

UIC Project ARISCC

Activities of DB AG

Workshop, October 19 & 20 2010, Paris

Roland Nolte, IZT Berlin

ARISCC - Adaptation of Railway Infrastructure to Climate Change

Extreme Weather Events in Germany – Elbe flood 2002



Priorities of DB Netz

- Consistent data bases (events, damage, status of assets)
- Damage & delays caused by storms and gales
- Heatwaves and extended dry periods
(track buckling, maintenance problems, safety, destabilization....)
- Flooding (surface and fluvial flooding)
- Long-term: Change in vegetation growth patterns

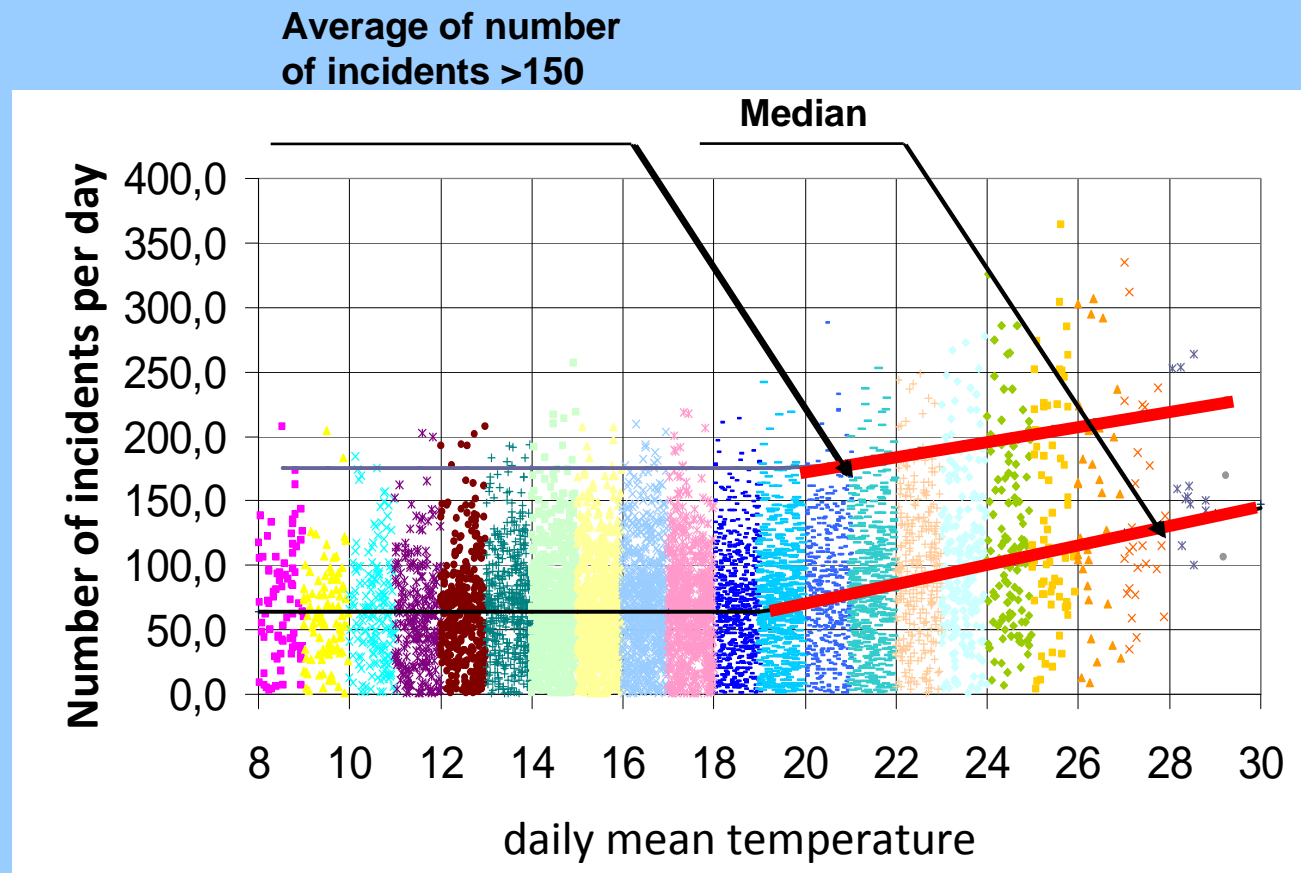
DB Activities - Overview

Activities of Deutsche Bahn

- Data analysis (weather-related incidents & delays)
- First assessment of regional climate scenarios
- Case study Rhine valley within ARISCC
- Dedicated on-line weather monitoring system (Bavaria)

Data analysis: Weather-related incidents & delays

Correlation between Temperatur and the number of incidents



ARISCC - Adaptation of Railway Infrastructure to Climate Change

Assessment of regional climate scenarios

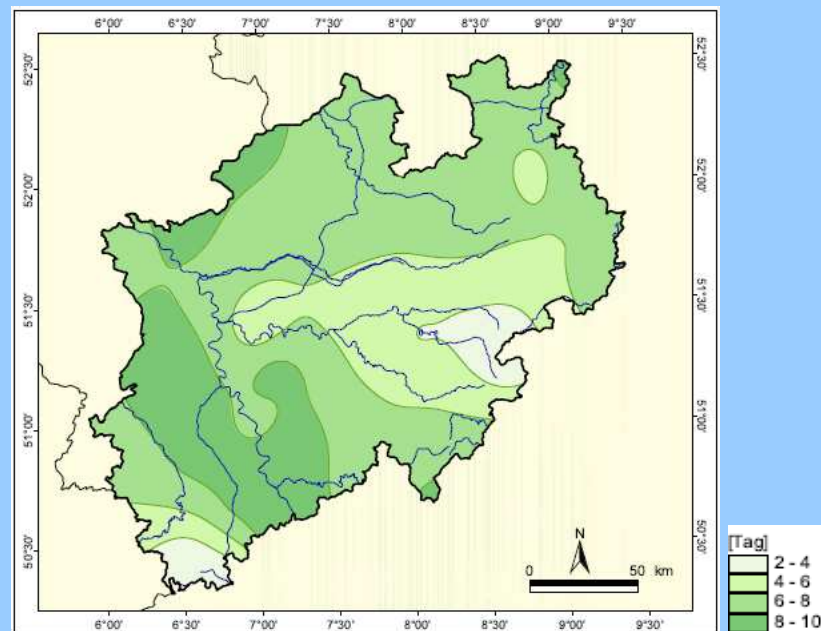
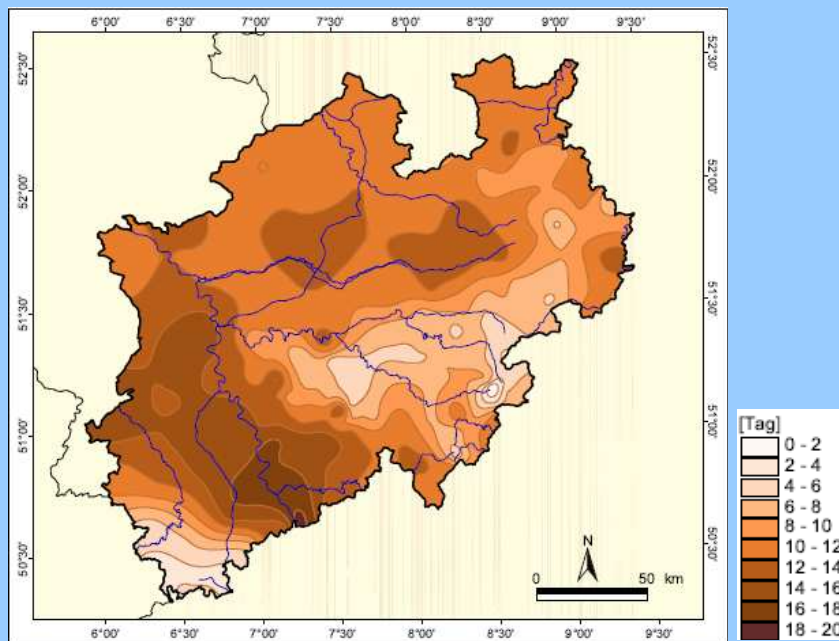
Summer rain	Winter rain	Heat waves
-		y
-	+++	
-	+	
-	+	y

- Nordwestdeutsches Tiefland/ Nord- und Ostseeküste
- Nordostdeutsches Tiefland
- Westdeutsche Tieflandsbucht
- Zentrale Mittelgebirge und Harz
- Südostdeutsche Becken und Hügel
- Links- und Rechtsrheinische Mittelgebirge
- Oberrheingraben
- Alp und Nordbayerisches Hügelland
- Erzgebirge, Thüringer und Bayerischer Wald
- Alpenvorland
- Alpen



ARISCC Case Studies – Rhine Valley

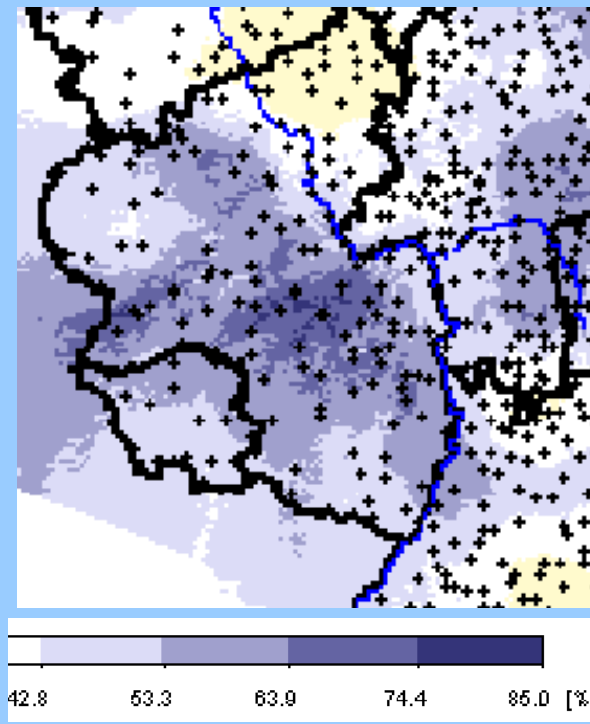
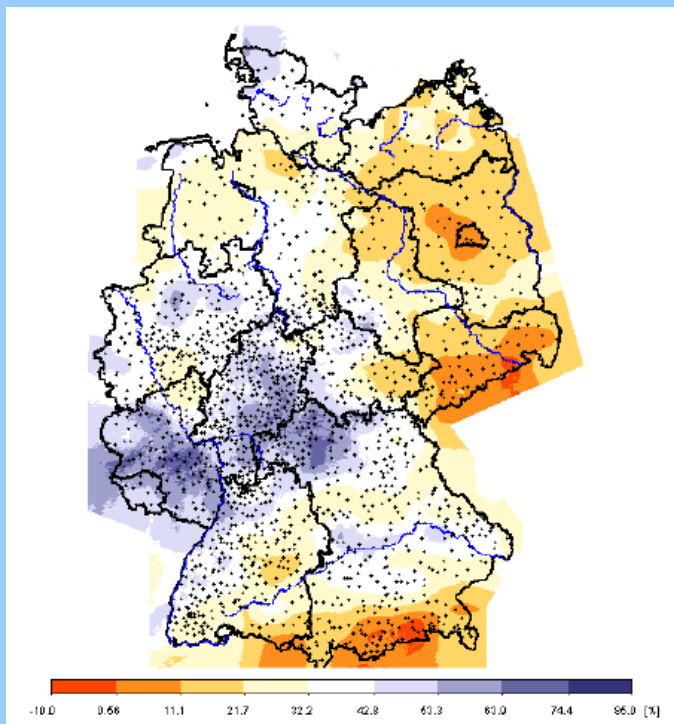
Expected Climate Loads for the Rhine Valley (1)



Number of hot summer days in NRW in 2046/2055 and change from the baseline 1951/2000

ARISCC Case Studies – Rhine Valley

Expected Climate Loads for the Rhine Valley (2)



**More winter
rain!**

Changes in Winter Precipitation 1961-1990 and 2071-2100
(Mountain Ranges along the Rhine)

ARISCC Case Studies – Rhine Valley

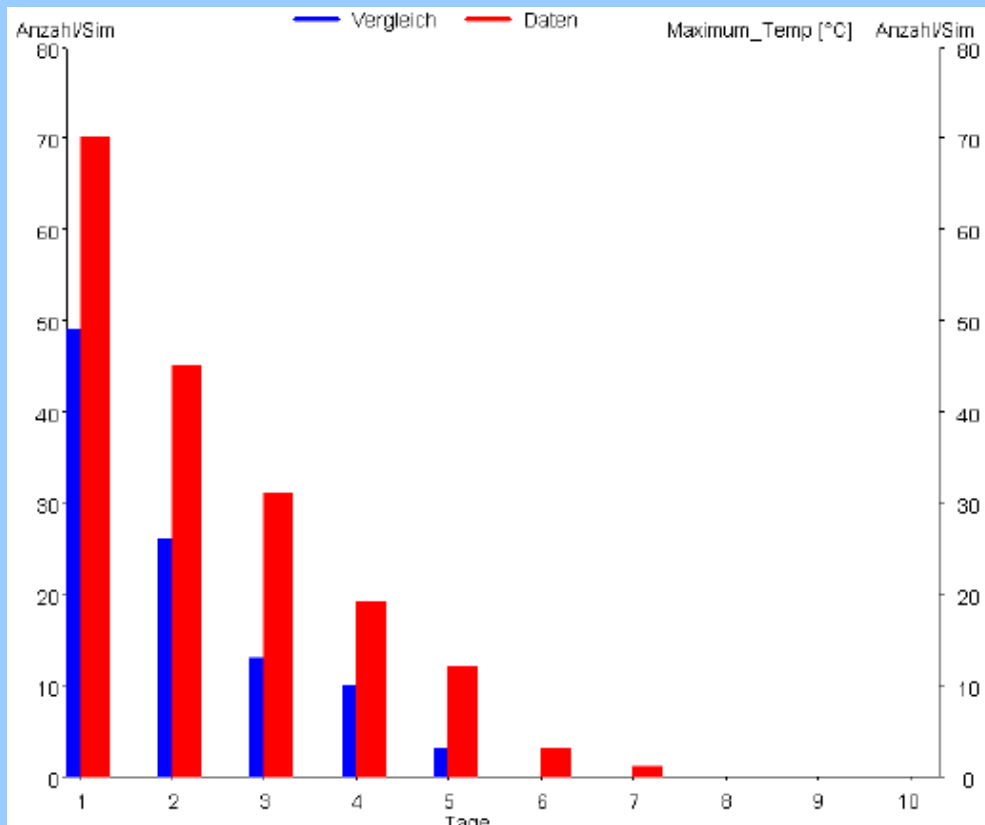
Expected Climate Loads for the Rhine Valley – „Event days“

Nr.	cold days	very cold days	warm summer days	hot summer days	dry days	wet days
	$T_{\min} < 0^{\circ}$	$T < 0^{\circ}$	$T_{\max} > 25^{\circ}$	$T_{\max} > 30^{\circ}$	$N < 0,1\text{mm}$	$N > 10\text{mm}$
1	-27,0	-5,0	22,5	8,7	4,0	0,5
2	-19,8	-3,6	21,6	8,2	9,0	1,0
3	-20,7	-8,5	16,9	6,0	3,6	0,7
4	-16,2	-6,6	17,4	5,2	4,4	1,4
5	-19,7	-5,2	17,6	6,3	-3,9	1,8
6	-28,6	-10,4	19,9	6,7	13,2	0,6
7	-11,9	-4,2	16,4	6,3	1,4	2,1
8	-23,7	-6,1	12,0	4,0	3,4	1,5
av	-21,0	-6,2	18,0	6,4	4,4	1,1

Change of the number of event days (1951/2000 compared to 2046/2055)

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Expected Climate Loads for the Rhine Valley (3)



**More and longer
heat waves!**

Periods with $T_{max} > 30^{\circ} C$ 1981/90 and 2091/2100 for the upper Rhine Valley;

Source: WettReg 2007

ARISCC Case Studies – Rhine Valley

Expected Climate Loads for the Rhine Valley (4)

Sources: Climate Study North Rhine Westphalia 2004 & 2006

Changes from 1951/2000 to 2046/2055

- Temperature change: $T_{av} +1,53^{\circ}$, $T_{max} +1,68^{\circ}$, **up to 2°**
- Most significant changes: “event days” (indicator for **extreme weather events**)
- Subzero days: -12....-30 days!, average -20 (**30%**)
- Summer days ($T > 25^{\circ}$) + 9....+26 days, average: **+63%** (**max: +100%**)!
- Hot Summer days (), +2...+12 days, av: **+136%**, **max > 150%**
- Total precipitation will increase with regional and seasonal differences
- Mainly Wetter winters & dryer summers
- Regional and local differences! Influence on vegetation growth!