„Global Change in the Elbe River catchment and the UFZ/TERENO approach within the Bode catchment“

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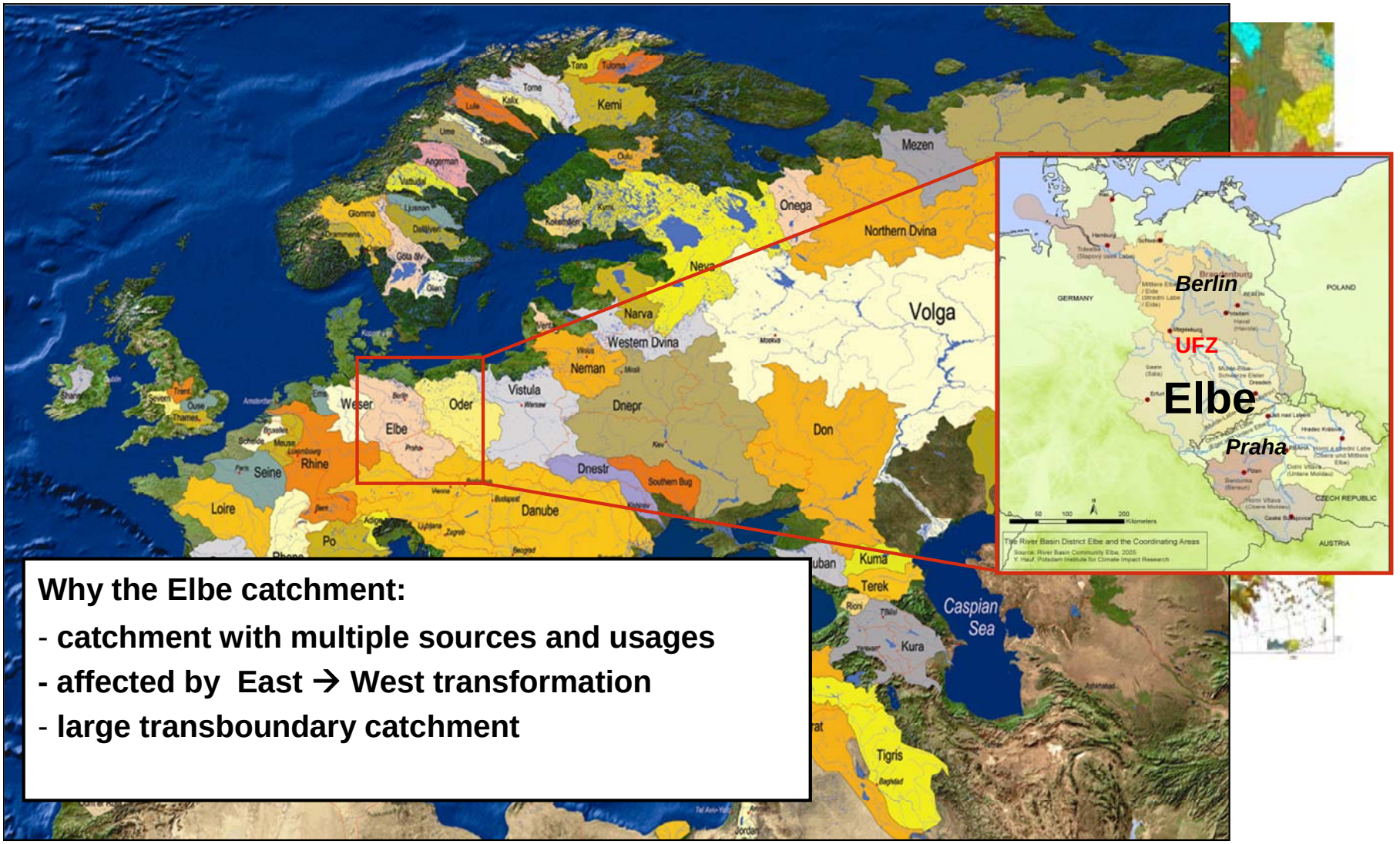
Characteristics of the Elbe River catchment



Why the Elbe catchment:

- **catchment with multiple sources and usages**
- **affected by East → West transformation**
- **large transboundary catchment**

Elbe River catchment

Past

- high atmospheric pollution
- pollution of surface waters
- open-pit charcoal mining (lowering of groundwater levels)
- collapse of political & economic system & of ecology

→remediation/revitalisation of former/polluted landscapes

Today – Uses:

Czech: Hydropower

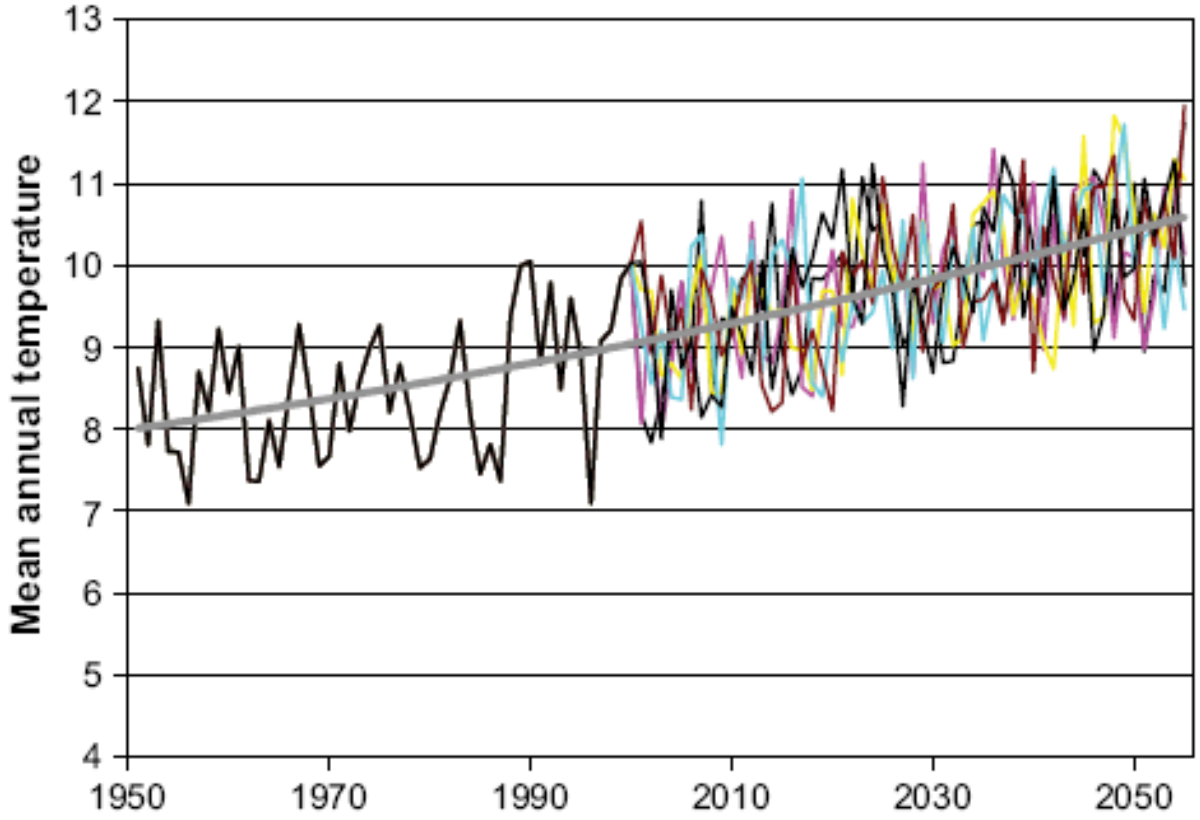
Germany: Navigation, mining, cooling, water supply

		1985	1989	1992	1993	1997	2001	2004
Abfluß (MQ)	m^3/s	558	520	515	510	592	584	511
BSB $_{21}$ *	t/a O_2	-	430 000	220 000	220 000	190 000	190 000	210 000
Chlorid	t/aCl^-	3700 000	3500 000	2400 000	2400 000	2600 000	2200 000	2100 000
Ammonium (filtr.)	t/a N	54 000	32 000	7 700	6 900	4 000	1 900	2 100
Nitrat (filtriert)	t/a N	54 000	75 000	88 000	81 000	92 000	74 000	63 000
Gesamt-N (Koroleff)	t/a N	140 000	140 000	110 000	100 000	110 000	93 000	75 000
o-Phosphat (filtr.)	t/a P	3 400	2 200	1 600	<1 500	970	940	690
Gesamt-Phosphor	t/a P	12 000	9 100	4 100	6 400	3 900	3 600	3 100
Quecksilber	t/a	28	12	4,2	1,9	1,4	1,2	1,0
Cadmium	t/a	13	6,4	5,3	5,0	5,6	5,9	5,2
Blei	t/a	110	110	76	75	100	59	59
Arsen	t/a	99	52	65	67	63	43	45
Trichlormethan	kg/a	14 000	13 000	2 000	860*	1 600*	1000*	160*
Trichlorethen	kg/a	40 000	7 300	1 900	1 100*	870*	170*	<16*
Tetrachlorethen	kg/a	13 000	8 300	1 600	790*	960*	470*	120*
α-HCH	kg/a	200	140	110	150	180	66	330*
β-HCH	kg/a	86	88	100	110	100	70	68*
γ-HCH	kg/a	570	490	320	440	420	200	41*
Hexachlorbenzen	kg/a	110	150	50	90	180	<52	19*
p,p'-DDT	kg/a	-	<15	< 15	18	<19	20*	17*
AOX (Cl)	kg/a	2600 000	1600 000	760 000	760 000	1100 000	240 000	350 000*

* Einzelproben

Jahresfrachten der Elbe 1985 - 2004
Meßstation Schnackenburg (Strom-km 474,5)

Trend in temperature in the Elbe River catchment



Source: Krysanova et al. 2007

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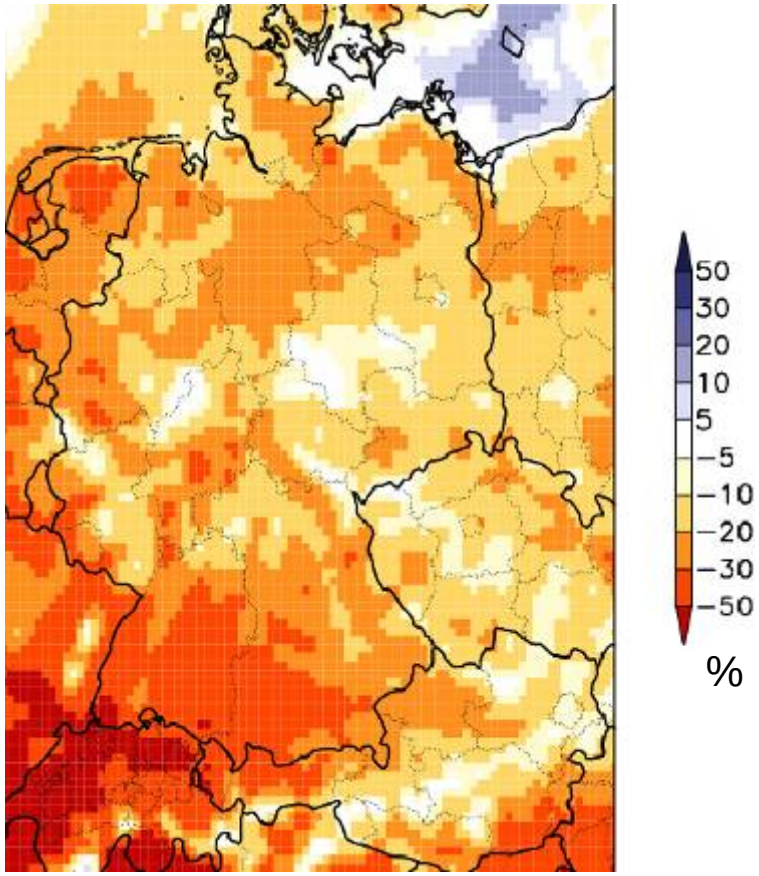
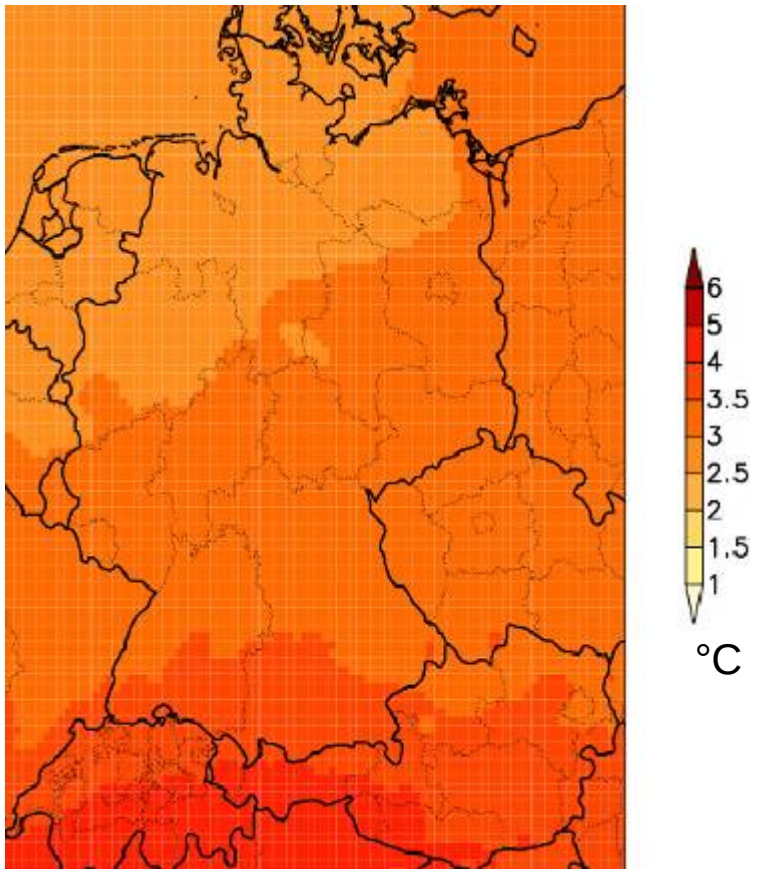
Climate Change projections in Germany



Decrease in summer precipitation (2071-2100 vs. 1971-2000)

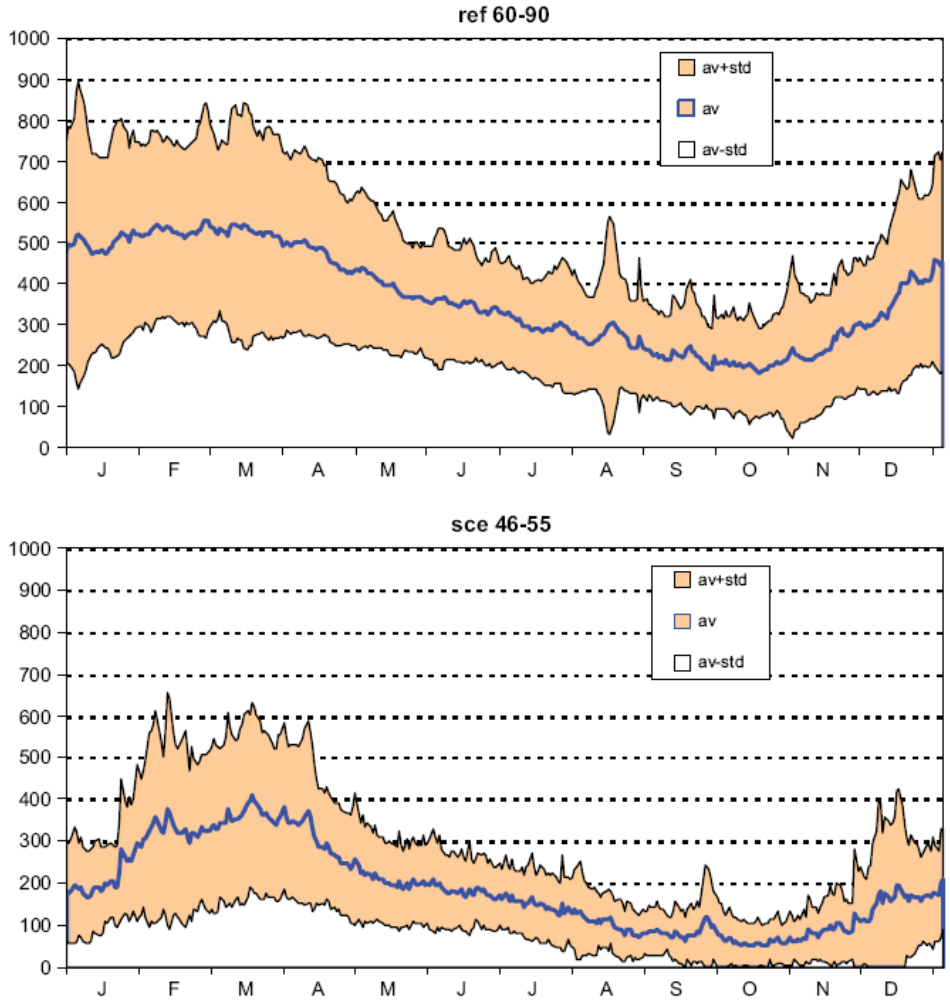


Increase in mean annual temperature (2071-2100 vs. 1971-2000)

Source: Results of the COSMO-CLM Model, 2008

River discharge

1960-1990 versus 2046-2055



Source: Krysanova et al. 2007

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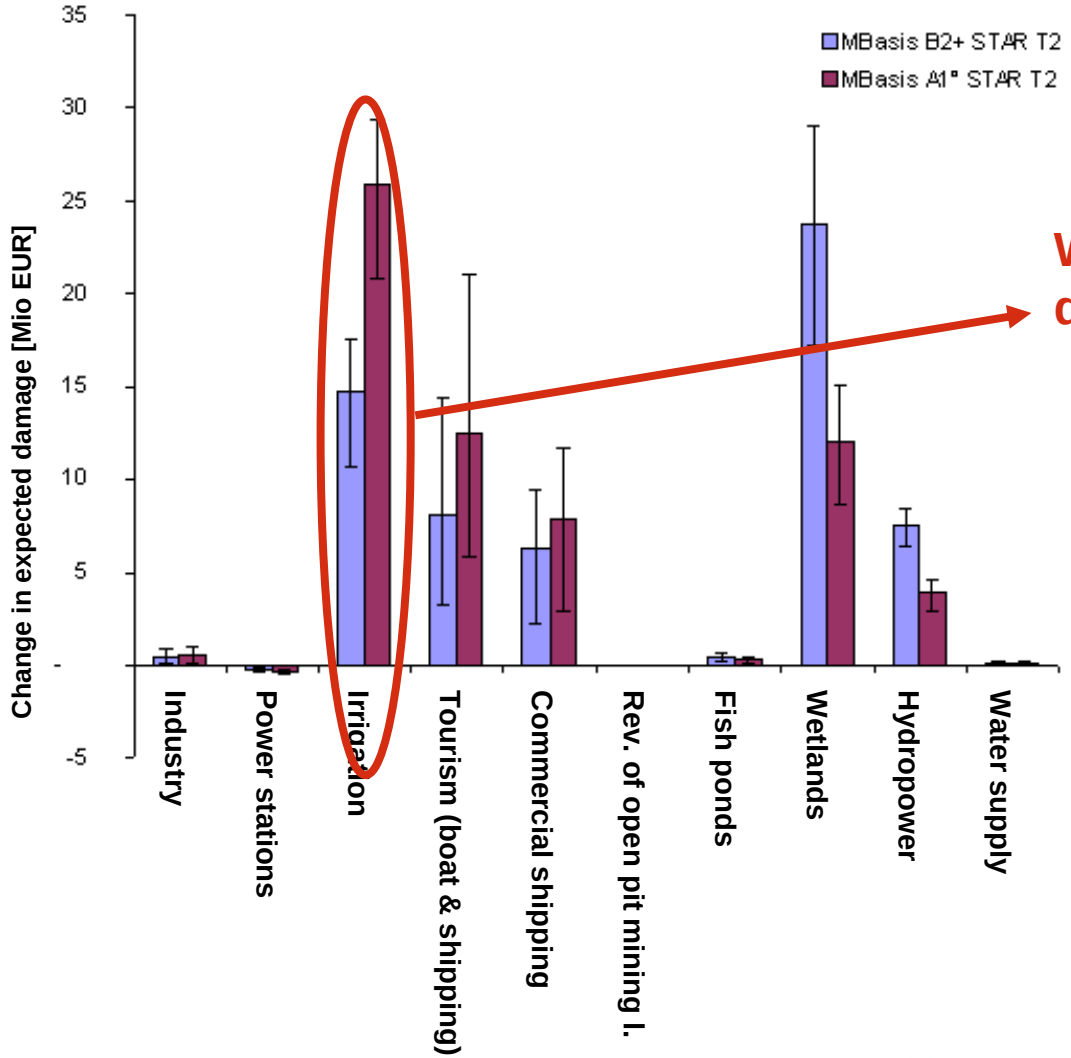
Expected damage for different water uses

2008-2012 versus 2048-2052



What about water quality issues?

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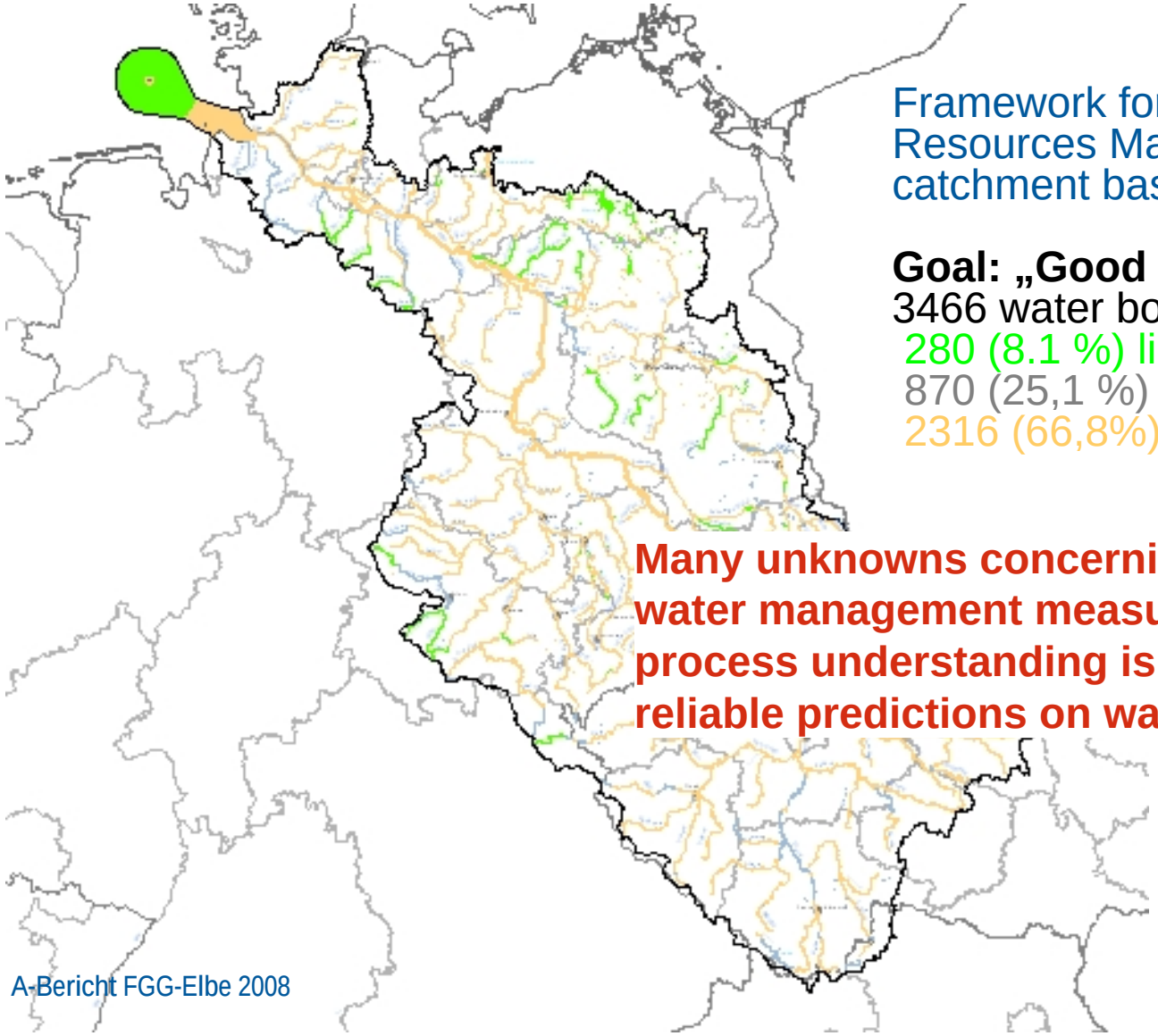
EU-Water Framework Directive



A-Bericht FGG-Elbe 2008

Framework for Integrated Water Resources Management (IWRM) on a catchment basis

Goal: „Good Status“
3466 water bodies, thereof
280 (8.1 %) likely
870 (25,1 %) uncertain
2316 (66,8%) unlikely

Many unknowns concerning the effectiveness of water management measures → more precise process understanding is needed for more reliable predictions on water & solute fluxes!

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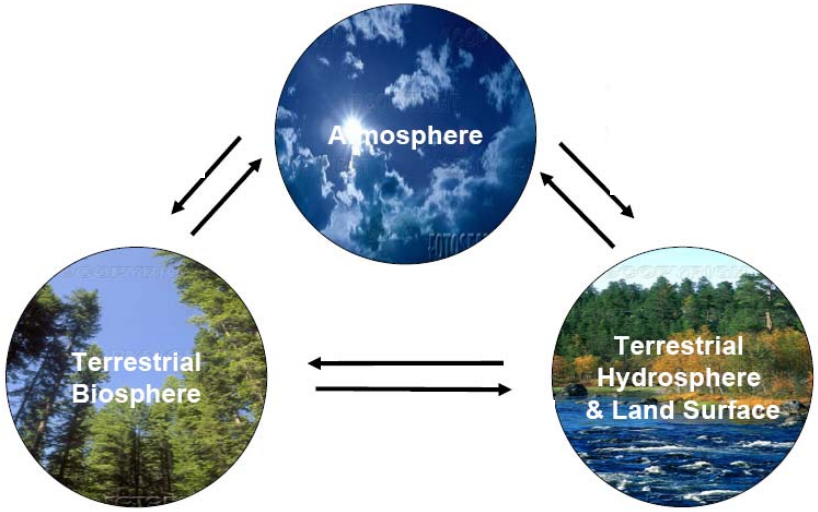
The UFZ approach: TERENO (Terrestrial Environmental Observatories)

- establish **common measurement platforms** as the basis for long term data sets → integrated investigations at catchment scale
- integrated and coupled modelling of different environmental compartments (e.g. atmospheric deposition, reactive solute transport)
- Long-term projection of environmental developments including water availability & quality, land use and climate scenarios
- Bridging the scale between observation/monitoring and management



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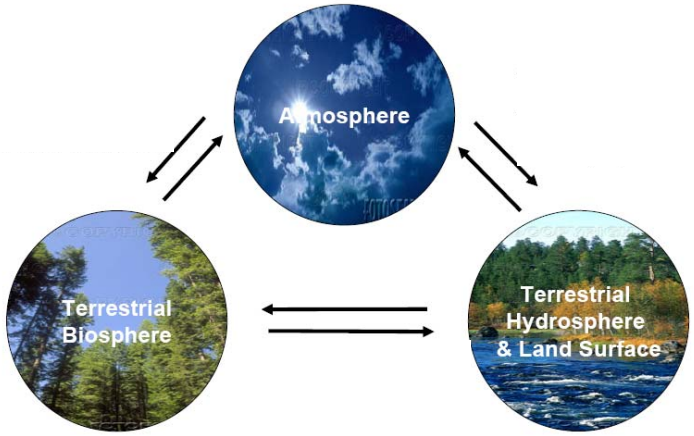
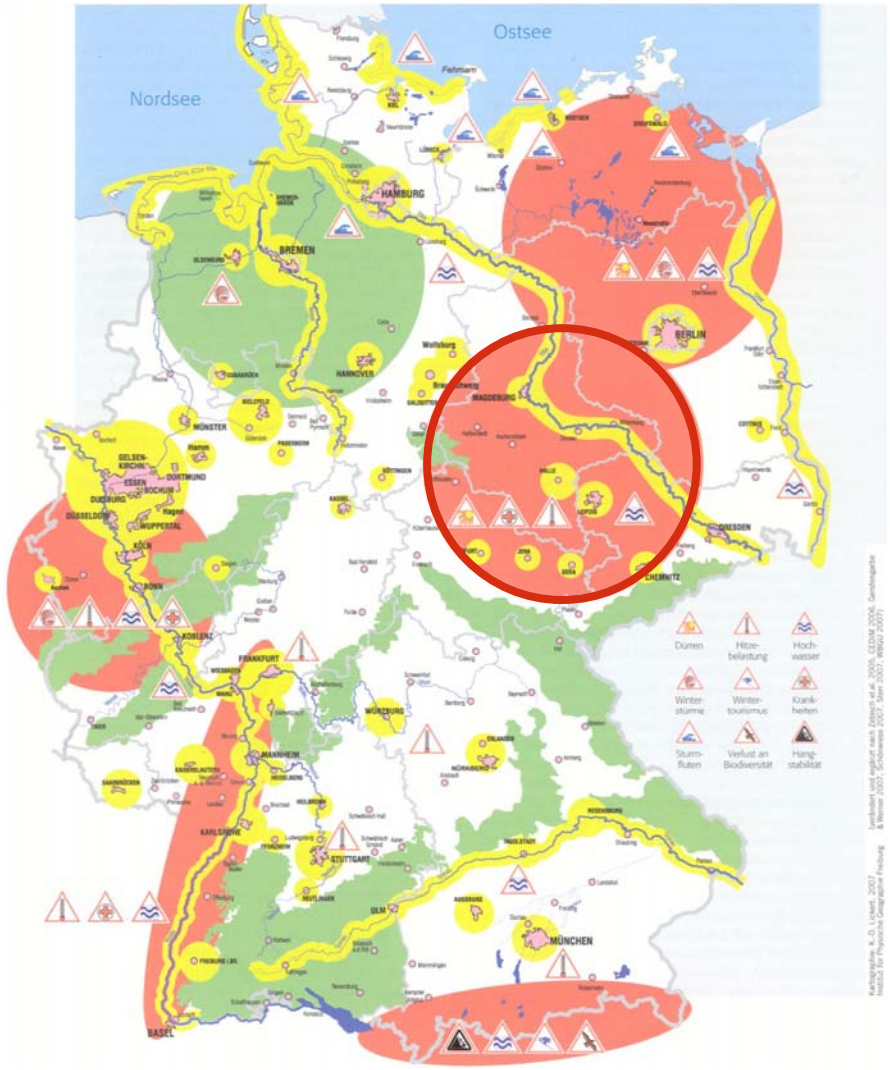
The TERENO Observatories

- Availability of long-term data
- Significant **gradients** in land use, climate and socio-economical boundary conditions
- Adequate size – Mesoscale
- Determine **effective parameters**, fluxes and state variables for different scales
- Study long-term influence of **land use** and **climate change** and **socio-economic development** in terrestrial systems and the **interactions** between different factors and compartments



Vulnerability to climate change



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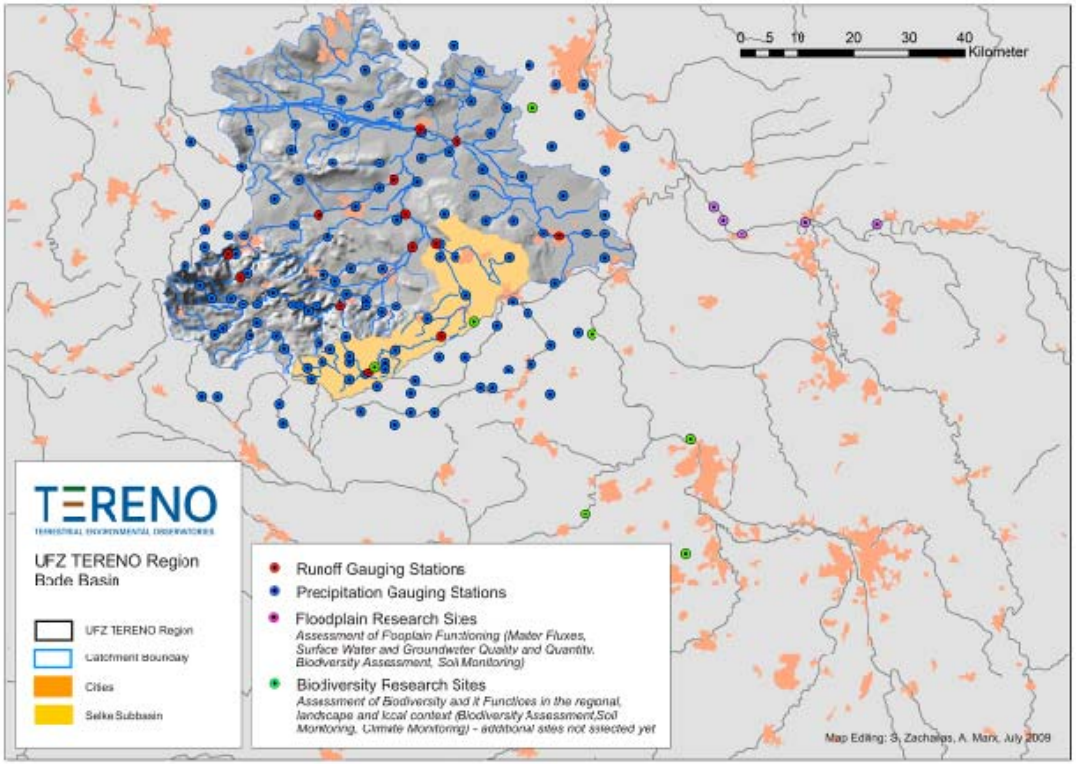
UFZ TERENO Site

- Impact of changing gradients and boundaries (climate, urbanity, biodiversity) in terrestrial systems under Global Change
- Impact on ecological patterns and processes
- Land use impacts, conflicts and options
- Quantification of global change induced changes in water resources



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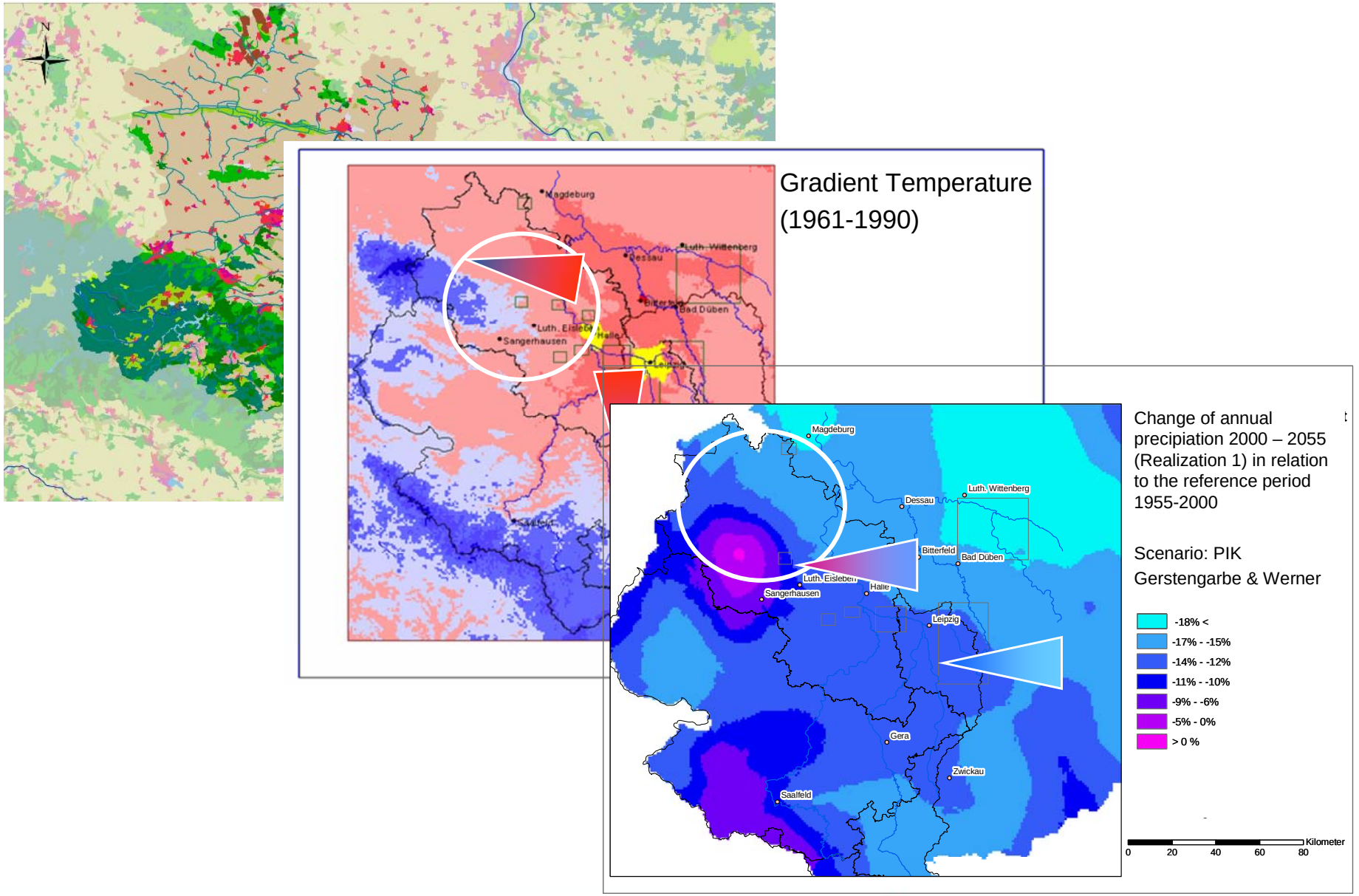
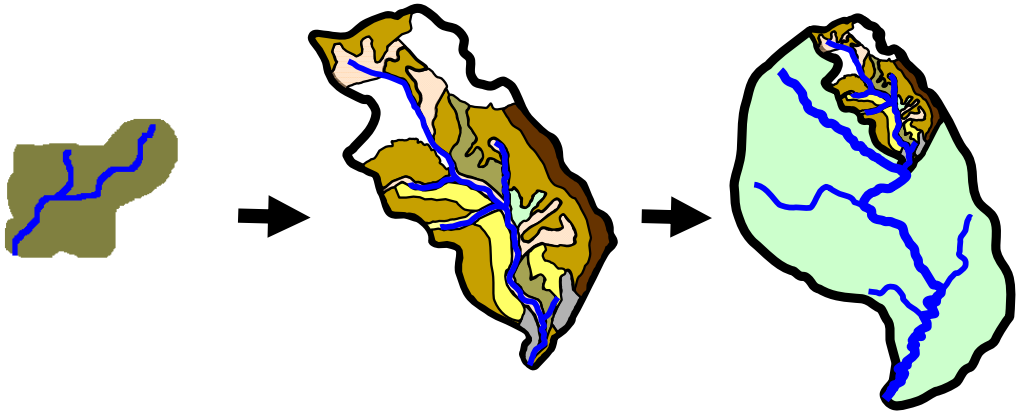
Bode-Catchment



Nested Catchment approach

Response units | Subcatchment | Catchment



Modelling Platform

Remote Sensing

Geophysics

Possible transects for groundwater monitoring

Wireless soil moisture sensor network

Lysimeters

Biodiversity monitoring

Mobile Mesocosms

Water quality monitoring

Eddy-Flux-Tower

Rainscanner

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TERENO Vision and Challenge

Predicting terrestrial processes from remote information

Multi-scale observations using non-invasive and novel technologies

SMOS

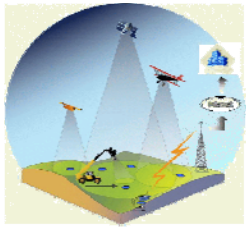
SAR

Weather-Radar

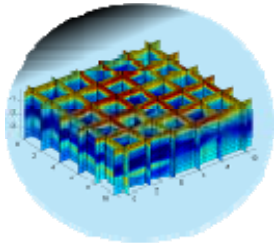
Radio-meter

EM

Data fusion upscaling



Super Computing



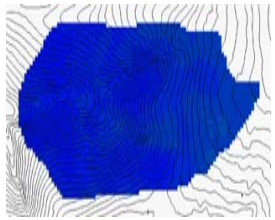
Data management visualization

Modelling

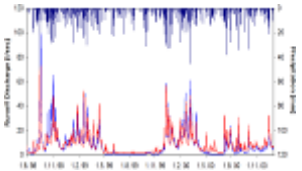
Hydrological processes

Evapotranspiration

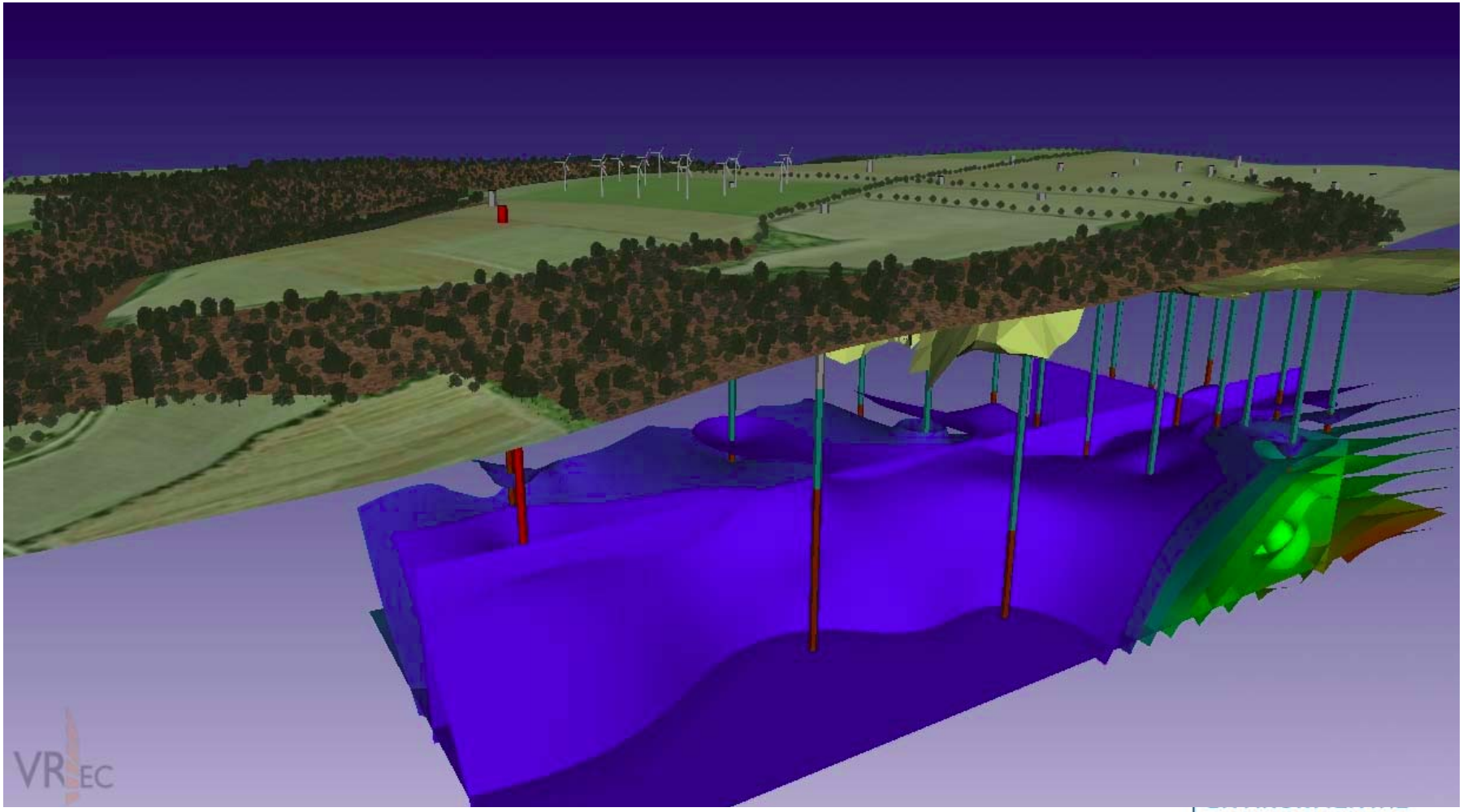
Soil moisture



Runoff



Visualisation as decision and management support



RESEARCH – UFZ