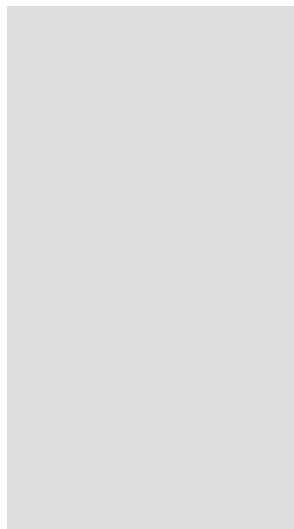


RIVA

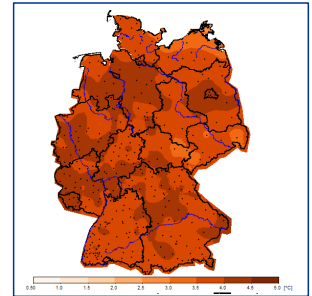
Risk analysis of important goods and transit transport axes including seaports of the German motorway network

4th Session Group of Experts on Climate Change Impacts and adaptation for international transport networks

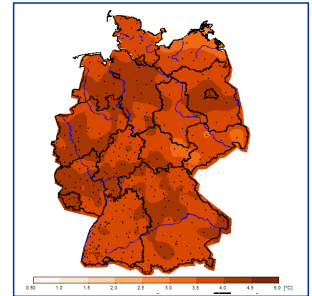
Dr. Katrin Fischer, Alfen Consult GmbH
Geneva, 9th October 2012



- (1) Welcome and introduction
- (2) Objectives of the research project
- (3) Research approach of RIVA
- (4) Data input
- (5) Lessons learnt



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Consequences of climate change



Increase in rutting



More "Blow ups" in concrete surfaces



Heat-expansion of prestressed concrete bridges

Heat waves and extreme precipitation



Inundation due to ill-dimensioned drainage systems

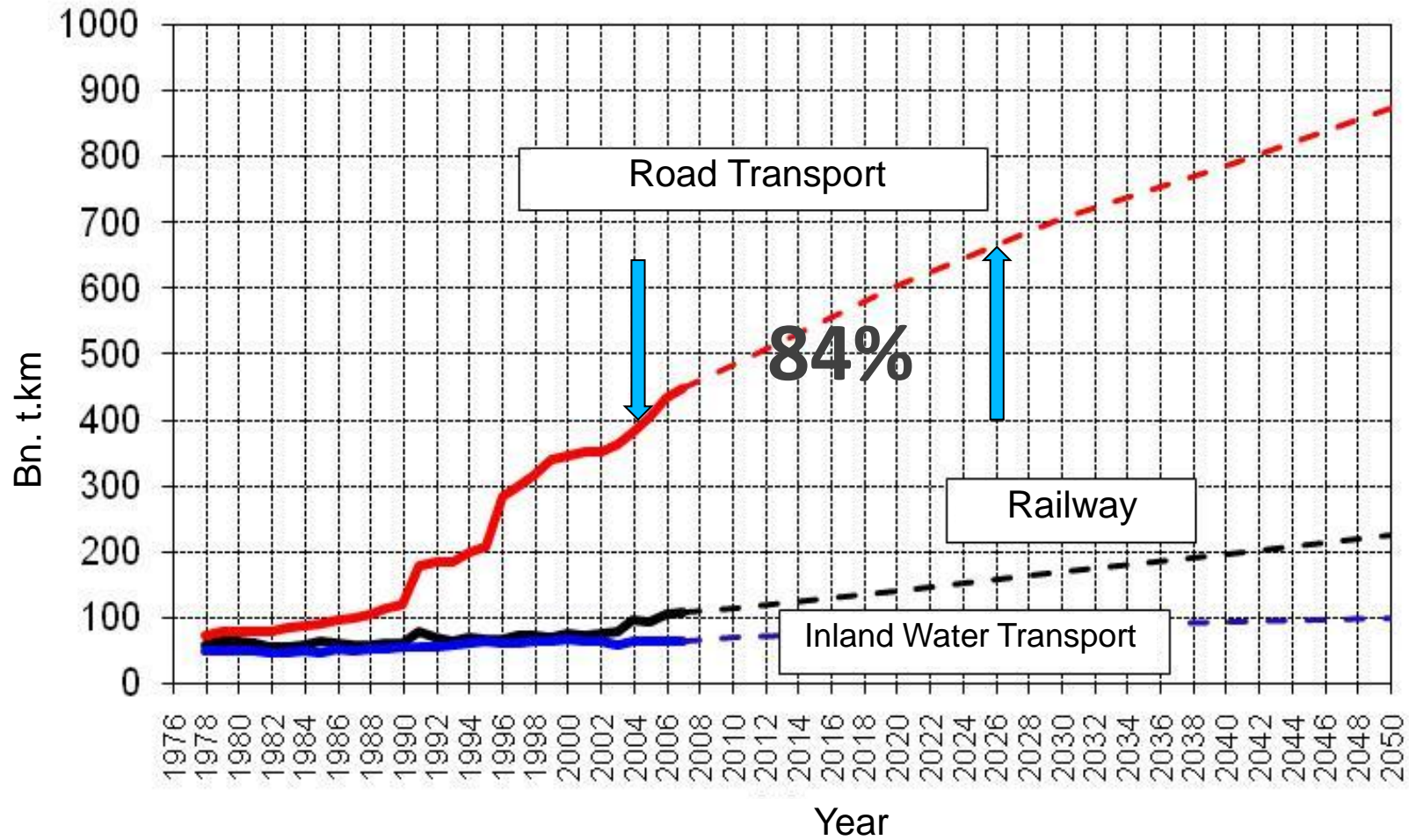


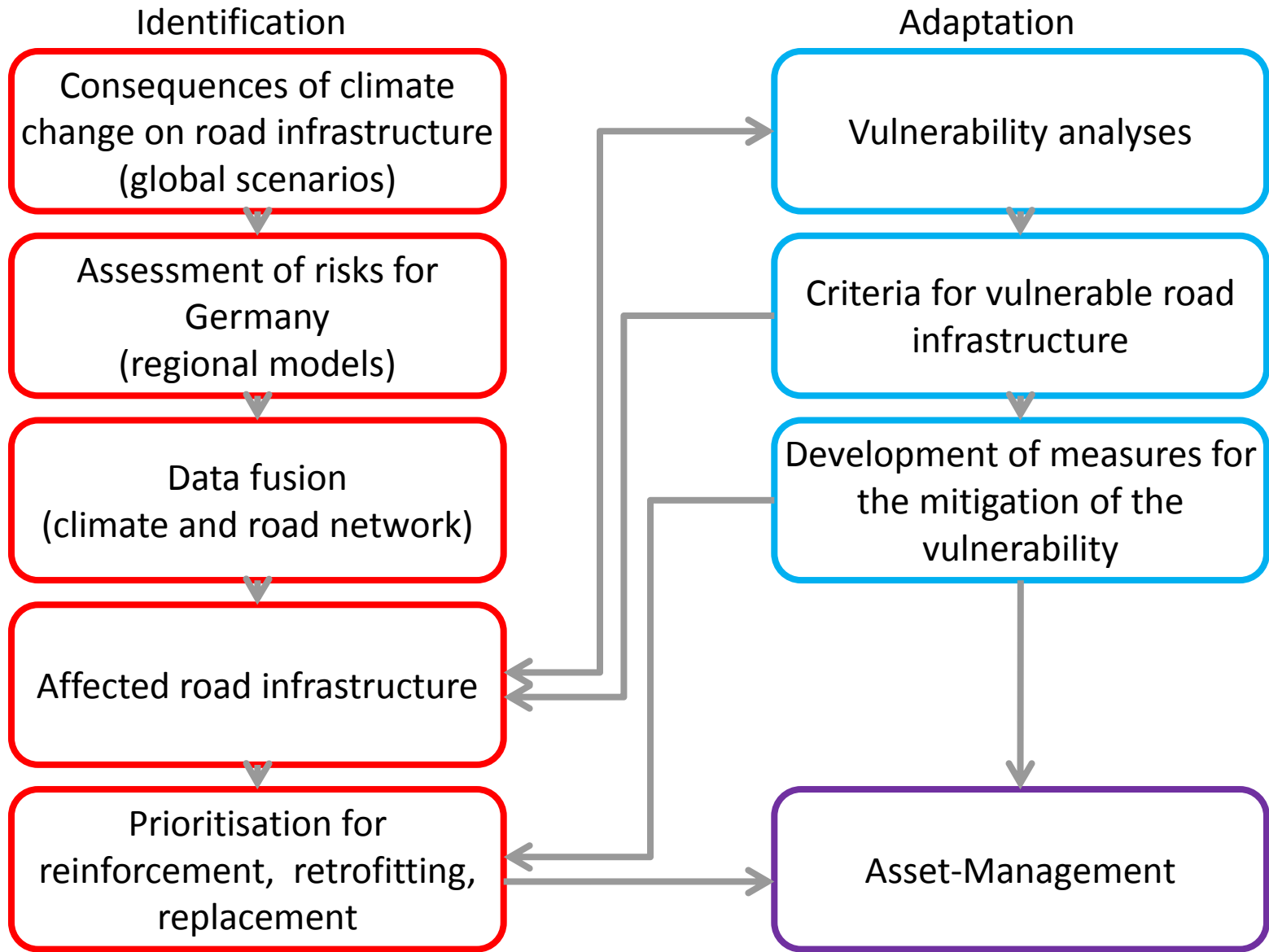
Inundation of tunnels



Storm-caused accidents

Forecasted high increase in traffic volumes

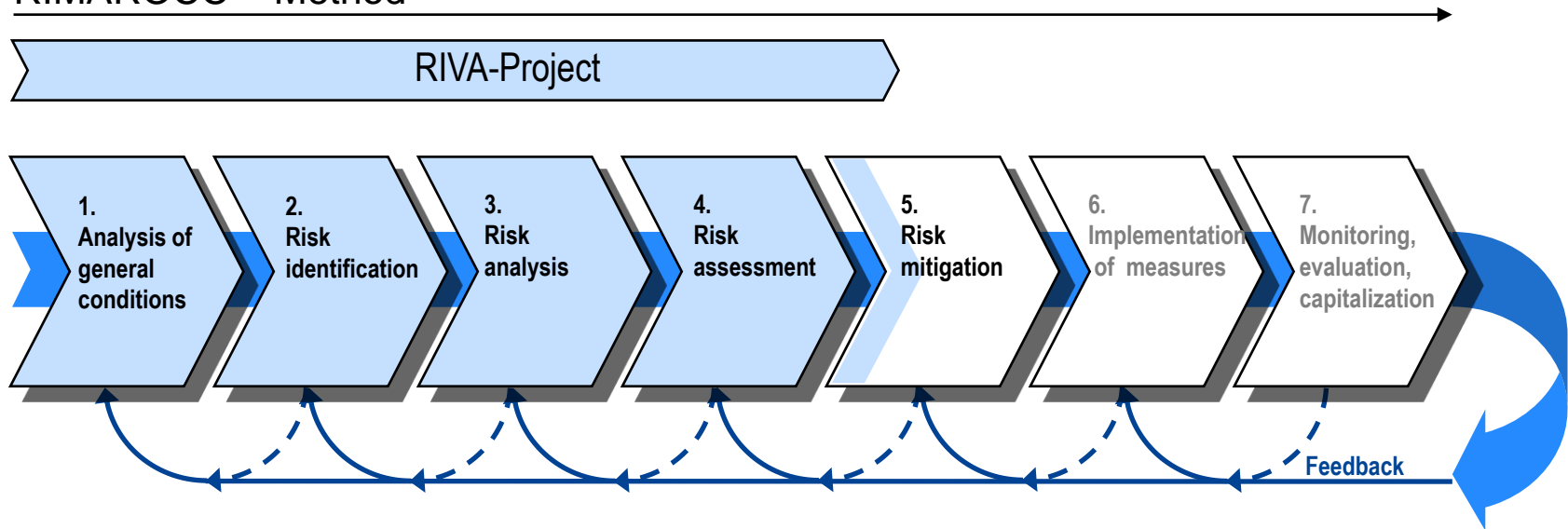




Main objective

- Development of a risk catalogue and a methodology based on RIMAROCC for the whole German motorway network

RIMAROCC – Method

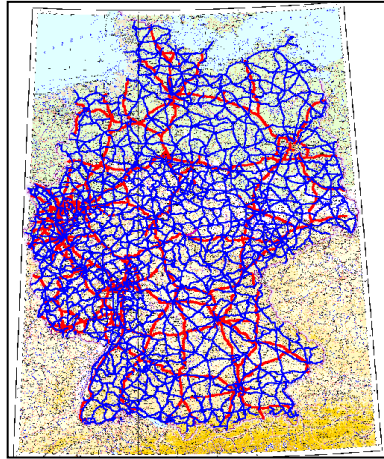


Other objectives

- Assess relevante climate signals relevant for road infrastructure
- Identify the elements of road infrastructure which are affected by weather and climate events
- Analyse the impact of climate change on road infrastructure and transport
- Analyse cost to society
- Indentify suitable measures of risk mitigation (reduction, avoidance, transfer or acceptance)
- Apply RIVA-methodology to selected national motorway sections

■ ■ ■ Road Infrastructure in Germany on Federal Level

Roads



Civil Engineering Structures



Federal Roads: 53.000 km
Motorways: 12.000 km
Other federal roads: 41.000 km

Federal Roads: 38.288 Bridges and 220 tunnels
Motorways: 17.083 Bridges
Other federal roads 21.205 Bridges

Asset Value

300 Bn.€

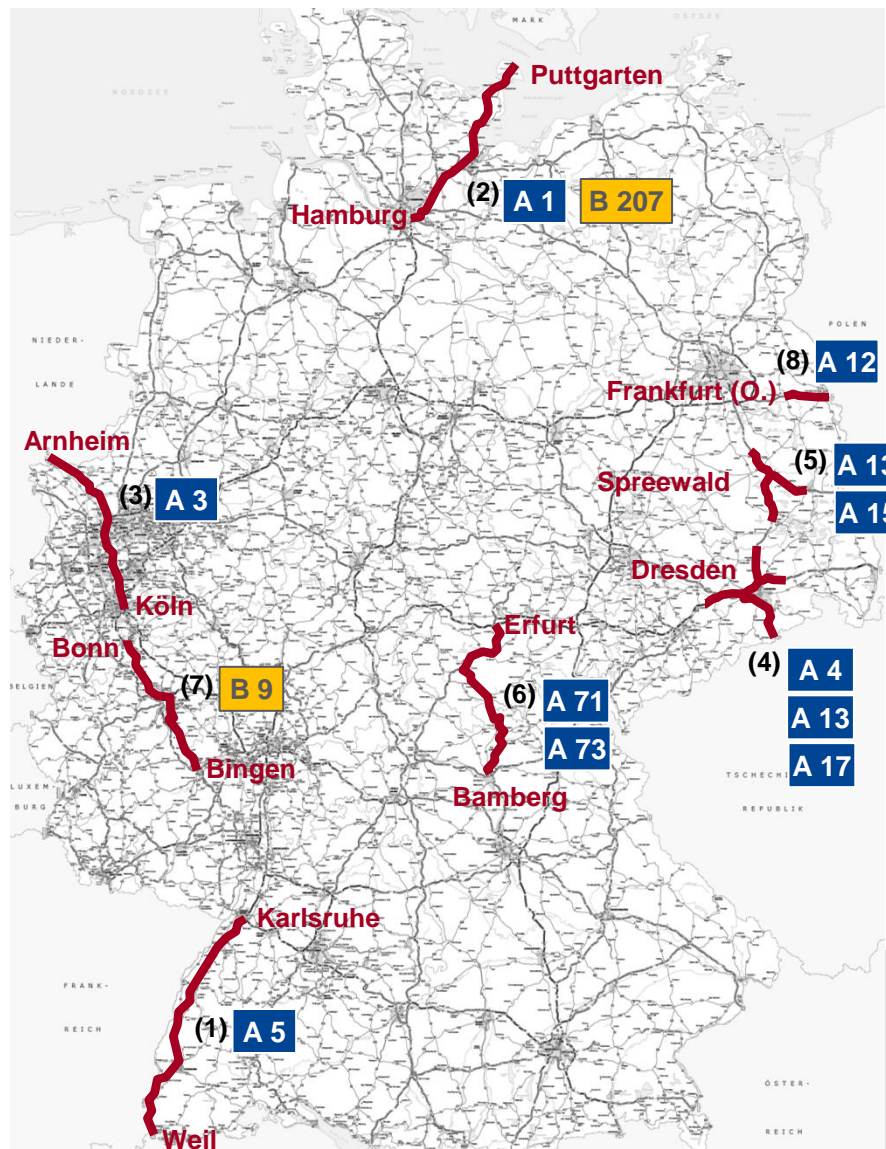
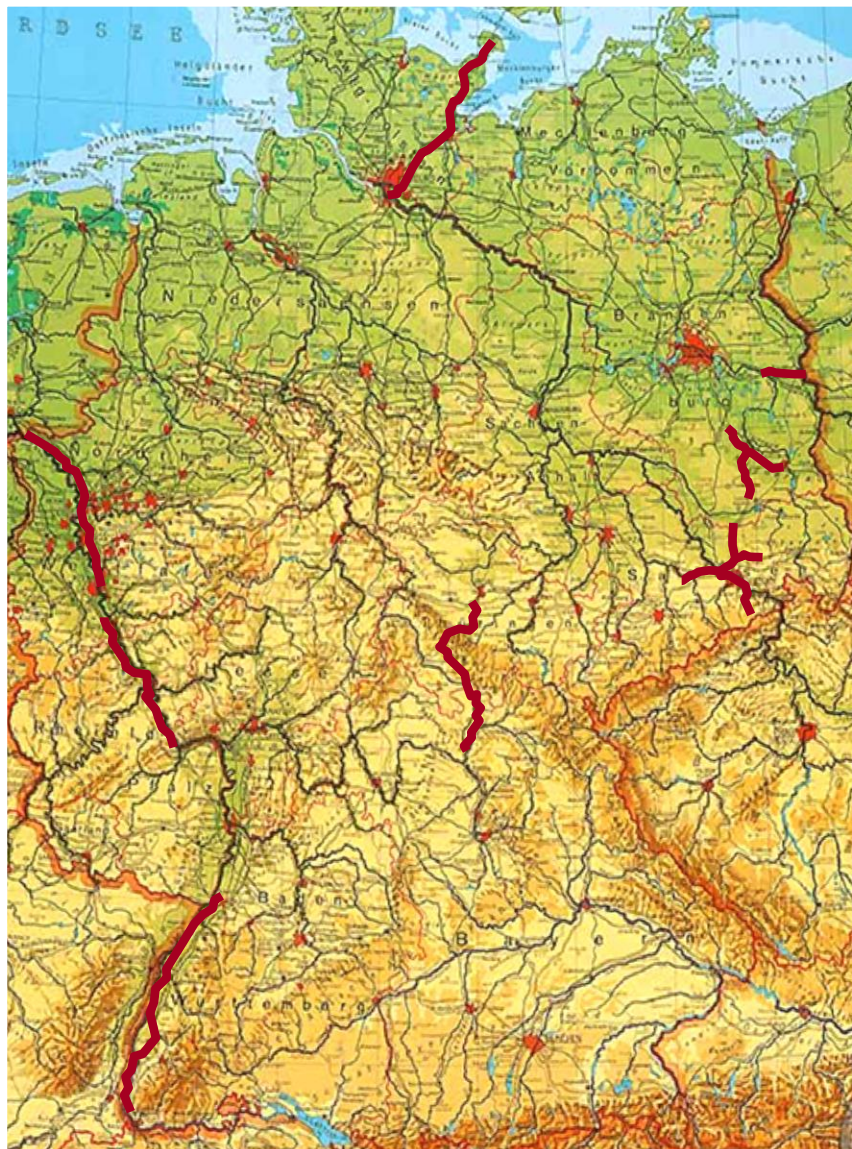
60 Bn.€

Service life

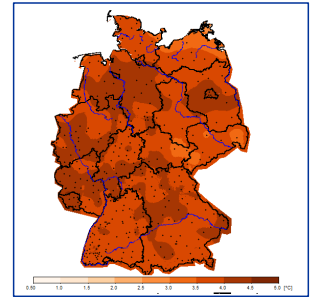
30 bis 50 Years
 Layout of the road > 50 Years

80 bis 100 Years

Selected motorway routes in Germany



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Risk elements: physical respectively virtual component parts of a infrastructure system which can suffer damage and are able to affect the considered part of transport process

Source: BMI, Schutz Kritischer Infrastrukturen - Risiko- und Krisenmanagement - Leitfaden für Unternehmen und Behörden, 2011, S.15.

Risk elements of transport infrastructure

Immobile elements (constructional and local existent)

Mobile elements (people and vehicle)

Virtual elements (composition, structure and functionality of the network)

Requirements for the catalogue of the vulnerable elements

- Elements/ processes which can be endangered (effectively or perspectively) by climatic events
- Relevant to the RIVA-investigation scale
(network approach; level of detail; clustering possible)
- Use current data collection to generate information about the vulnerable elements
- Use applicable standards for systematization of data collection

Impact of climate change signals

Can a weather event potentially occur (in a certain frequency, duration and intensity) on the spot of the risk element?

occurrence weather event

- frequency
- duration
- intensity

exposure

Vulnerability

To which extend is a risk element potentially vulnerable for a physical damage or functional disruption by events caused by climate change?

fragility (sensitivity)

exposure (surrounding conditions)

resilience (durability)

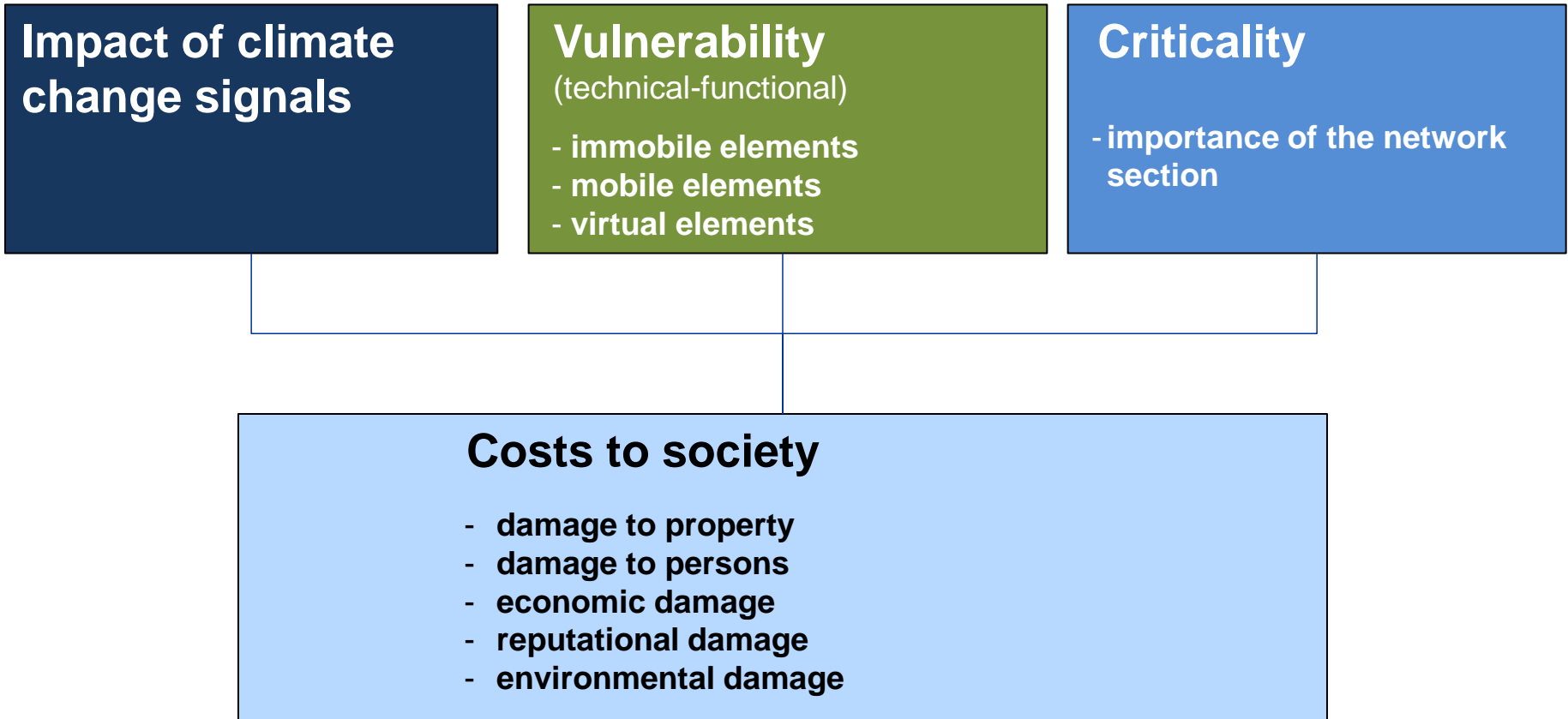
Criticality

How important is the specific segment of the network regarding consequences resulting from a disruption of traffic flow and flow of goods?

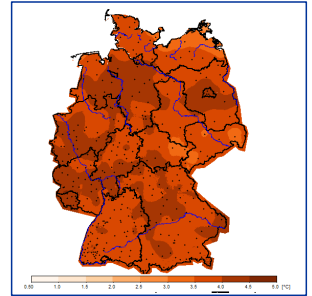
traffic volume

alternative routes

.....



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Climate Data

- Relevant climate parameters
- Regional climate models
- Specific variabilities of different models
- Emission scenarios (A1B)
- Multi-Modell Ensembles
- Spread of output parameters

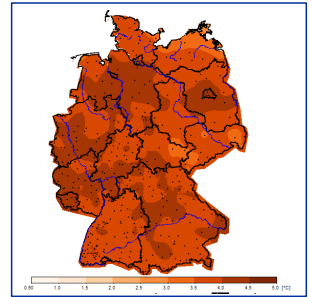
Technical and functional data

- network, administration, pavement condition, geometrical data
- Information on civil engineering structures
- pavement condition, pavement construction, road treatments
- Traffic intensity

Network information

- Density of traffic, traffic volume and mix
- Alternative routes
- Freight intermodality and logistics
- Travel times
- Traffic congestion costs
- Accident costs

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Climate data and climate projections

Task: “based on a set of different emission scenarios and their regional projections data shall be generated regarding likelihood of extreme weather events”

However, what does it mean for RIVA?

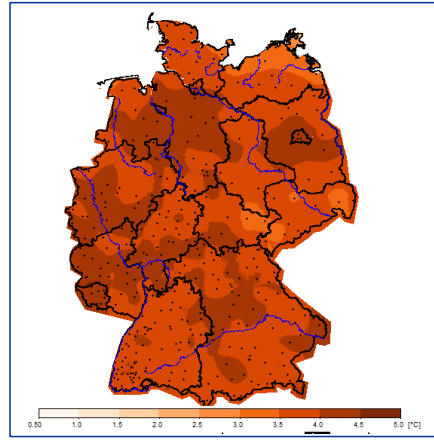
- Which and how many climate models shall be included?
(strengths and weaknesses, availability)
- How to deal with model specific variations of outcomes and the resulting range of diversity in regional projections? => interpretation necessary!
How to implement ‘interpretation’ in a network based approach?
- Regional climate data generated need to be suitable for risk based vulnerability assessment
 - Which climate events are relevant? Which events can be described with adequate level of detail and reliability?
 - How about long-term development of ‘normal’ climate conditions (average temperatures, average rainfall etc.)?
 - Which parameters need to be generated on what level of detail?

Complex cause-and-effect relationships, need for cross linking with other transport modes and international approaches

- Some impacts to road infrastructure caused in relation to climate events cannot be predicted on an adequate level of reliability based on climate model projections, e.g.
 - Landslides (dependent on individual aspects such as angle of inclination, geology, cardinal direction, morphology, hydrology)
 - Flooding of roads and structures caused by surface water (rivers, creeks)
- => Investigation of such complex cause-and-effect relationships to be undertaken in separate research projects; outcomes of these Projects to be implemented in RIVA
- => outcomes need to be suitable to be included in RIVA assessment methodology
- => separate research projects to provide for suitable states of vulnerability levels and hazard maps (data sets suitable for implementation in data bases)

Infrastructure data requirements

- Existing databases are a good basis
- However, a database providing all relevant infrastructure data out of one system would be of great value
- Some relevant infrastructure data are (not yet) available, for example characteristics of drainage systems, age of structures ...
- To allow for an efficient network based assessment method database(s) need to provide for systematic interpretation and merging of data suitable for RIVA information needs
- to draw conclusions regarding economic losses within the RIVA project an approach needs to be developed to assess criticality of roads / road sections on a network level (using existing methods to calculate loss of time and detour costs)



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