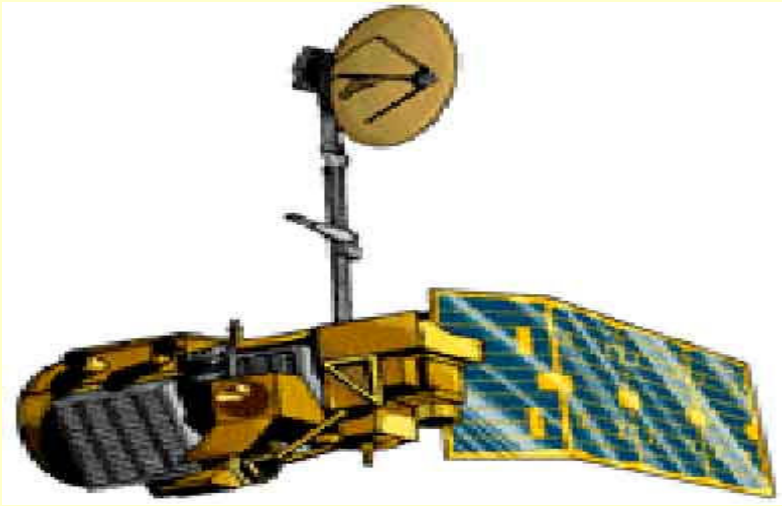
The evaluation of the impact of climate change on the water balance of a mesoscale catchment in Northeastern Germany

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Outline:

- Introduction
- Material and Methods
- Results
- Conclusions
- Acknowledgements

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Introduction:

• Estimation of the impact of climate change on soil water storage, ground water recharge and evapotranspiration - Development of adaption strategies in the management of agricultural and forested areas as well as water resources.

• Climate models (e.g. ECHAM4-OPYC3,MPI Hamburg): Information about trends of future climate based on different CO_2-Emission Scenarios such A1B.

• Application of a semidistributed conceptual hydrological model for the estimation of the impact of climate change on water balance in a catchment located in the North Eastern German Lowlands.

Material and Methods: Location of the Ucker catchment in Europe

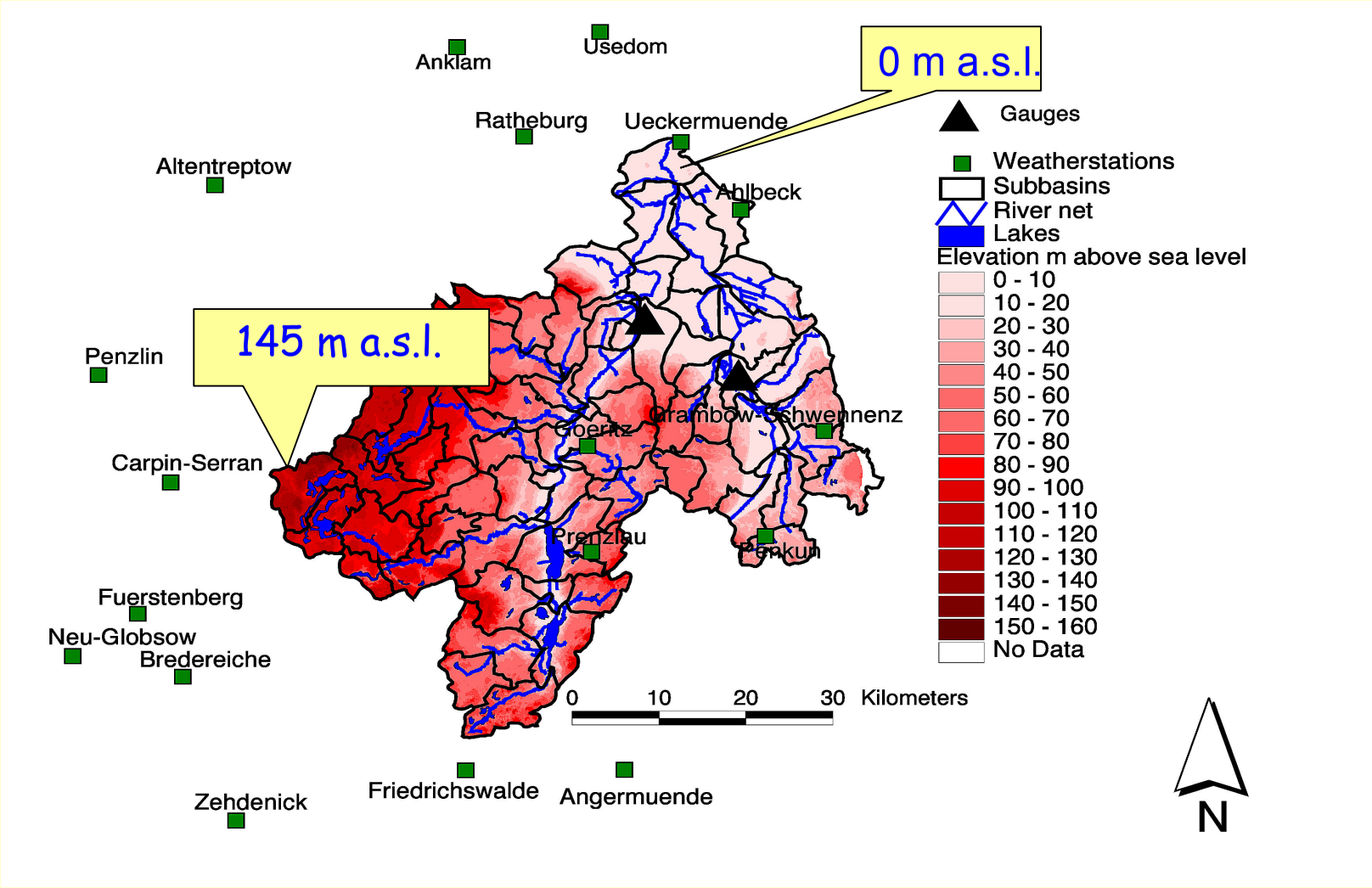


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Material and Methods:

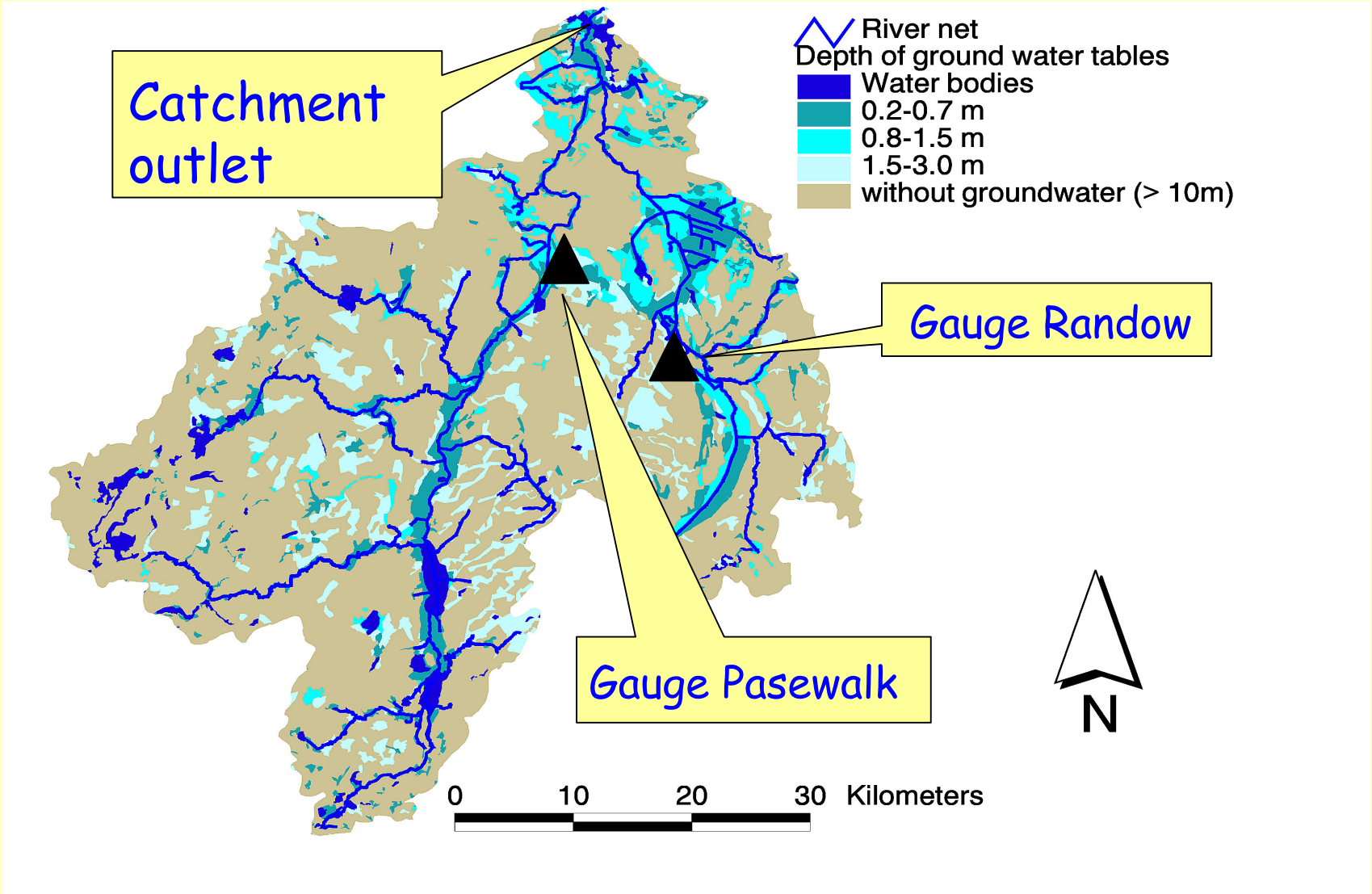
- Area= 2415 km^2
- Mean longterm annual precipitation rate =480-540 mm y^{-1} (760 mm y^{-1} for Germany) - Mean annual temperature = 7.8-8.0 (1951-1980)
- Landuse map: 5% Settlements, 4% Water bodies, 13% Meadows, 3% Wetlands, 25% Forests, 50% Arable land
- Northern parts: Sandy soils (=high infiltration rates and low water storage capacities)
  Southern parts: Loamy soils
  Flat river plains: Peat soils
- Time series 1951-2055 for 18 meteorological stations
  Scenario A1B (= +1.4 K mean annual temperature, -8% mean annual precipitation) provided by PIK Potsdam (Gerstengarbe et al. 2003)
  Reference scenario: 1951-2002 (DWD, Gerstengarbe et al. 2003)
  Climate change scenario: 2003-2055 (Gerstengarbe et al. 2003)
- Measured daily discharge rates from two gauges Pasewalk and Randow for the period 1989-2003 for the calibration of the model (LUNG MV, STAUN MV)
- Simulation quality estimated by using Nash-Sutcliffe-Index NS (∞ - 1) and Index of Modelling Agreement IA (0 – 1) .

Material and Methods: Digital elevation model 50m x 50m and station network (= Interpolation of meteor. data – Inverse Distance Interpolation procedure)



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Material and Methods: Rivernet, ground water tables, outlet and gauges

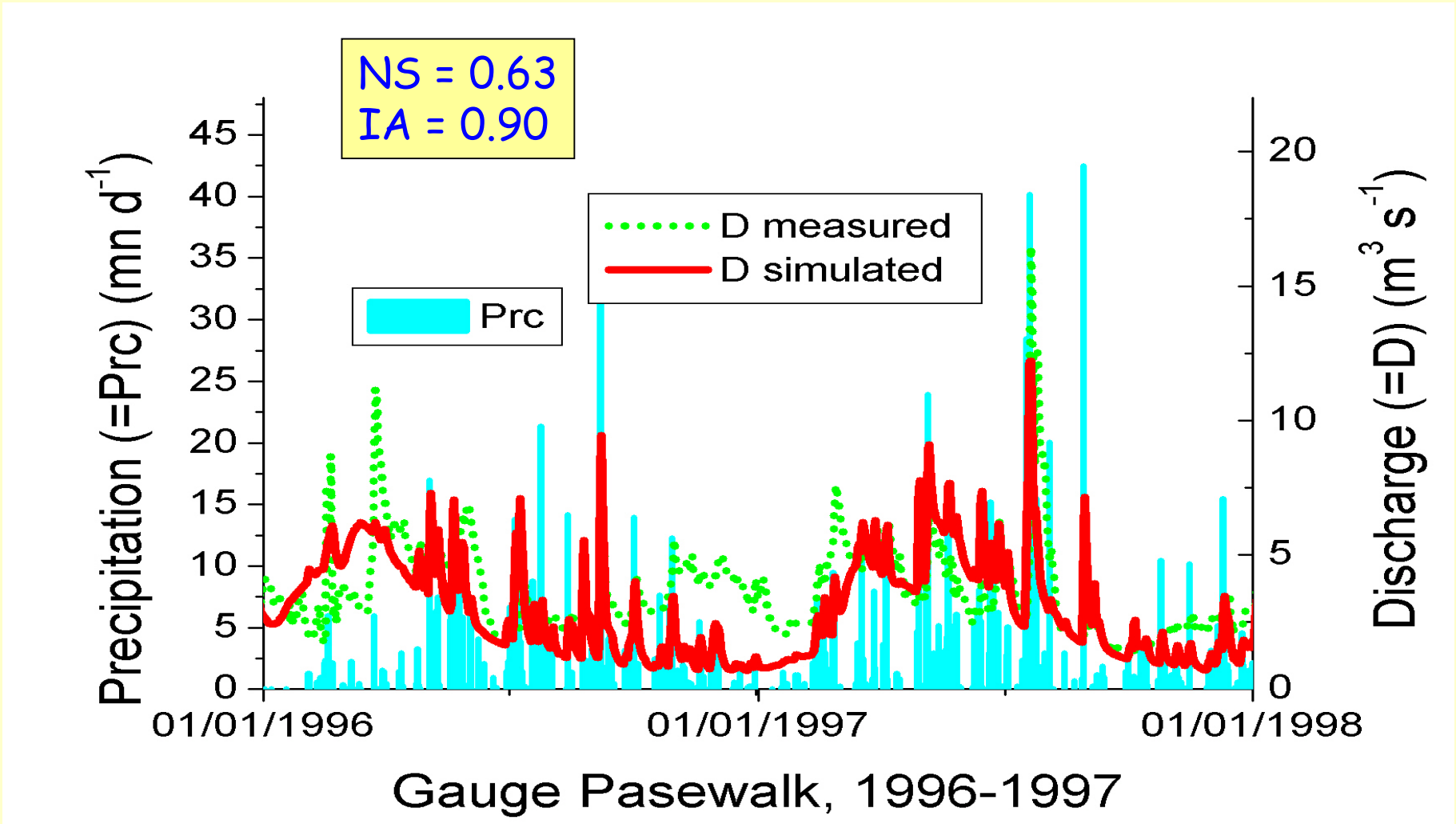


Material and Methods: Simulation model

Characteristics of the water balance model
THESEUS (WEGEHENKEL 2000)

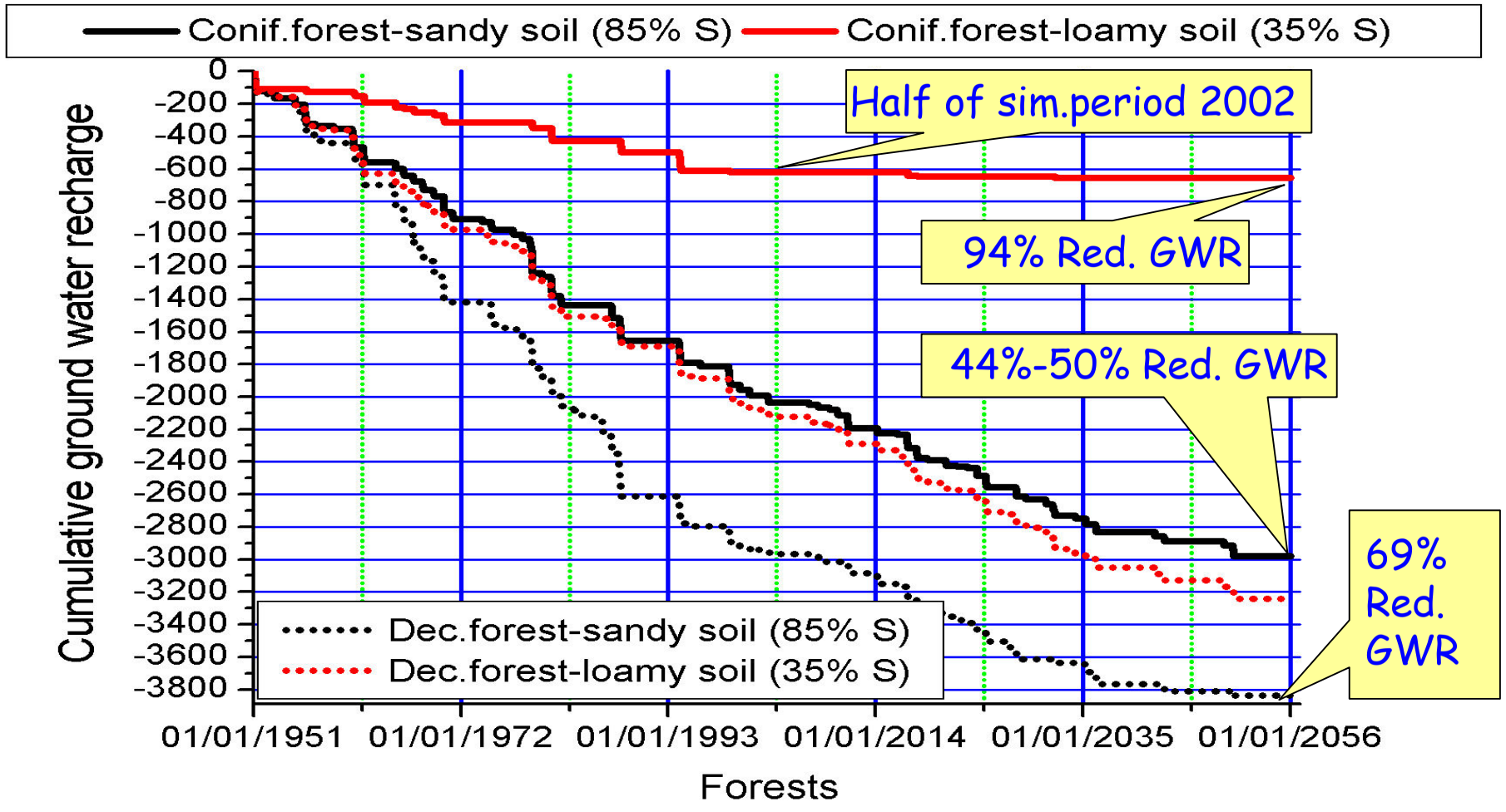
Spatial discretization	Hydrotopes, subbasins, catchment
Time discretization	1 day
Characterization	Conceptional
Evapotranspiration	PENMAN, HAUDE, TURC, WENDLING, PENMAN-MONTEITH
Vegetation cover	Semiempirical plant modelling approach
Interception	Single linear storage
Snowmelt	Degree-day approach
Infiltration and soil water balance	Modified HOLTAN approach and multiple layer capacity model
Overland - Channel Flow	Linear storage routing over subbasins, river sections and catchments
Saturated Zone	Single linear storage –routed over subbasins and catchment

Results: Calibration of the model for 1989-2003: daily rates of precipitation (=Prc), simulated (=D simulated) and observed (=D measured) daily discharge rates Ucker for 1996-1997



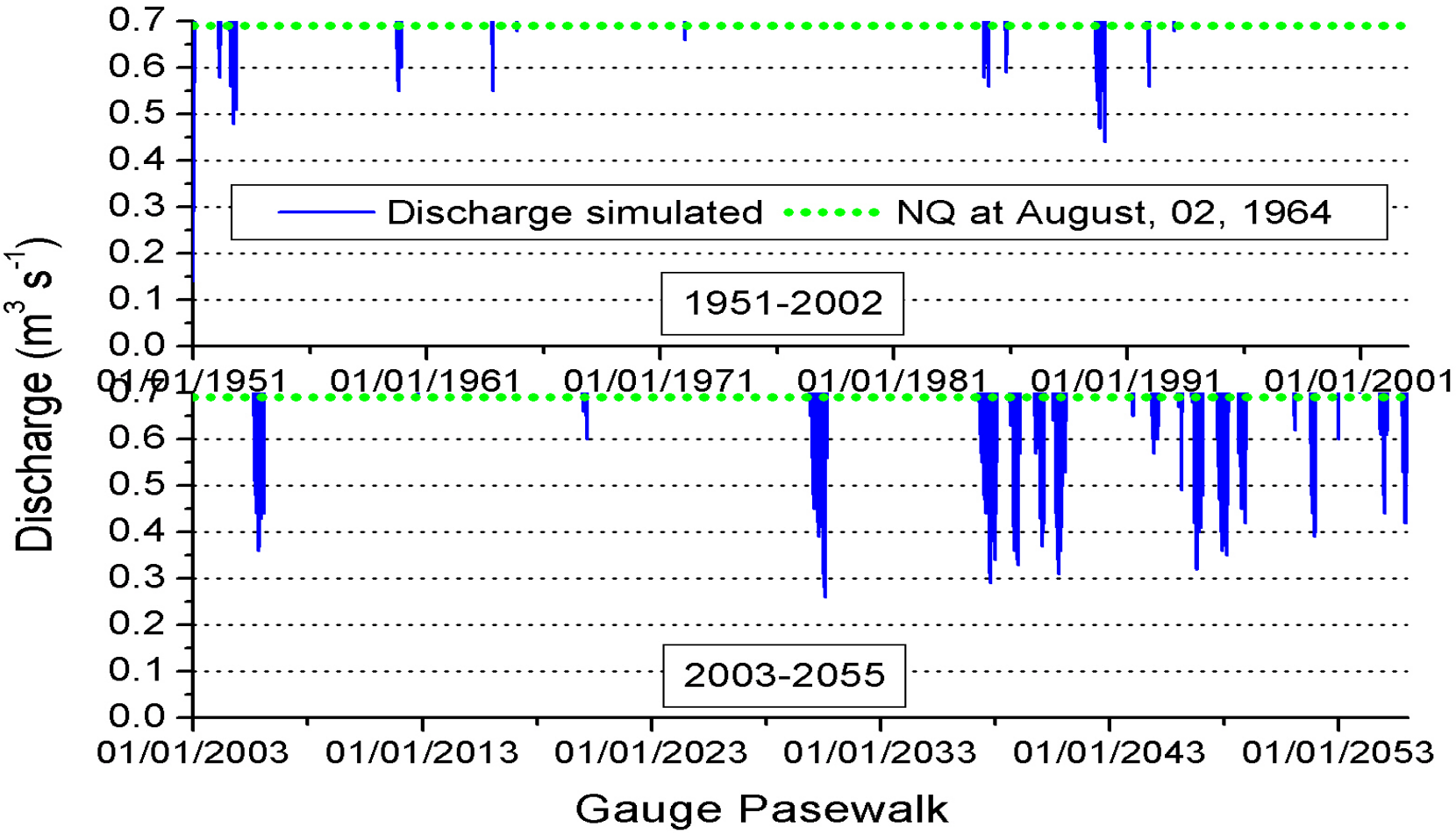
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Results: Simulated cum. ground water recharge (GWR, mm) for coniferious and deciduous forests, sandy soil and loamy soil, Ucker catchm., reference scenario: 1951-2002 - climate change scenario: 2003-2055



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Results: Simulated low water conditions in the Ucker river in comparison with low. discharge rate NQ for 1951-2002 measured at gauge Pasewalk reference period (1951-2002) - climate change scenario (2003-2055)



Conclusions:

• The model showed a trend for overestimating peak flows and underestimating low discharge rates, NS and IA indicated a sufficient simulation quality of the model for the discharge simulations.

• The amount of simulated discharge rates below NQ increased after 2002.

• Simulated ground water recharge decrease in order of 18%-24% for arable land and for forests in order of 44-94% after 2002 depending on soil type .

• However, results depend on the quality of scenarios. New better scenarios will be used in future.

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• We have to thank the Potsdam Institute of Climate Impact Research (PIK) and Germany's Meteorological Service (**DWD**) for providing meteorological data and the A1B-Scenario (Gerstengarbe et al. 2003).

• We also have to thank the Federal Agency for Environment and Nature Protection Mecklenburg-Vorpommern **STAUN MV** and the Agency for Environment, Nature protection and Geology Mecklenburg-Vorpommern **LUNG MV** for providing discharge data from the gauges Pasewalk and Randow.

• The digital elevation model DEM50 were provided by the Federal Agencies Landesvermessungsamt Brandenburg and Landesvermessungsamt Mecklenburg-Vorpommern (**LvermA BB + M-V, GB-A 03/1**).



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