CC-LandStraD
Climate Change — Land Use Strategies

From site measurements to spatial modelling – multi-criteria model evaluation

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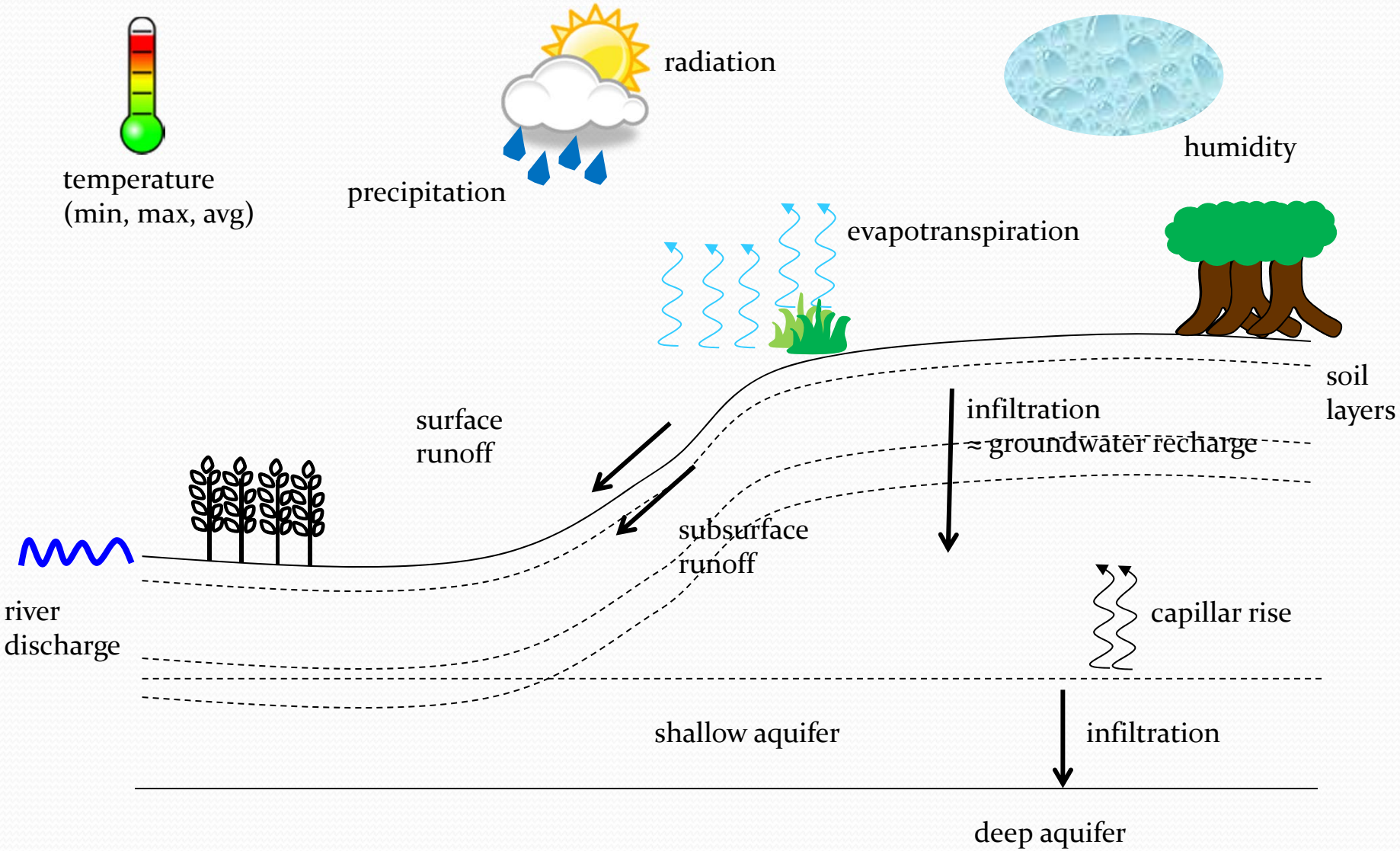
This talk …

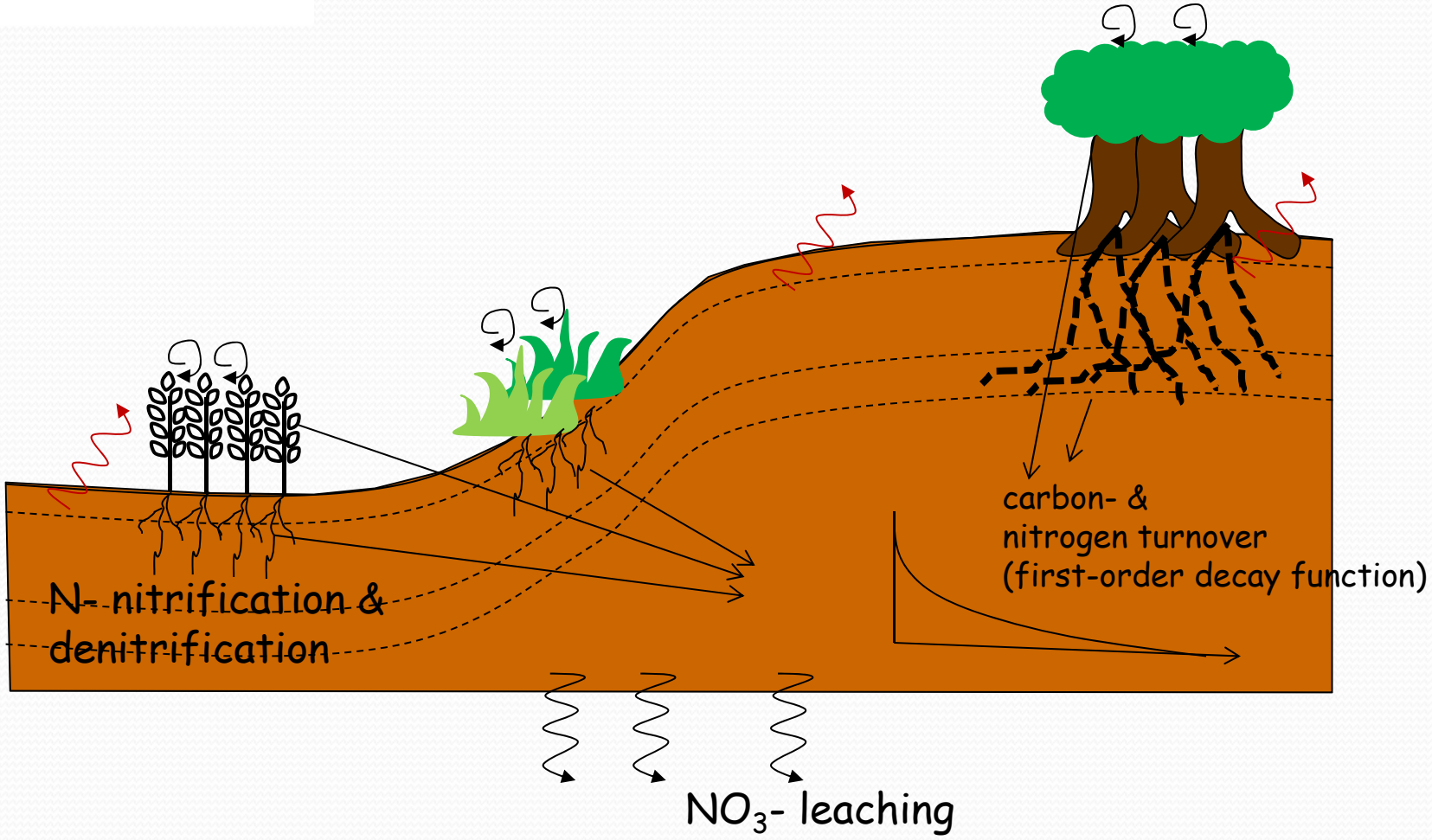
- … is about the eco-hydrological model SWIM
- … is about our current activities in multi-criteria model evaluation

The eco-hydrological model SWIM (Soil and Water Integrated Model)



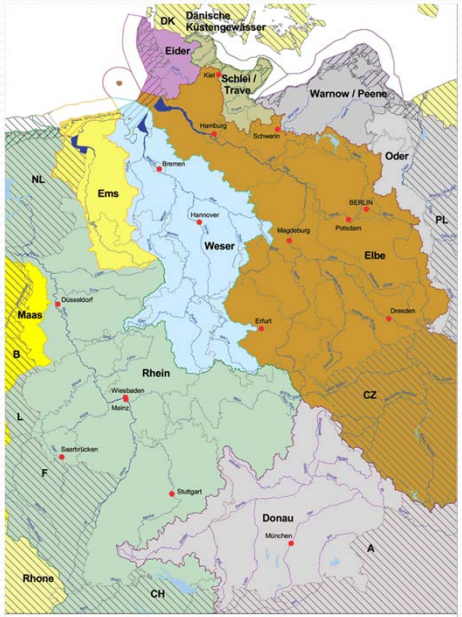
Carbon & nitrogen processes in SWIM

- Carbon assimilation (photosyntheses)



SWIM-Evaluation for Germany

- Hydrologic evaluation: Huang et al. (2010) – PIK, Assessment of changes in discharge components under climate change
  - Discharge calibration and evaluation
  - Evapotranspiration-, total discharge- & groundwater recharge evaluation

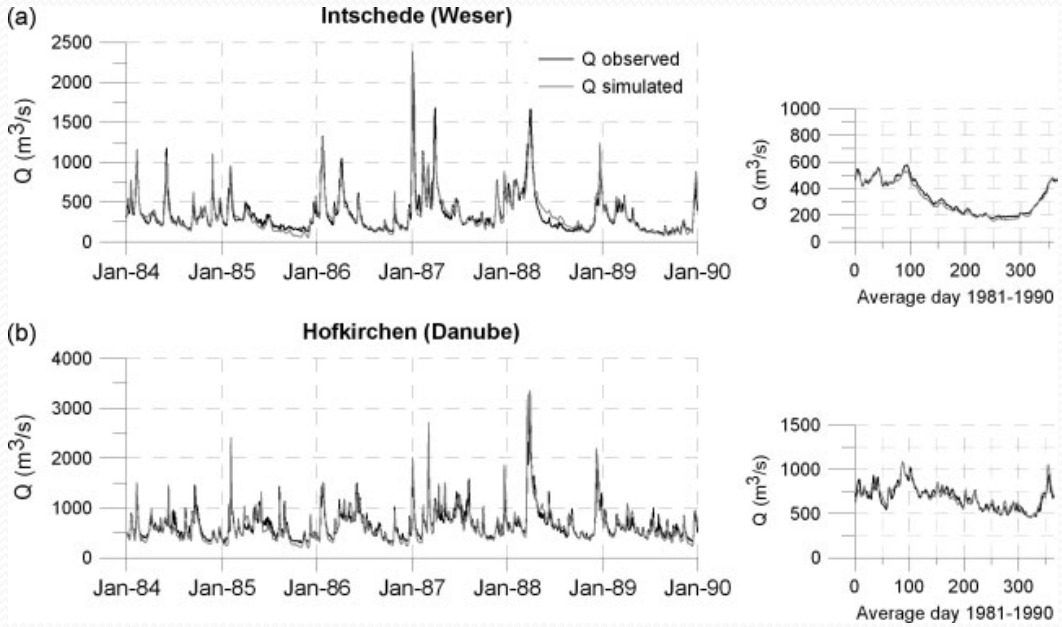


Flussgebietseinheiten in der Bundesrepublik Deutschland (Richtlinie 2000/60/EG - Wasserrahmenrichtlinie)

Die Markierung und Kennzeichnung der außerhalb der Grenzen der Bundesrepublik Deutschland liegenden Teile internationaler Flussgebietseinheiten dienen lediglich der Veranschaulichung und lassen Festlegungen anderer Staaten sowie internationale Abstimmungen unberührt.

Quelle: Umweltbundesamt, Juni 2004

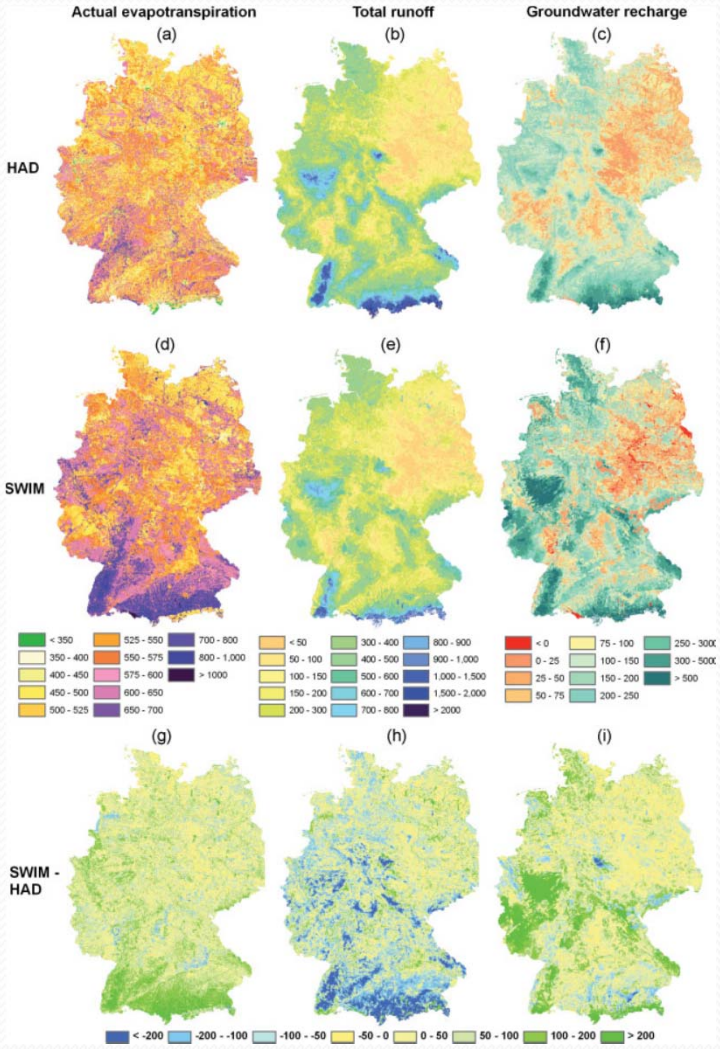
Kartengrundlage: Länderarbeitsgemeinschaft Wasser (LAWA), Bundesamt für Kartographie und Geodäsie (BKG)



Referenz: Huang, S., Krysanova, V., Österle, H., Hattermann, F.F., 2010, Simulation of spatiotemporal dynamics of water fluxes in Germany under climate change, Hydrological Processes, 24, 3289-3306

SWIM-Evaluation for Germany

- Comparsion to hydrological Atlas of Germany

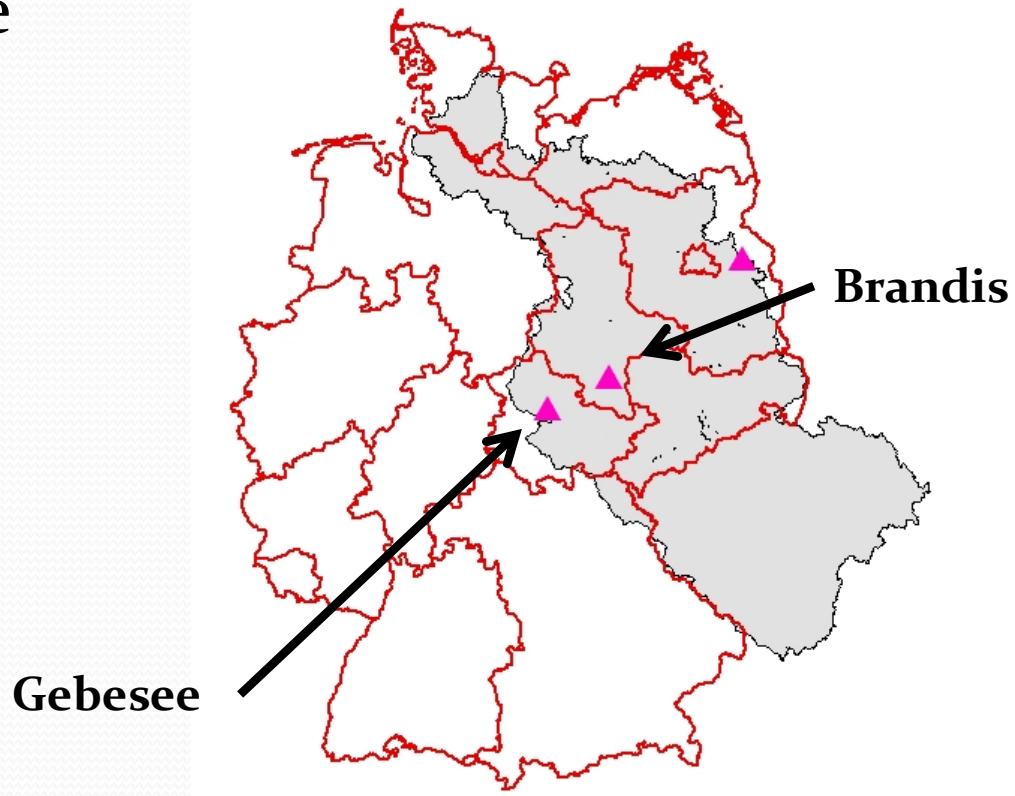


Evaluation data

- river discharge data
- data from lysimeter sites
- eddy-flux data
- statistic yield data
- soil, vegetation monitoring data
- etc.

Evaluation „sites“

- Spatial yields: Germany
- Eddy-flux site: Gebesee
- Lysimeter: Brandis

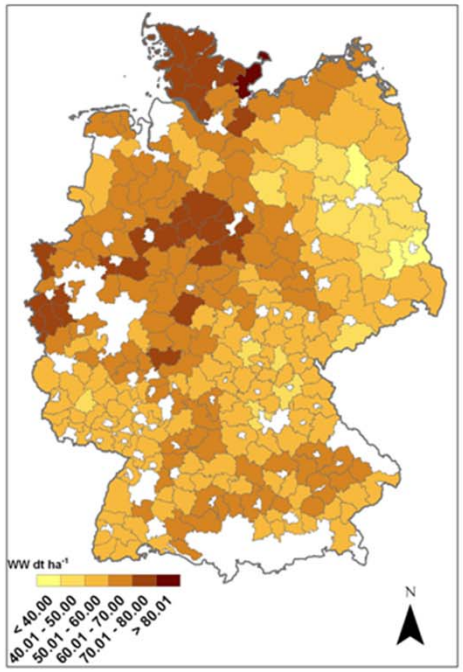
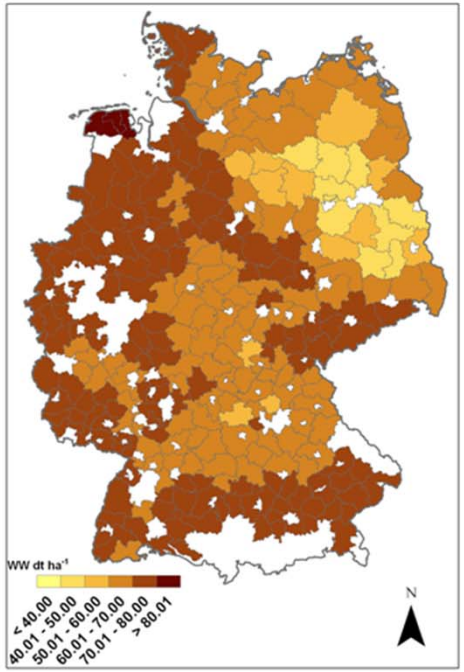
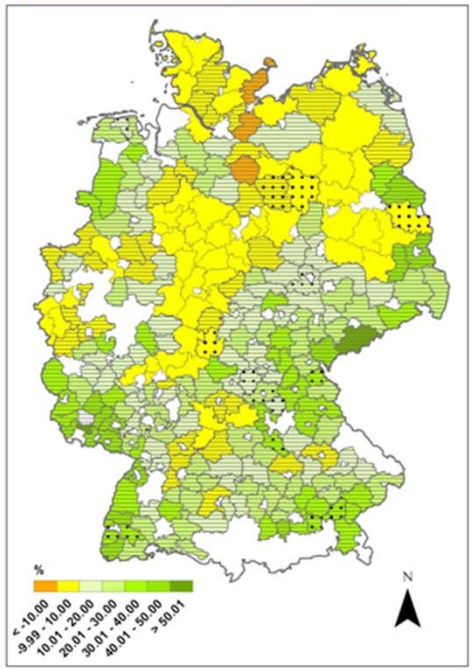
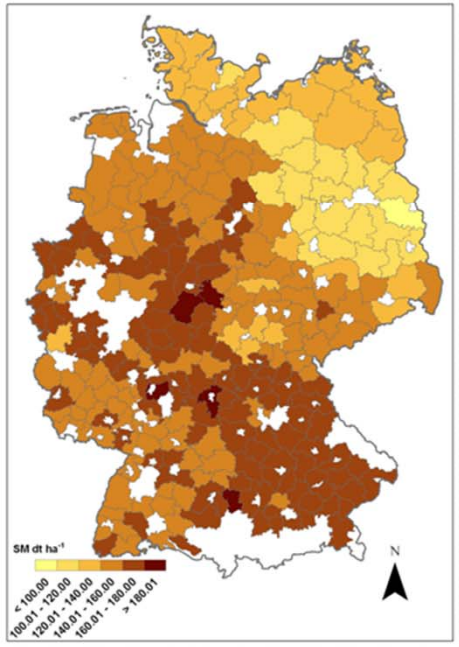
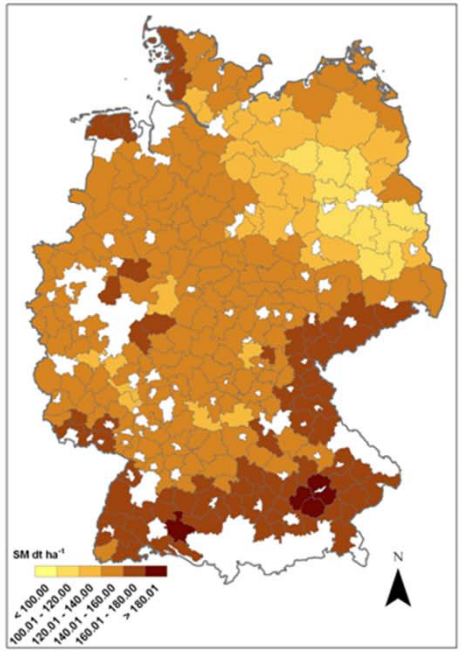
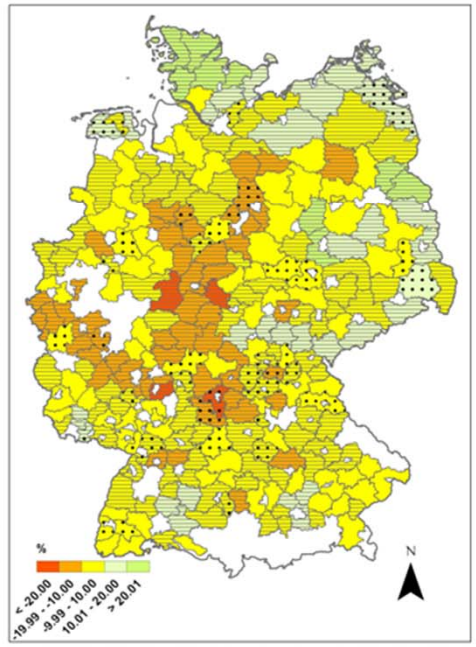


Spatial yield evaluation

- Yields are key factors for the landscpae water and nutrient balances
- They are proxyies for biomass development where biomass constitues the link between the water and carbon household via stomata (photosynthesis/transpiration)
- Furthermore, they serve as proxy for the return of organic matter (carbon and nitrogen) to the soil, which is determining for the calculation of carbon sequestration and nutrient cycling

Yields

20-year averages
1991-2010

	statistics	simulated	differernce
Winter wheat			
Silage maize			

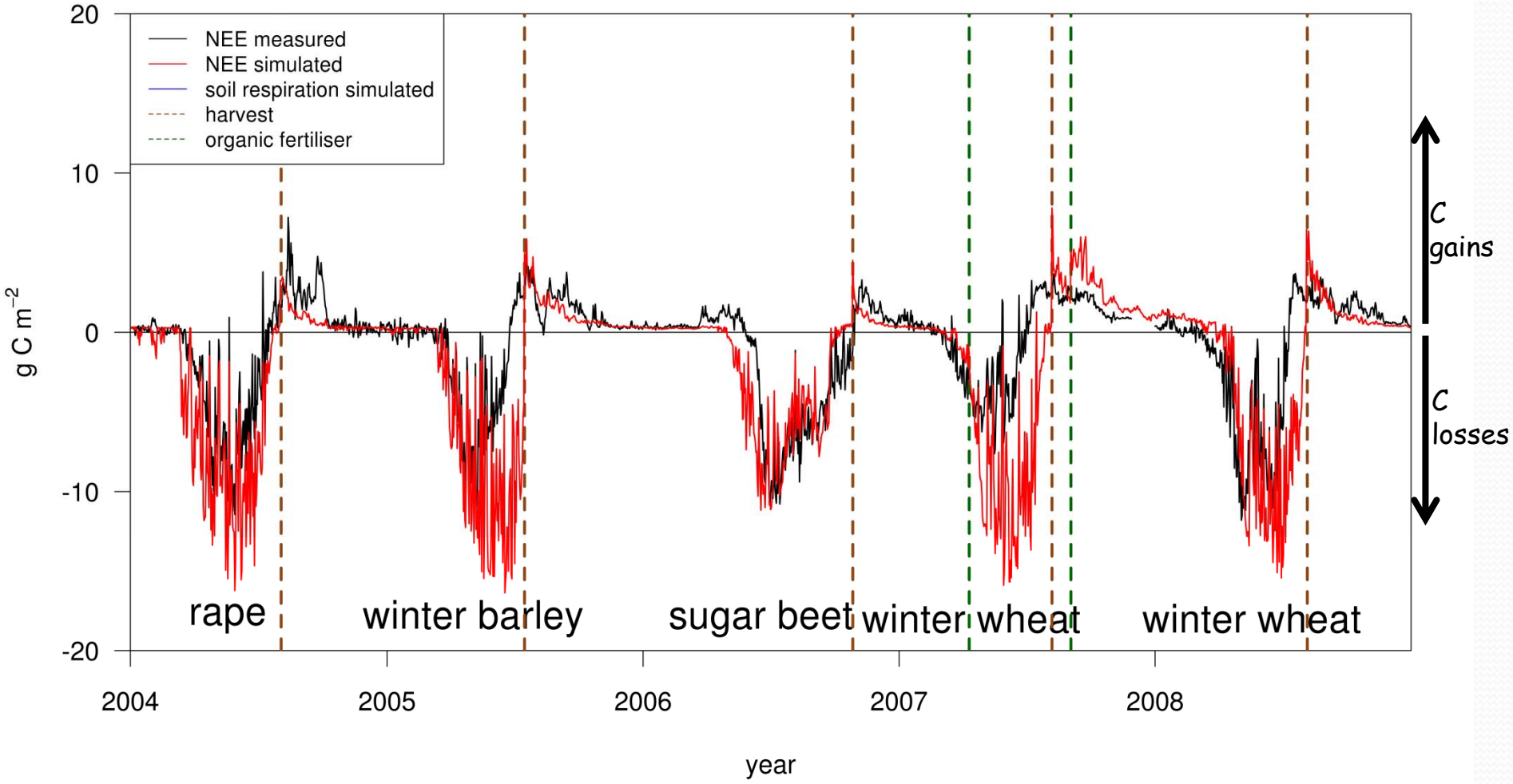
Yields

- the results show partly unsatisfactorily results
- this highlights problems which impact on hydrological model results as well
- to get sound hydrological results, yield results have to be achieved at a satisfactoring level

Evaluation of the water- and carbon household at the eddy-flux site Gebesee

(data source: W.L. Kutsch, TI Braunschweig)

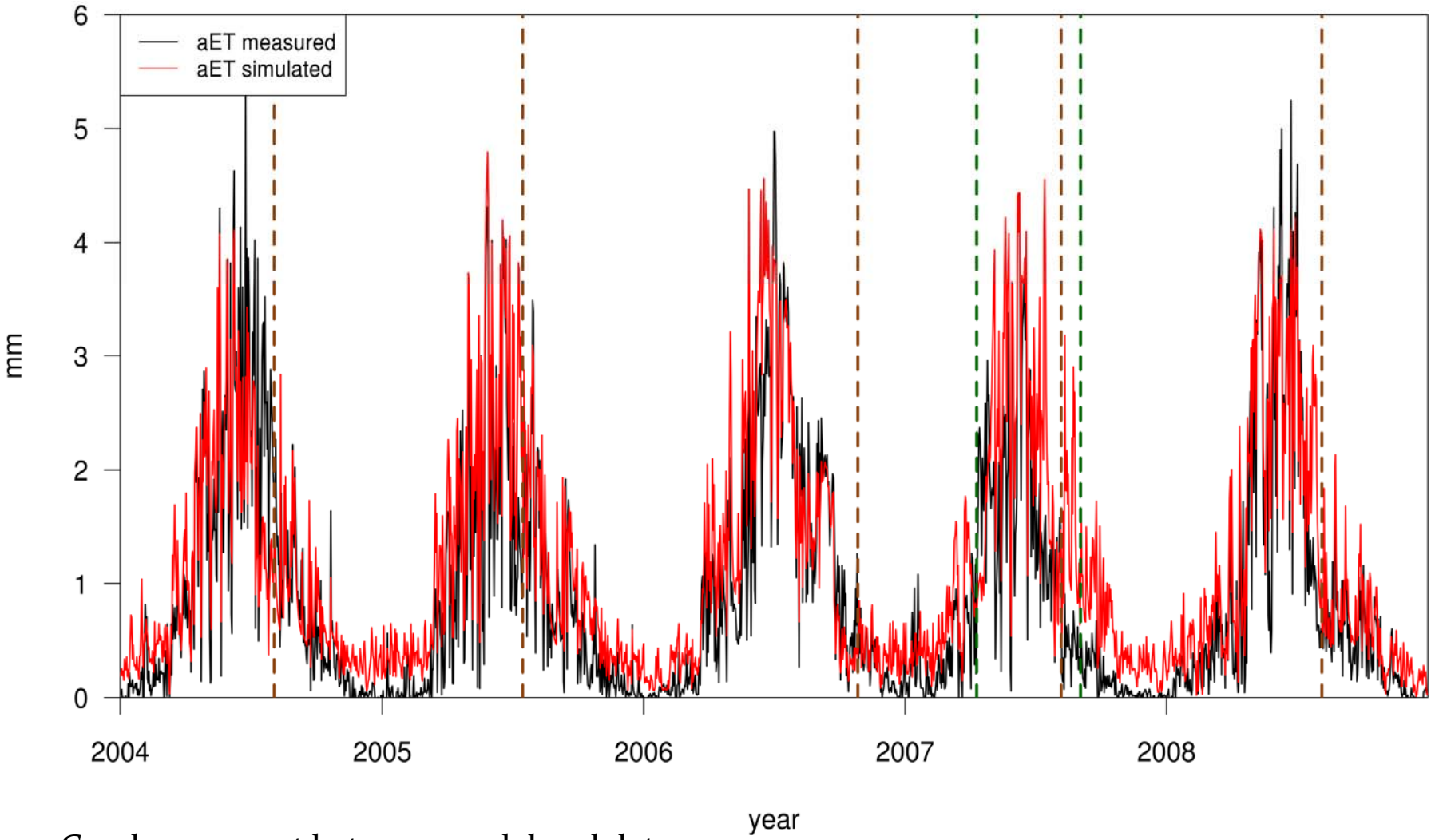
Net eco-system exchange (NEE) [g C m^{-2}]



- NEE as proxy for biomass growth
- The temporal development of biomass is well reflected by the model
- The model overestimates biomass growth at times

Observed data from Dr. W.L. Kutsch
(Thünen-Institut Braunschweig)

Actual evapotranspiration



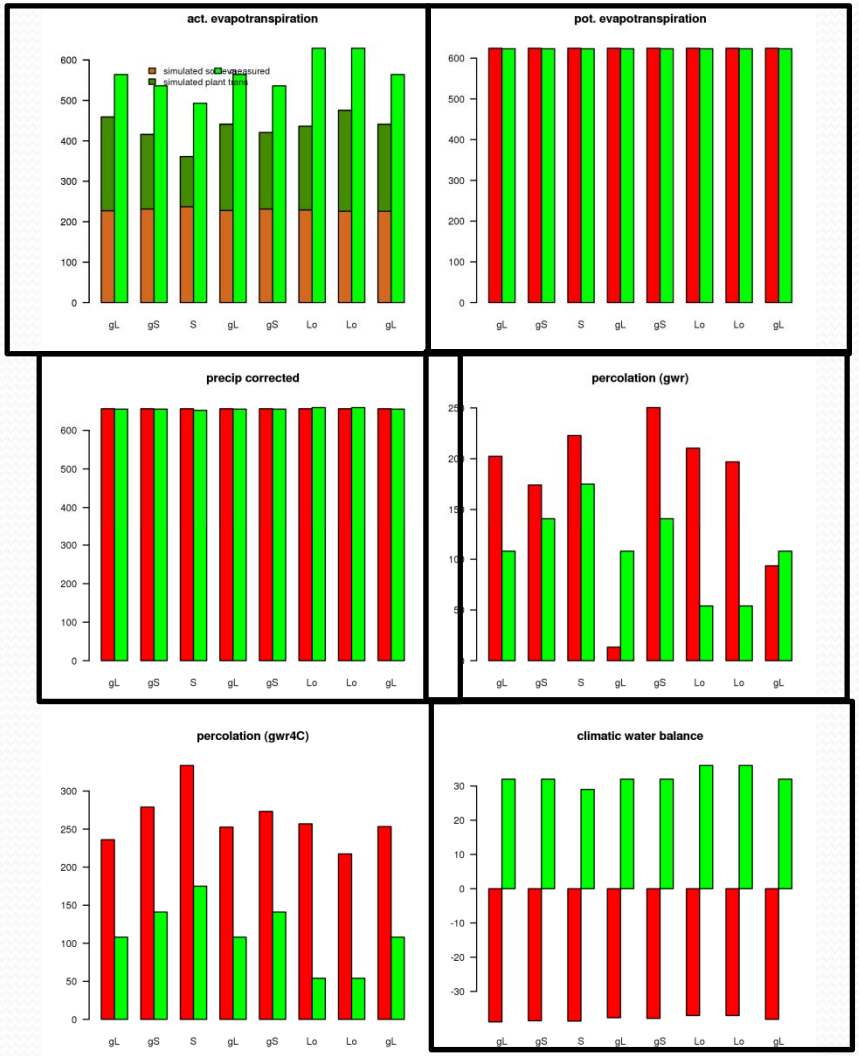
- Good agreement between model and data
- This component of the water household is well refelected by the model

Observed data from Dr. W.L. Kutsch
(Thünen-Institut Braunschweig)

Evaluation of hydrological componetents at the lysimeter site Brandis

(data source: Dissertation of Haferkorn, 2000)

Yearly average hydrologic parameters of 8 soil types



- Adjusted model input data:
  - Pot. evapotranspiration
  - Precipitation
- actual evapotranspiration
- Percolation/groundwater recharge
- Climatic water balance

measured
simulated
plant transpiration simulated
soil evaporation simulated

Wrap-up

- multi-citeria model evaluation is a valuable approach to constrain model performance
- it helps to identify problems and to improve the model
- to compensate for limited data sets from one site we use several data sources from different sites

Thank you for your attention!