

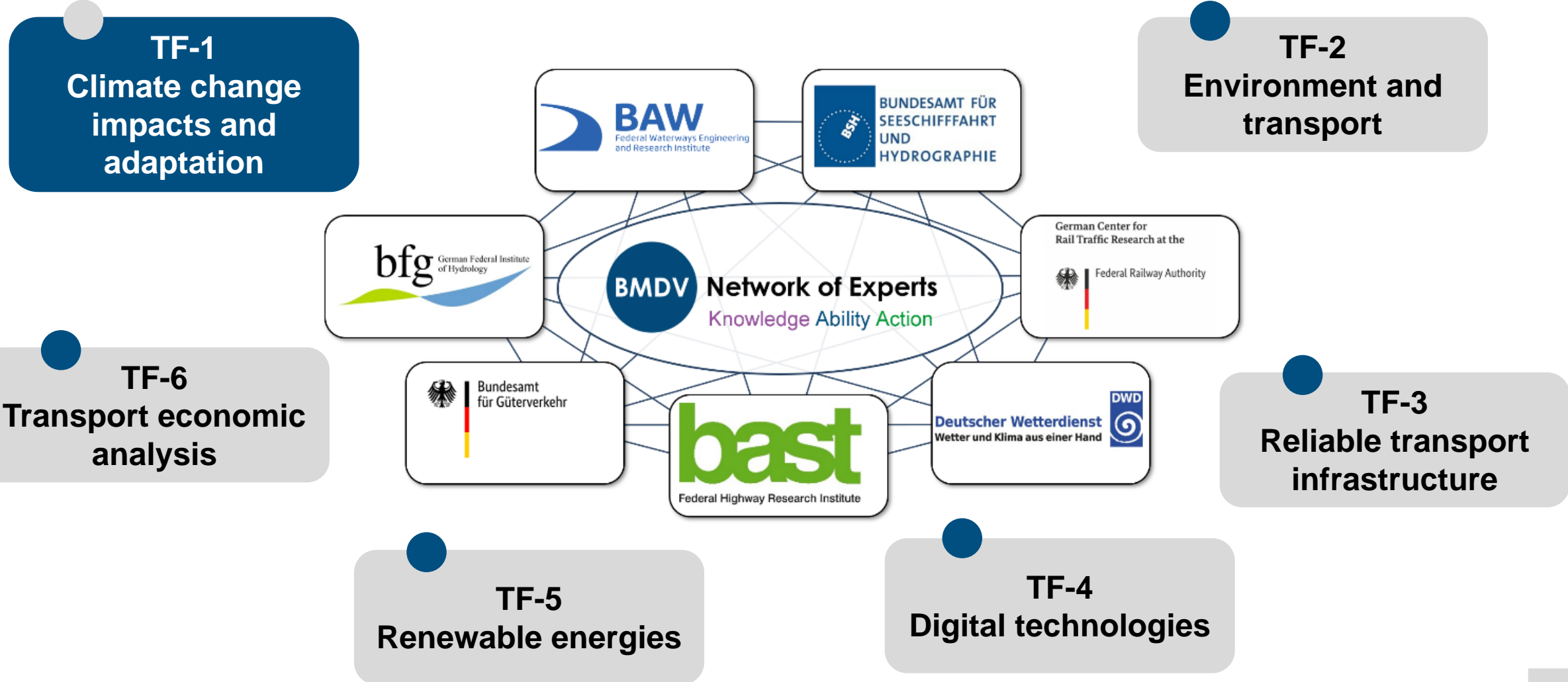


Increasing the resilience of the German transport system to climate change and extreme weather events



Stephanie Hänsel, Lara Klippel, Christoph Brendel, Enno Nilson, Nils Schade, Lennart Meine, Carina Herrmann, Ingo Hache and many more ...

The BMDV Network of Experts





Adapting transport infrastructure and traffic to climate change and extreme weather events

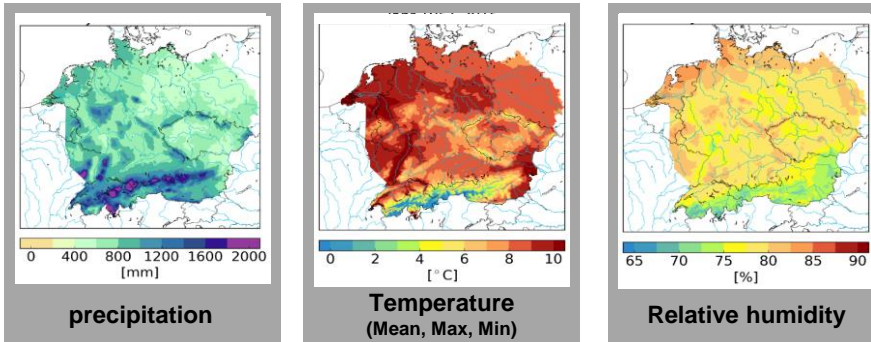


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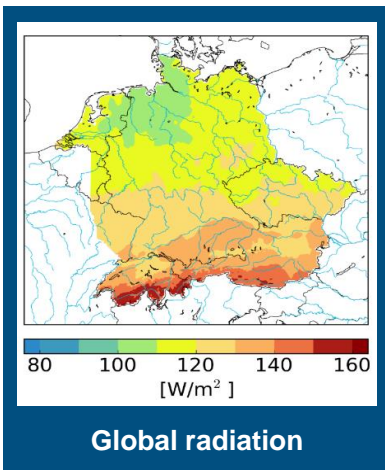
Improved reference datasets

Example: HYRAS global radiation 1951-2015, 5 km x 5 km grid

Phase 1



Phase 2.1



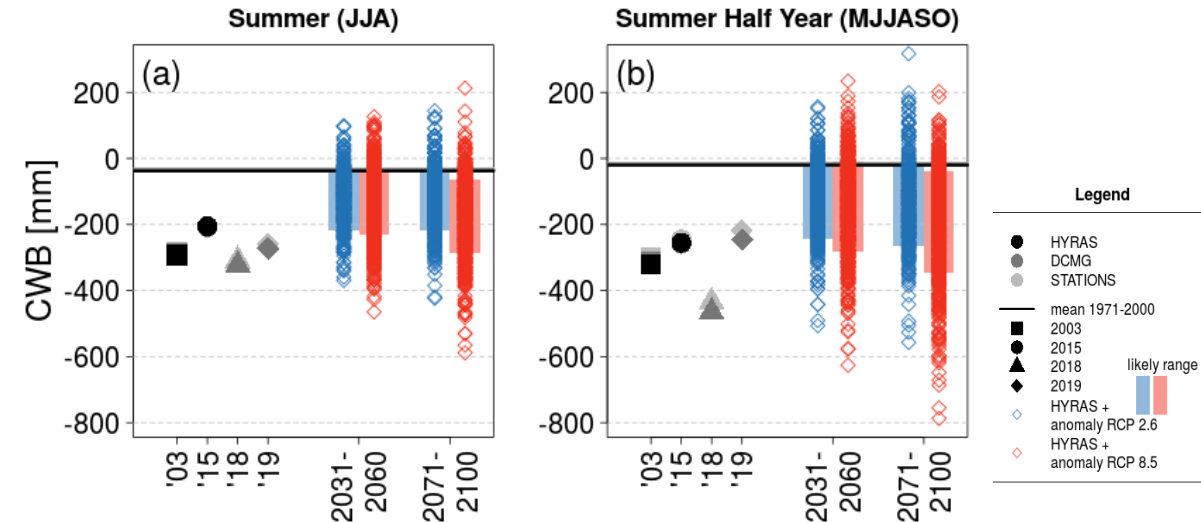
DWD, Brendel (2021): Jahresmittel Niederschlag Mitteltemperatur, relative Feuchte, Globalstrahlung 1951-2015

- Important for calculation of evapotranspiration, estimating soil moisture and hydrological modelling

→ Improving the database for climate change analyses (spatial and temporal resolution; more parameters)

Studying future climatic changes

Changes in mean conditions and extremes; use of climate indices



Plots of the German mean surface area climatological water balance (CWB) values for observation datasets compared to all model summer indicator values



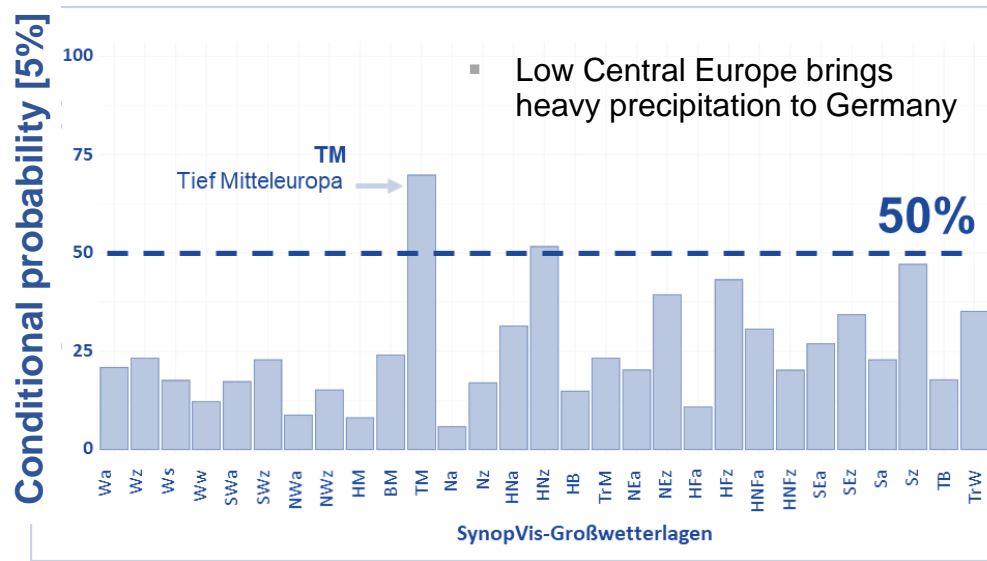
Kelly Stanley
Session UP3.1
07.09.22 | 9:00

Recent hot and dry summers in Germany in comparison to climate projections

→ Development of new/tailored indices that can be used by the transport modes and the DAS core service „Climate and Water“

Circulation pattern and heavy precipitation

SynopVis GWL



Angelika Palarz

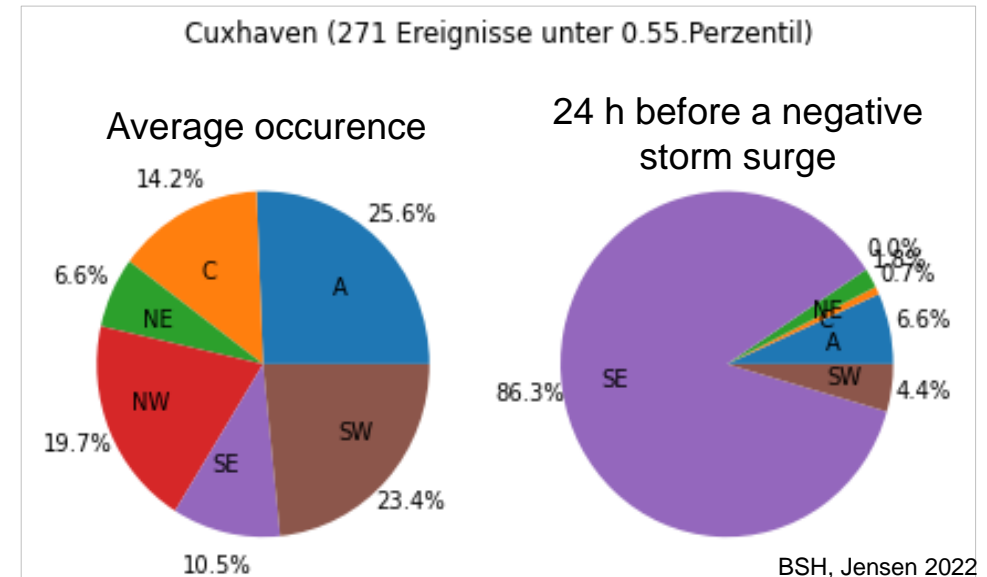
Session UP1.6
08.09.22 | 14:45

Short-duration precipitation extremes detected by the DWD radar network and associated circulation patterns

→ Analyses are the basis for integrating damage information
→ Improving process understanding of flood-generation

Circulation pattern and tidal dynamics

LAMB circulation



BSH, Jensen (2022): Average occurrence of LAMB circulation pattern using daily mean sea level pressure from ERA5

- Negative storm surges occur mainly under South-Eastern circulation with strong offshore winds

→ Basis for the analysis of shipping restrictions due to negative storm surges

Exposure

Assessment of future climate changes and their impact on transport infrastructures

Mass movements



Low water levels



Water quality



Storm surges



Windthrow



High water levels



Erosion



Extreme low tides



Flash floods



Embarkment fires



Sea level rise



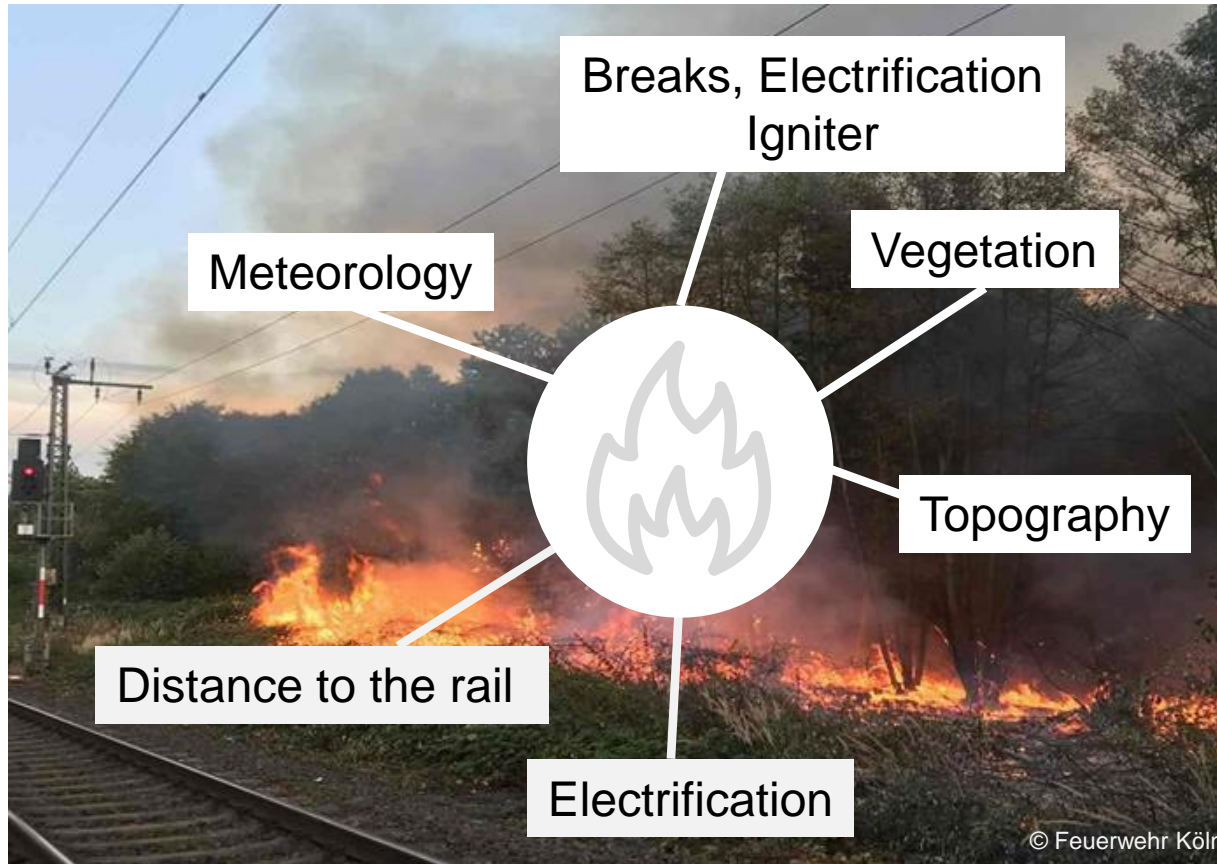
Extreme waves



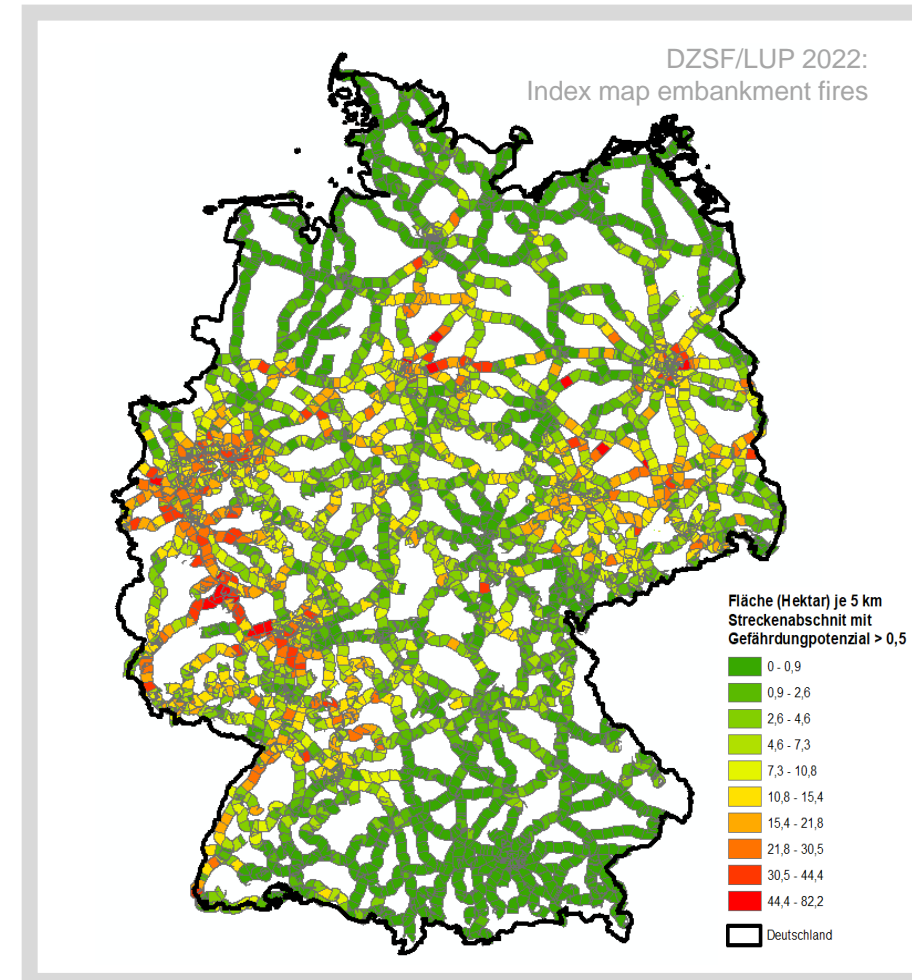
➤ Development of impact models

➤ Studying spatial and temporal changes in the occurrence of specific climate impacts on transportation

Assessment of the exposure towards embankment fires (rail)



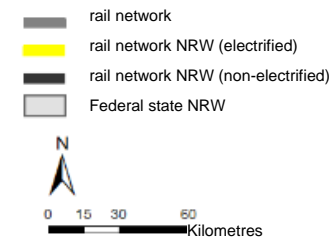
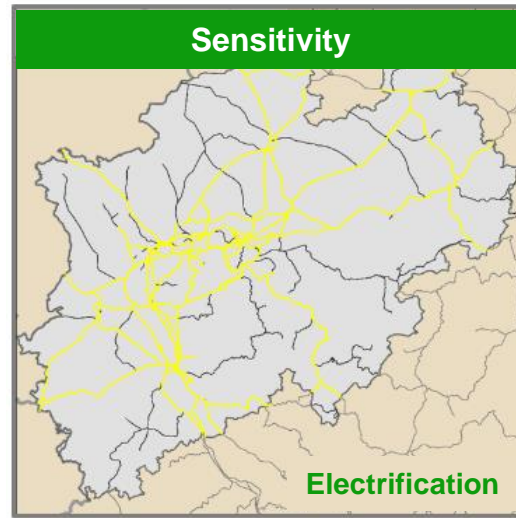
Embankment fires cause infrastructure damages and traffic interruptions



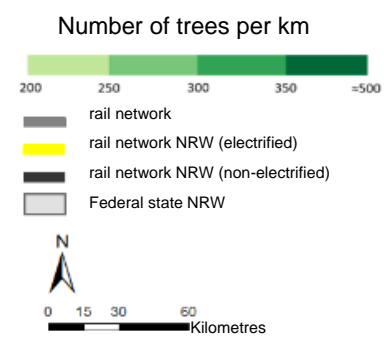
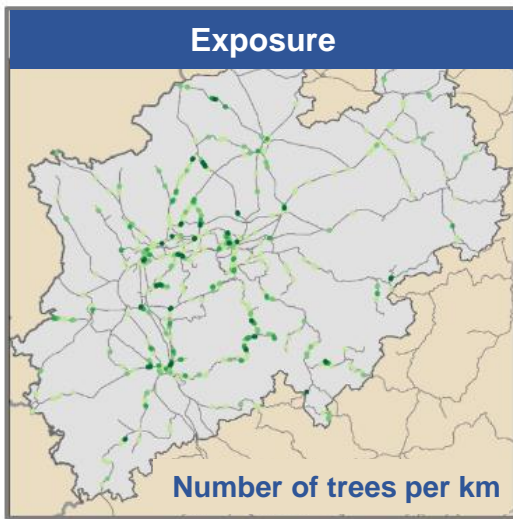
Exposure and sensitivity to windthrow along railways



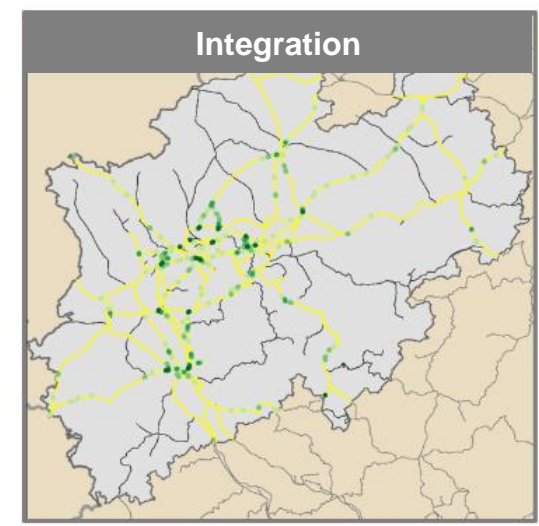
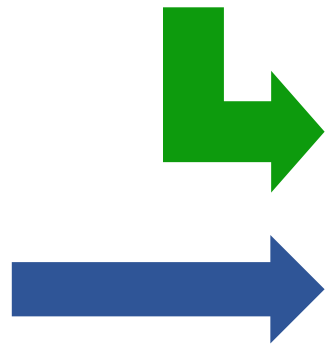
Frick et al. (2021)



69.6% of the railway network with electrification



7% of the railway network with >350 trees per km



4.7% high exposure and sensitivity

DZSF/EBA (2022)

Developing adaptation options

Engineering approaches

Regulatory approaches

Operative infrastructure management

Informational approaches

Operative traffic management

How to adapt?

Developing operational climate services

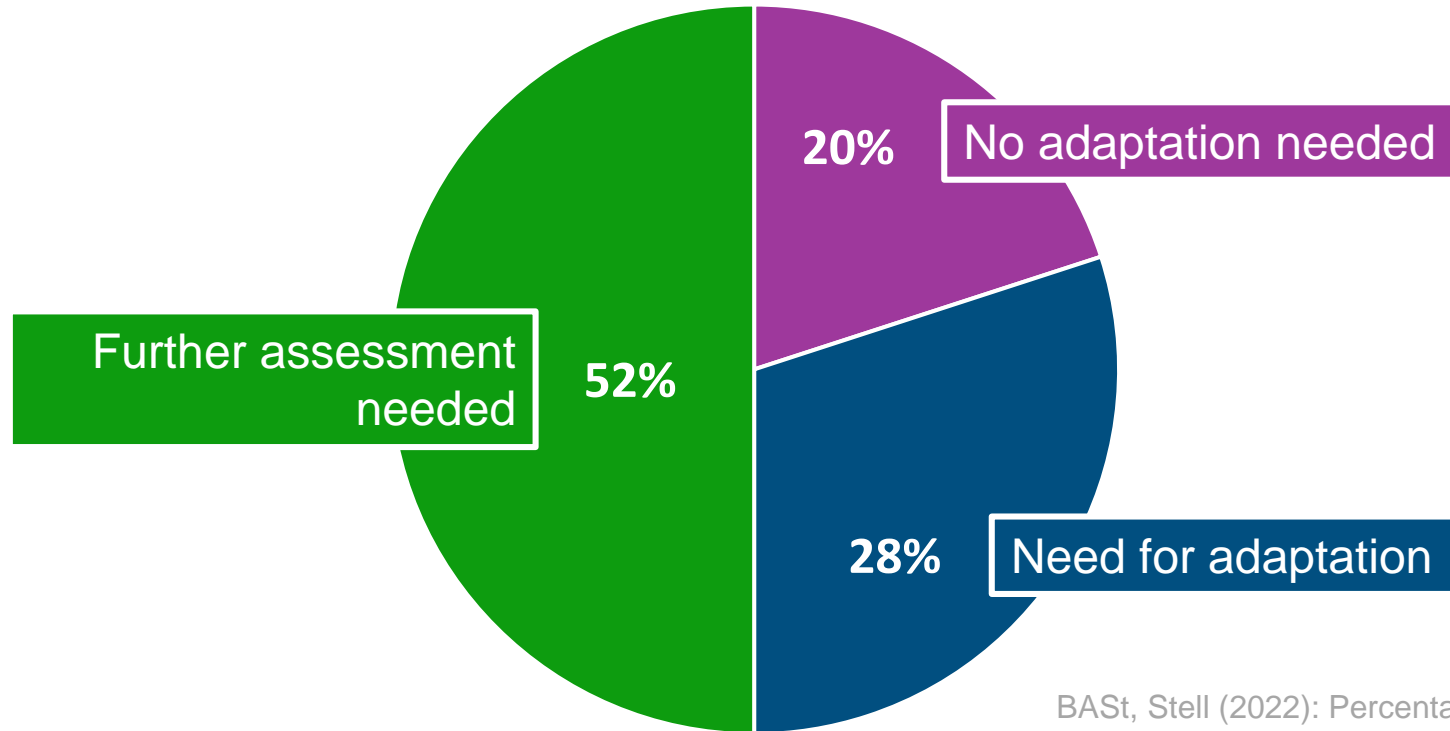
Adaptation of rules, regulations and design values

Structural measures

Adapted management of transport infrastructures

Traffic shifts, modelling traffic flows

Regulatory Approach



BASSt, Stell (2022): Percentage of regulations with need for adapting to climate change

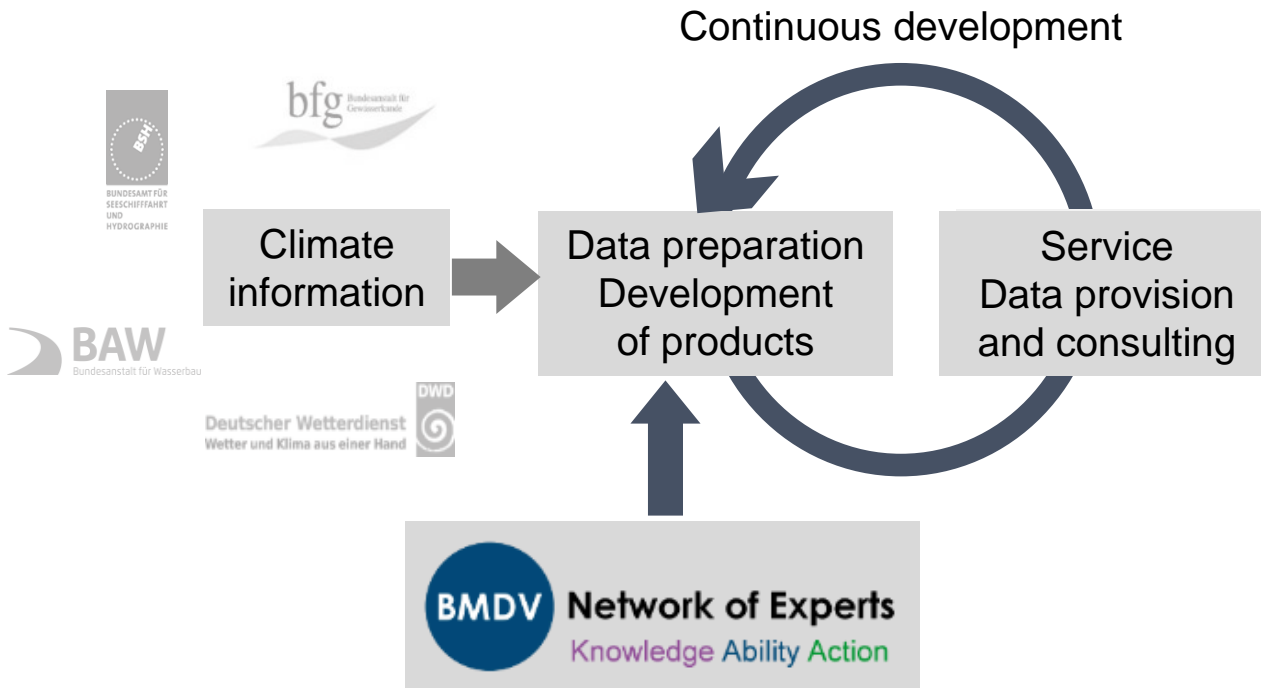
- Example: Adaptation need of regulations for federal roads
- About 900 regulations and rules have been studied with respect to the adaptation needs to climate change

→ The adaptation of rules, regulations and design values is the basis for the systematic integration of climate change aspects into infrastructure planning

Informatory approach

DAS core service “climate and water”

- Provision of knowledge on climate change (data, consultation, education) to infrastructure planners, e.g. the Federal water and shipping administration.
- Information is available in a routine process | operational service



Mit dem DAS-Basisdienst steht ein operativer Klimaschutzservice für die Themen Klima und Wasser zur Beratung und Datenbereitstellung im Rahmen der Anpassung an den Klimawandel in Deutschland bereit.

Auf diesem Webportal finden Sie Informationen rund um den DAS-Basisdienst und die zugehörigen Produkte. Dieses Angebot wird Ihnen im Auftrag des Bundesministeriums für Verkehr und digitale Infrastruktur (BMVI) gemeinschaftlich durch die Bundesoberbehörden Bundesanstalt für Wasserbau (BAW), Bundesanstalt für Gewässerkunde (BfG), Bundesamt für Seeschifffahrt und Hydrographie (BSH) und Deutscher Wetterdienst (DWD) bereitgestellt.

Unter der Rubrik „DAS-Basisdienst“ sind Hintergrundinformationen rund um die Deutsche Anpassungsstrategie an den Klimawandel (DAS) und zum DAS-Basisdienst „Klima und Wasser“ selbst zu finden. Die beteiligten Behörden und die zugehörigen Beratungsteams stellen sich unter „Partner“ vor. Unsere „Produkte“ sind neben der Beratung das Kernstück des DAS-Basisdienstes. Das Angebot der Produkte wird fortlaufend in enger Abstimmung mit den Nutzerinnen und Nutzern des Portals und unter Berücksichtigung von aktuellen Forschungsergebnissen, zum Beispiel aus dem BMVI-

www.das-basisdienst.de

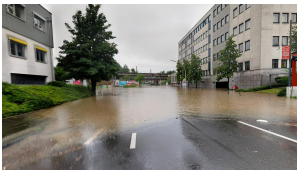


Summary



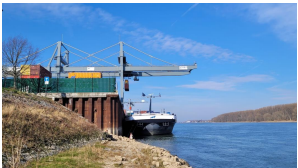
Studying climate change

Development of new datasets and methods;
Analysis of changes in the climate average and extreme events



Analysing climate change impacts on transportation

Study cause-and-effect relationships;
Development of hazard maps



Assessing sensitivity and criticality of infrastructures & traffic

Collection of event and damage data;
Development of data bases and information portals



Developing adaptation options

Exemplarily study different types of adaptation measures

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Further information ...

... may be found at our website
www.bmdv-expertennetzwerk.info.de

- general information
- Scientific and synthesis reports
- Scientific publications
- Past and future events; e.g. German Climate Adaptation week
-and more !!!



**More information at
12 September 2022**

Vorstellung des BMDV-Expertennetzwerks

13:10 Klimawandelfolgen und Anpassung für das Bundesverkehrssystem –
von Anpassungsmaßnahmen im BMDV Expertennetzwerk
Dr. Stephanie Hänsel, Deutscher Wetterdienst DWD, Themenfeldkoordinatin

Vorstellung aktueller Forschungsergebnisse

13:30 Klimawandel und der Schienenverkehr – Risiken heute und in Zukunft
*Dr. Sonja Szymczak, Deutsches Zentrum für Schienenverkehrsforschung beim
Eisenbahnbundesamt DZSF/EBA*

13:50 Klimawirkungsanalyse für das Bundesfernstraßennetz
Lennart Meine, Bundesanstalt für Straßenwesen BAST

14:10 Pausengespräch

14:25 Binnenwasserstraßen im Klimawandel – Niedrigwasser, Hochwasser und weitere
Wirkungszusammenhänge.
Dr. Enno Nilson, Bundesanstalt für Gewässerkunde BfG

Von der Forschung in die Praxis

14:45 Prozessverständnis kommt vor Anpassung. Ein Ansatz für die Wasserstraße.
Lisa Scharf, Bundesanstalt für Wasserbau BAW

15:05 DAS-Basisdienst "Klima und Wasser" – Informationsdienst zur Unterstützung der
Anpassung an den Klimawandel
Dr. Jennifer Ostermüller, Deutscher Wetterdienst DWD

15:25 Verabschiedung
Dr. Stephanie Hänsel, Deutscher Wetterdienst DWD, Themenfeldkoordinatin

Special Issue "Impacts of Climate Change on Transportation Infrastructure, Networks and Nodes"

- Szymczak et al (2022) Impacts of Heavy and Persistent Precipitation on Railroad Infrastructure in July 2021: A Case Study from the Ahr Valley, Rhineland-Palatinate, Germany

Under review:

- Uber et al. (2022) Climate Change Impacts on Soil Erosion and Sediment Delivery to German Federal Waterways: A Case Study of the Elbe Basin

- Jensen et al. (2022) Ne...
– Large... climate

...ar. (2022) Implementing hydrological forecasting services supporting waterway management and transportation logistics relating to hydroclimatic impacts

Submit your manuscript till 10 February 2023



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Impacts of Climate Change on Transportation Infrastructure, Networks and Nodes

Guest Editor:

Dr. Stephanie Hänsel
Deutscher Wetterdienst,
Frankfurter Straße 135, 63067
Offenbach, Germany
stephanie.haensel@dwd.de

Message from the Guest Editor

Dear Colleagues,

There is growing concern about the impacts of climate change on the transportation system as they may be connected with the destruction of transport infrastructure and limit the availability of transport services. In many parts of the world, we have recently witnessed disruptions in transport infrastructure or transport limitations that were related to extreme weather events. With the continued warming of Earth's surface, an increase in the intensity, frequency and duration of the adverse effects of climate change on transportation are expected in the coming decades. Thus, studies are needed that assess and address the impacts and risks for the transport system that are connected with climate change and extreme weather events. It is important to act now, as many transportation assets are very long-lived, and planning and implementation processes are generally very time-consuming. Innovative solutions are required for climate change adaptation as well as sustainable development of the transport system resulting from a dialogue between science, policy and practice.

Dr. Stephanie Hänsel
Guest Editor



mdpi.com/si/104062

Special Issue

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