



Indicators for a sustainable agriculture – Model linking to estimate N-Emissions from agricultural crop production systems

Diffuse Inputs into the Groundwater:
Monitoring – Modelling – Management
Graz, January 29th to 31st, 2007

Diffuse Einträge in das Grundwasser:
Monitoring – Modellierung – Management
Graz, 29.01.2007



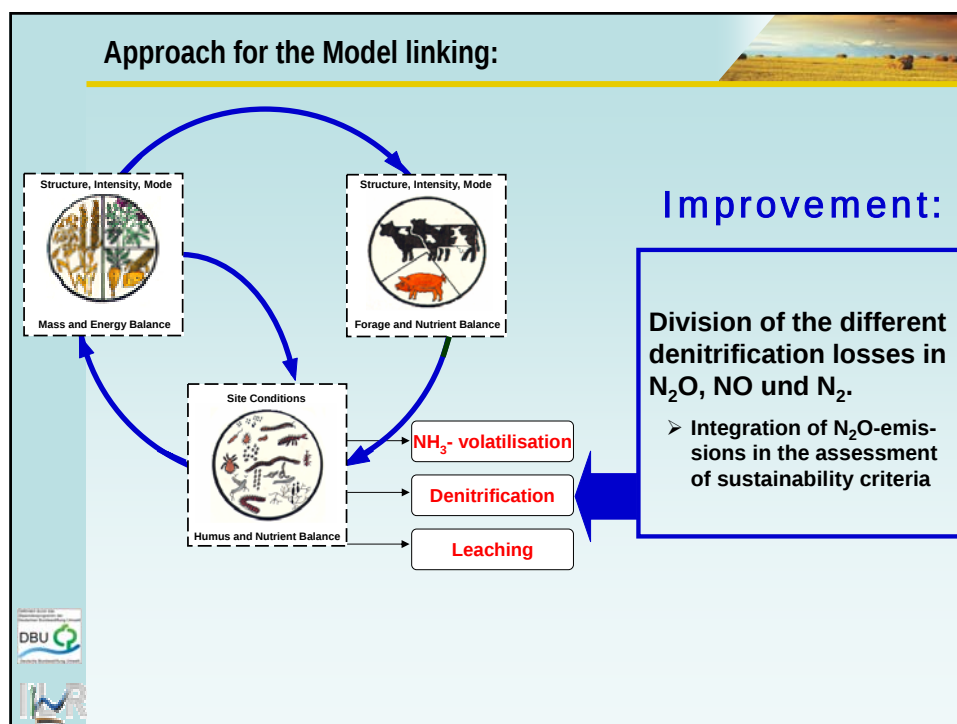
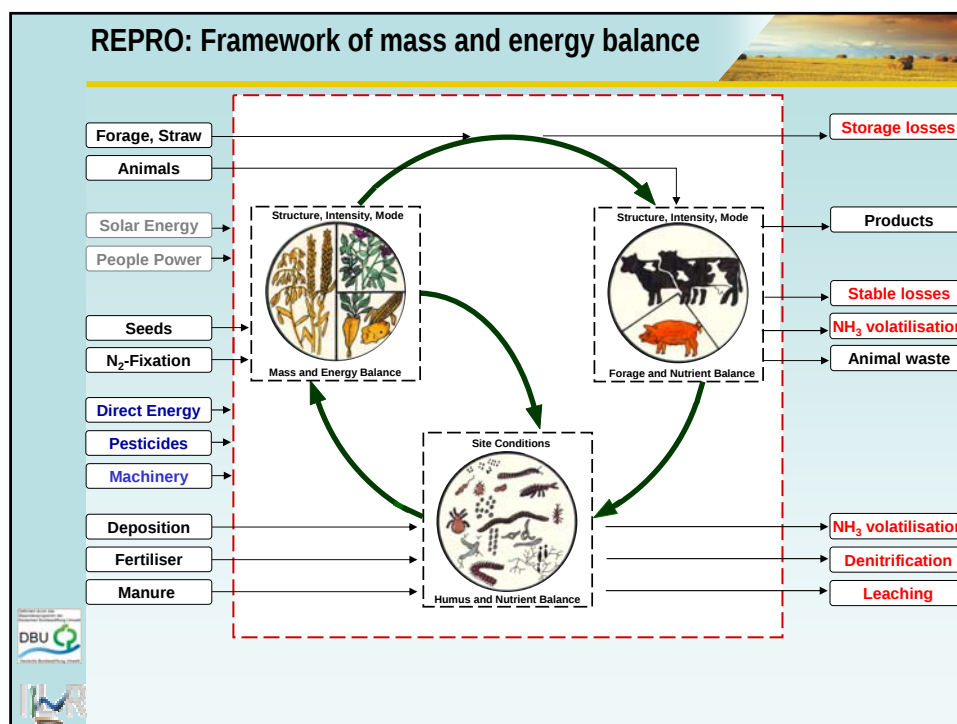
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University of Giessen

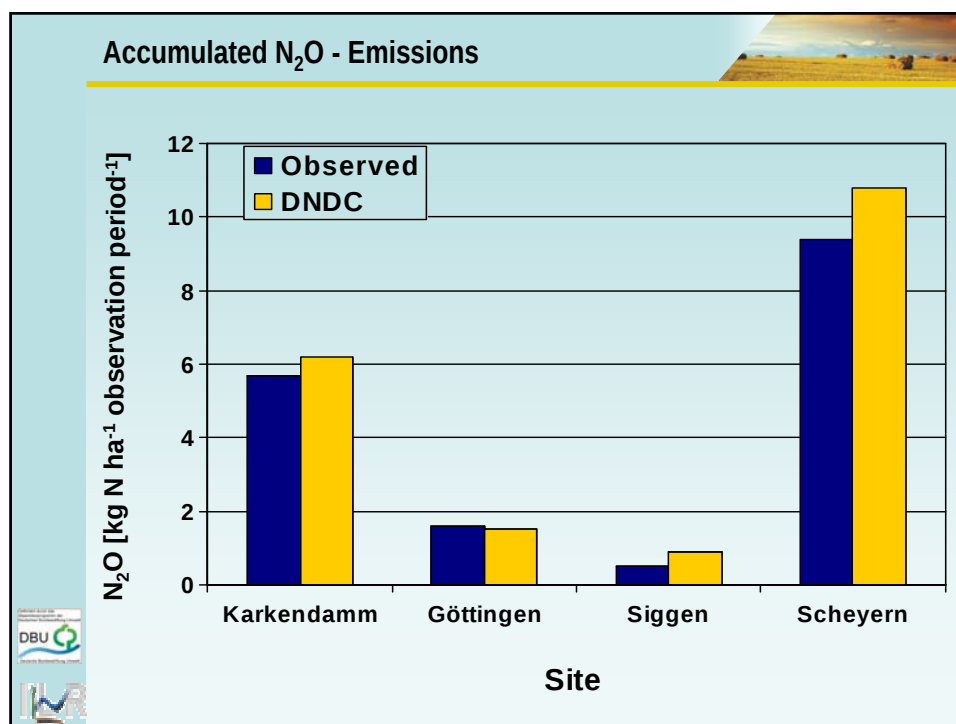
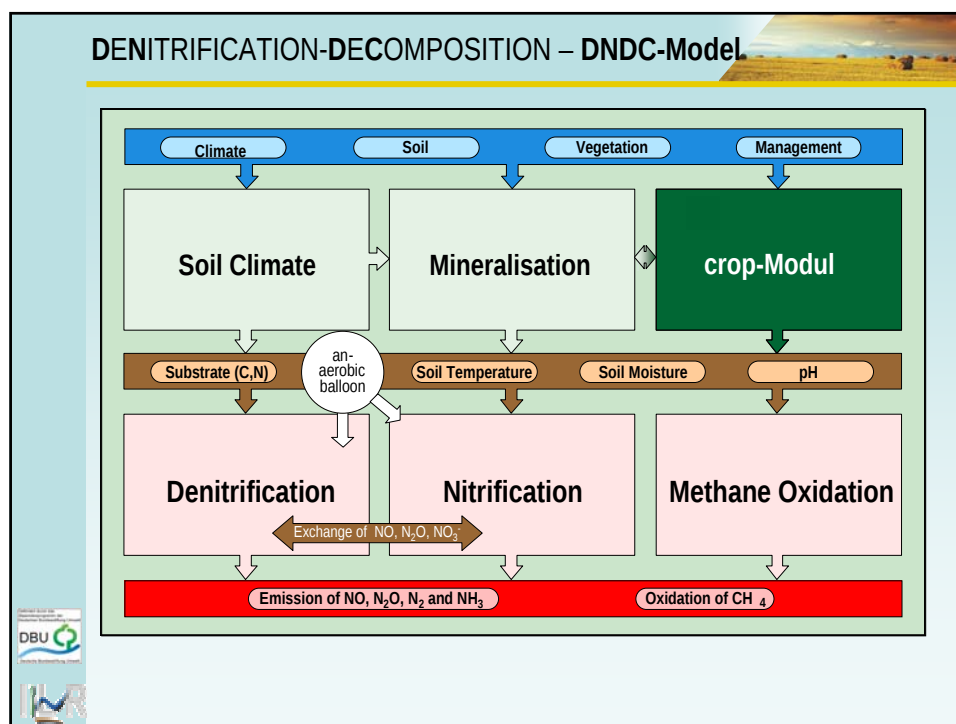
Goals

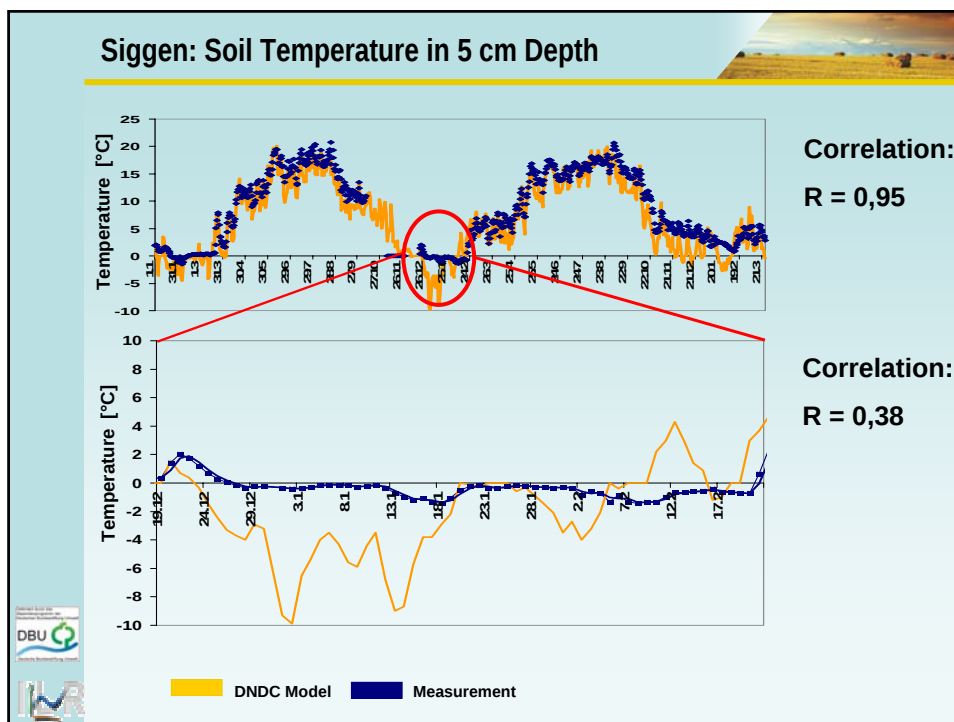
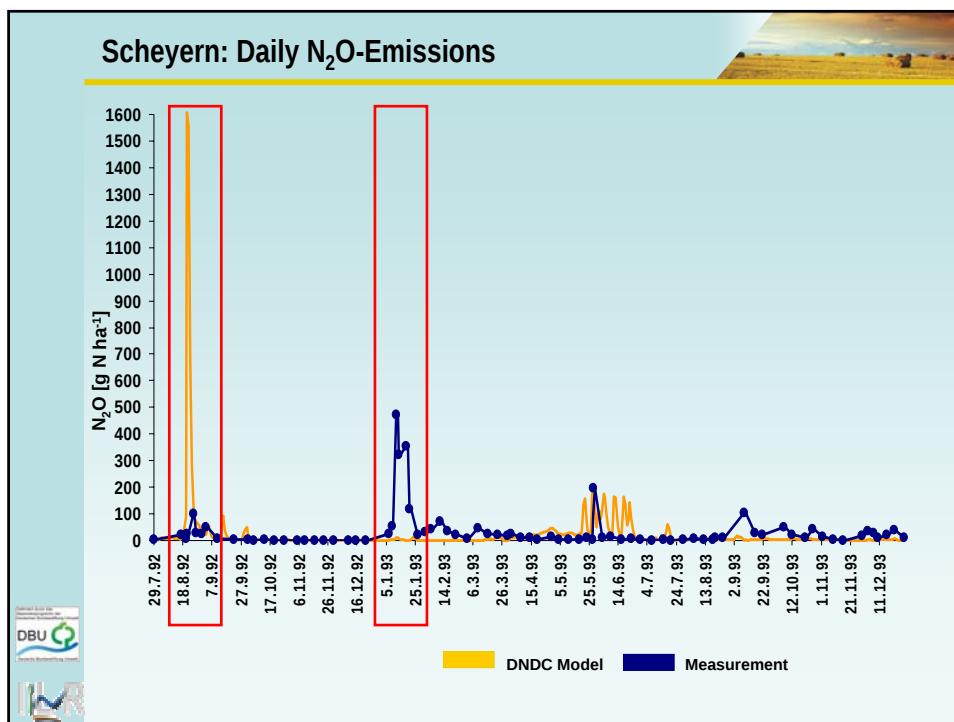
Identification of new indicators assessing the sustainability of agricultural systems.

- ➔ quantitative estimation of the trace gas N_2O
- ➔ integration of N_2O as an indicator in the agricultural consulting software REPRO (Hülsbergen, TU München)

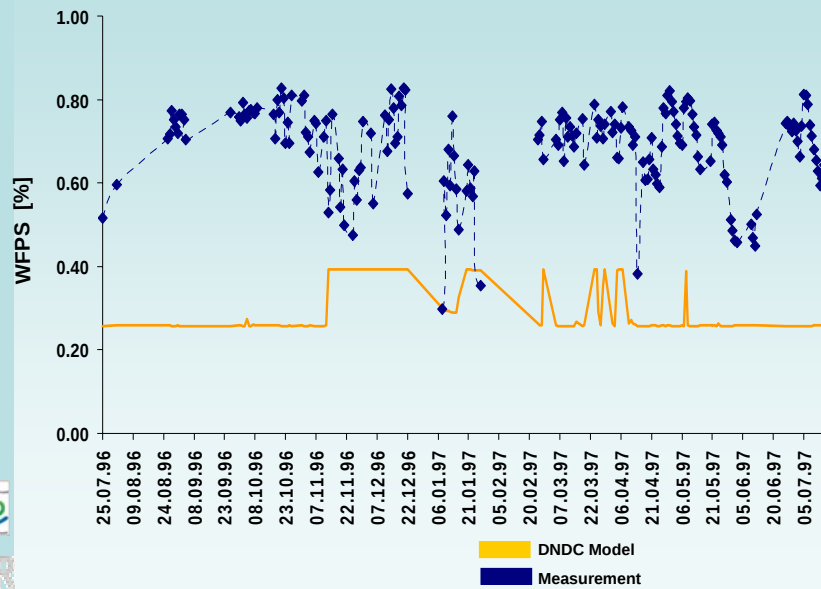








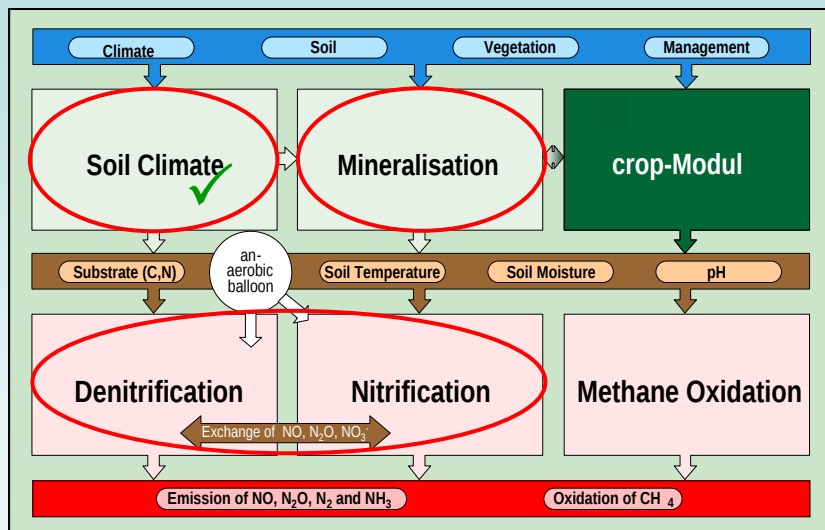
Siggen: Soil Moisture in 5 cm Depth



Calibration of DNDC



DNDC: Calibration of the different modules



Methods

1. Sensitivity Analysis

- variation of all parameter at one time
- parameter were varied in a range between 1/10 and 10 times starting from the original value
- Monte Carlo Sampling
- $n = 200$
- testing of sensitivity
 - multiple linear regression
 - selection of the significant parameters for further operations (ANOVA)

Methods

2. Calibration

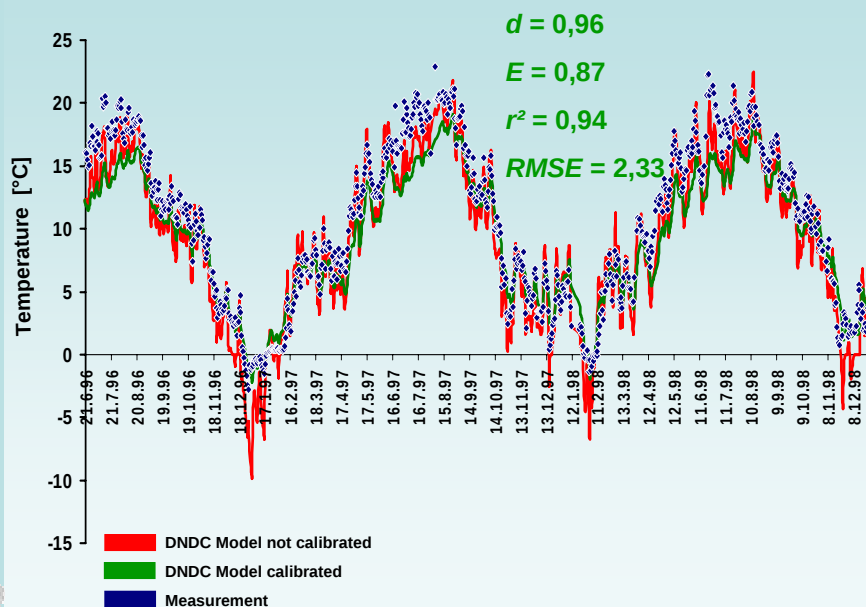
- variation of all sensitive parameters at one time
- parameter were varied in a range between 1/10 and 10 times starting from the original value
- Monte Carlo Sampling
- $n = 10.000$
- selection of the parameter sets:
 - different efficiency criteria
 - comparison of observed and calculated values (visually)

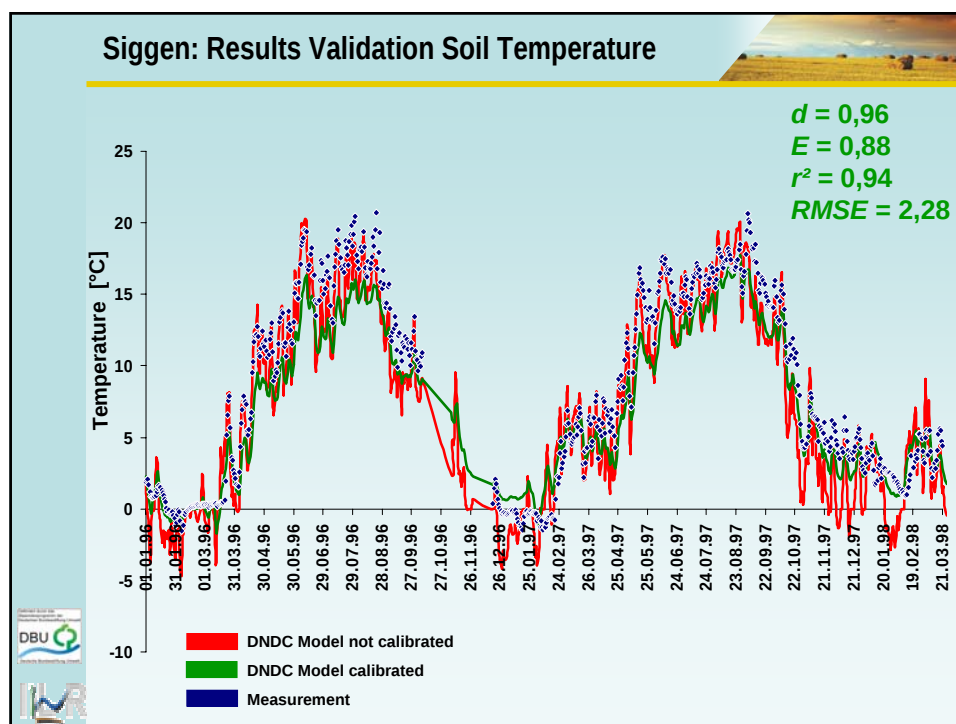
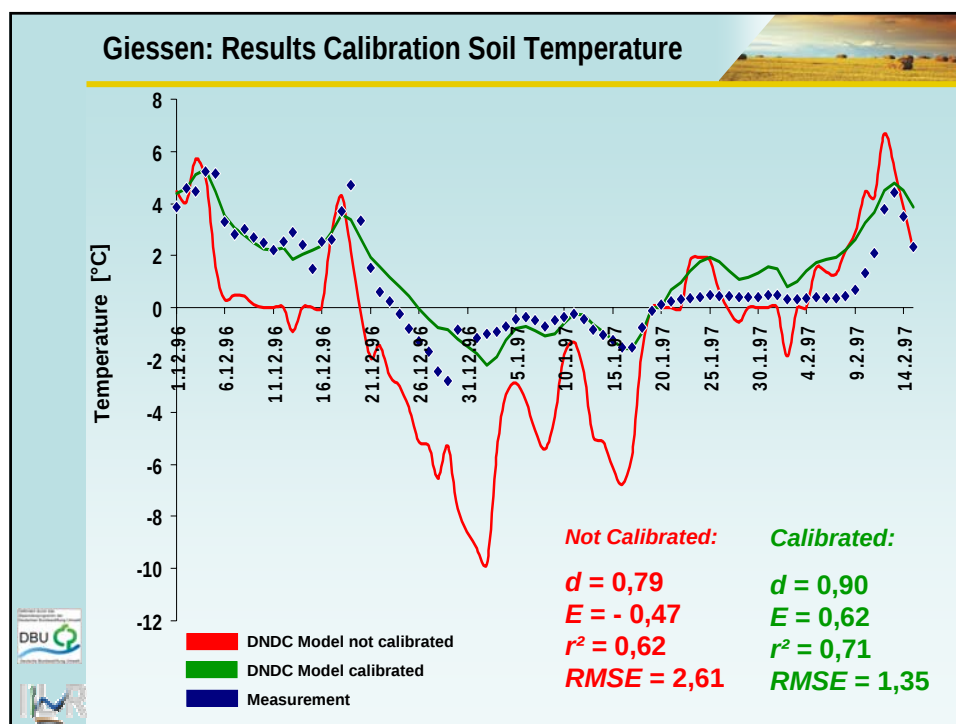
Efficiency criteria:

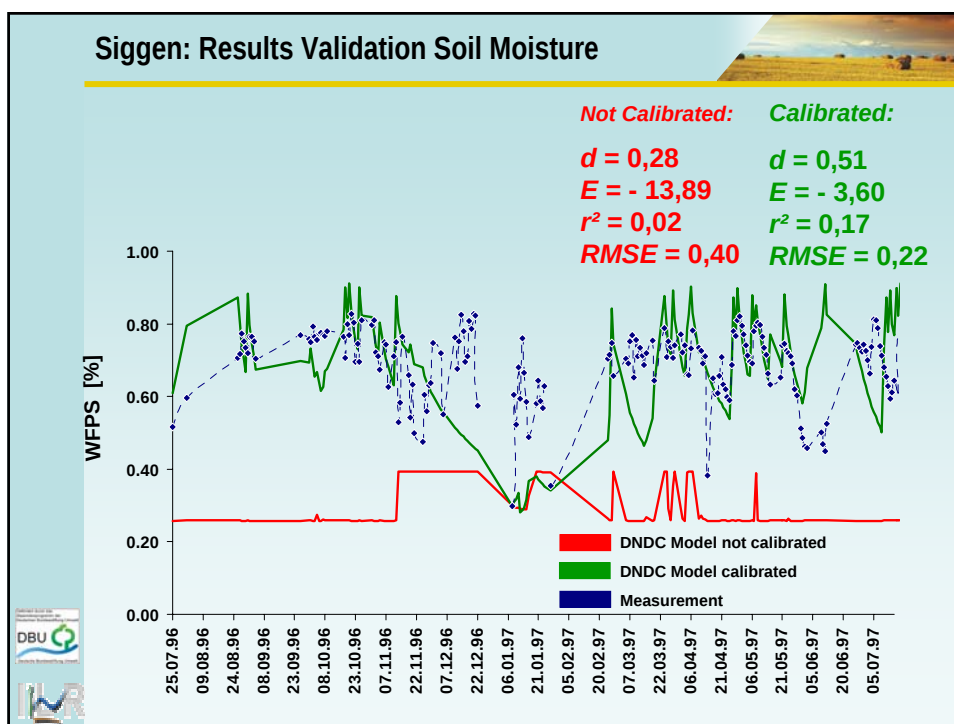
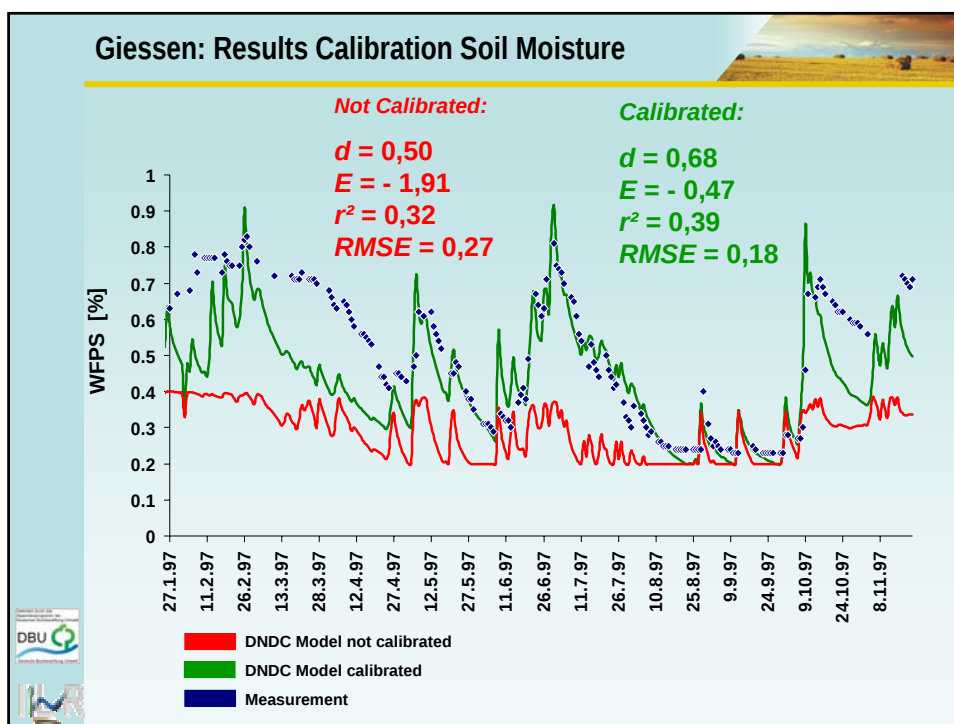
Factor of Agreement: d , between 0 👎 and 1 👍
Nash-Sutcliffe: E , between $-\infty$ 👎 and 1 👍
Factor of Determination: r^2 , between 0 👎 and 1 👍
Root Mean Square Error: $RMSE$, between 0 👍 and ∞ 👎

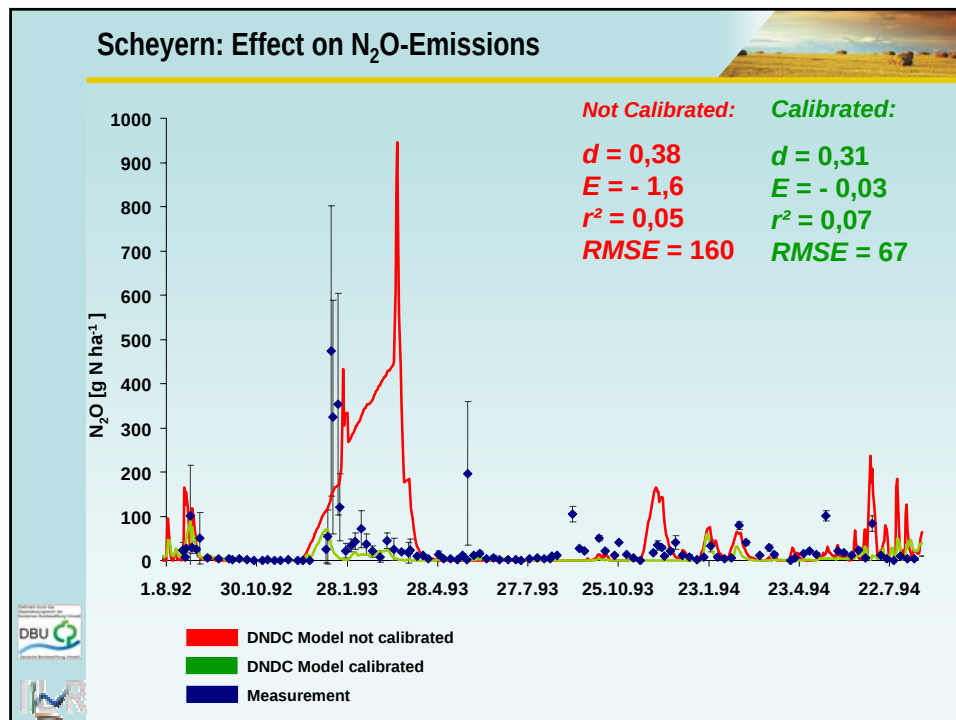


Giessen: Results Calibration Soil Temperature









- ### Summary & Outlook
- better fit of calculation of soil temperature during winter (frost-thawing-cycles)
 - improved calculation of the soil moisture
 - good transferability of the calibrated soil climate module to other sites
 - improved but still not satisfying results of the daily N₂O-emissions
 - calibration of mineralisation and N-decomposition processes necessary



Thank you for your kind attention!

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