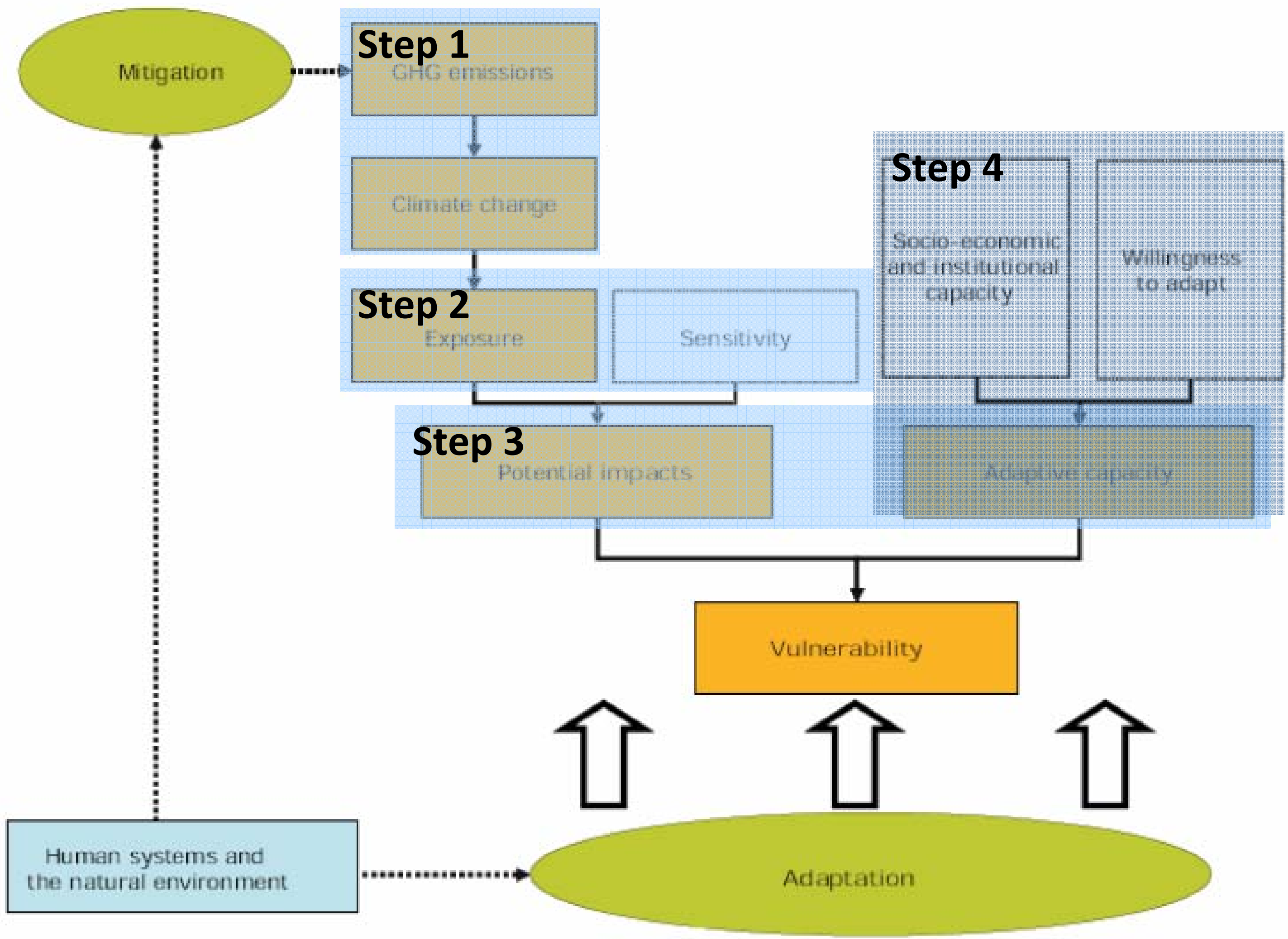
Currently ….

- Project reports & publications
  dimension of climate signals & when, dimension and relevance of impacts for running the waterways, adaptation options
- Synthesis for decision makers



- Synthesis on methodology
- → contributions for the GFCS

Currently + outlook



Ministry & Water and Shipping Authorities & research

[5] European Environment Agency. 2008. Impacts of Europe's changing climate: 2008 indicator based assessment (Ch.6. Adaptation to climate change; figure from Isoard, Grothmann and Zebisch (2008)).

Currently …

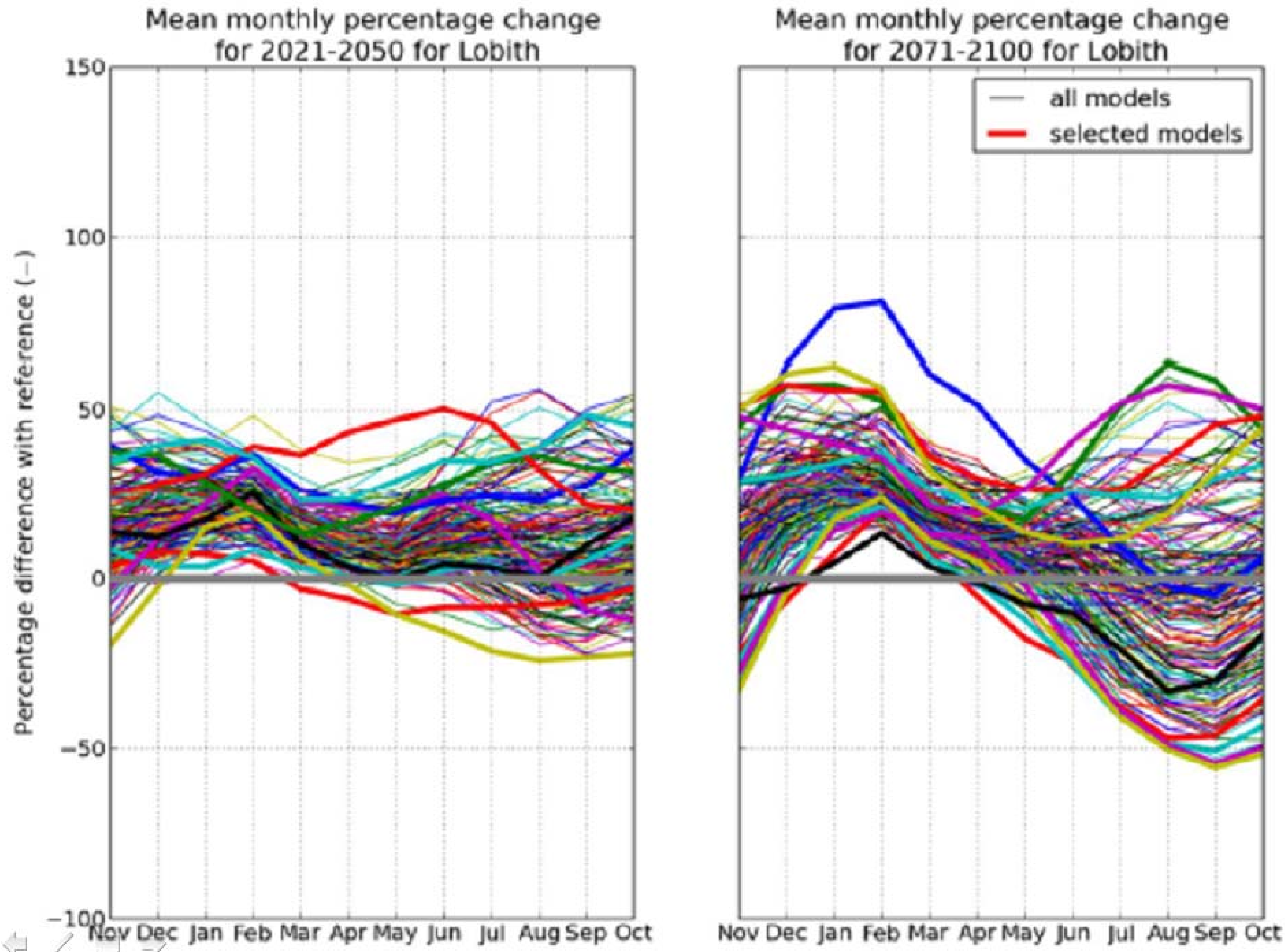
Seasonal prognosis/ decadal projections

2021-2050 2071-2100

Short-term long-term

planning horizon investments in infrastructure

outlook: new projections



Source: Sperna Weiland & Bouaziz (2014)

Deltares

outlook: consistent scenarios for all transport modes

Source: dpa (2013)

Thanks

To the KLIWASians

Thank you!

www.kliwas.de

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Stefanie Wienhaus

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Kliwas@bafg.de