Examination and advancement of soil water balance parameters by soil water content measurements in the drought 2003

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BAYERISCHE STAATSFORSTVERWALTUNG

Introduction

Water balance parameters were need for:

- Determination plant available water (field capacity, permanent wilting point)
- Choice of stand location
- Comparison of stand locations
- Modelling of water balance, nutrient transport and tree growth

Introduction

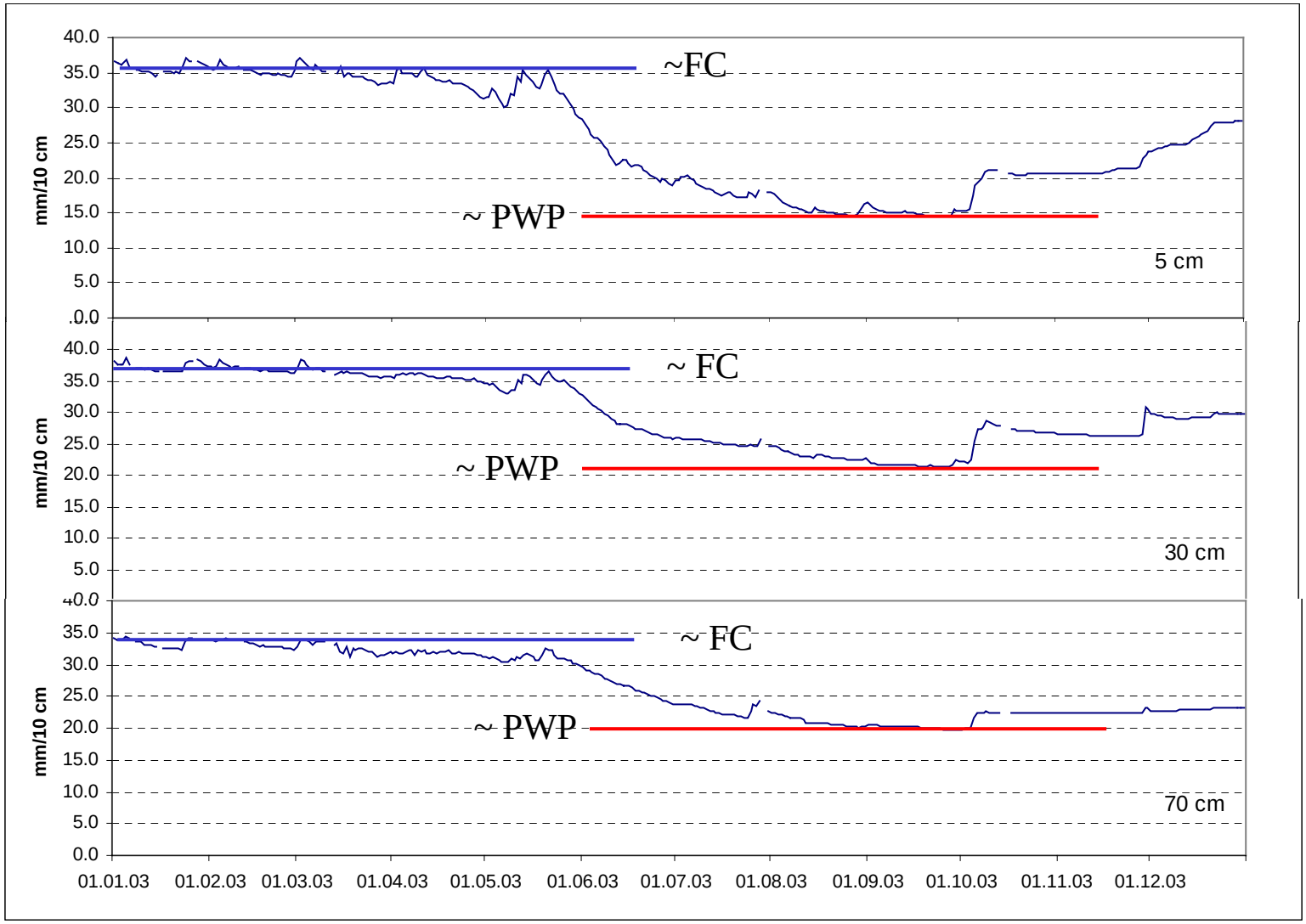
The natural field experiment in the drought 2003:

- Extreme dehydration of the soil at many level II sites
- Whole plant available water supply was consumed
- The permanent wilting point was reached
- Examine the used model parameters in a wider range

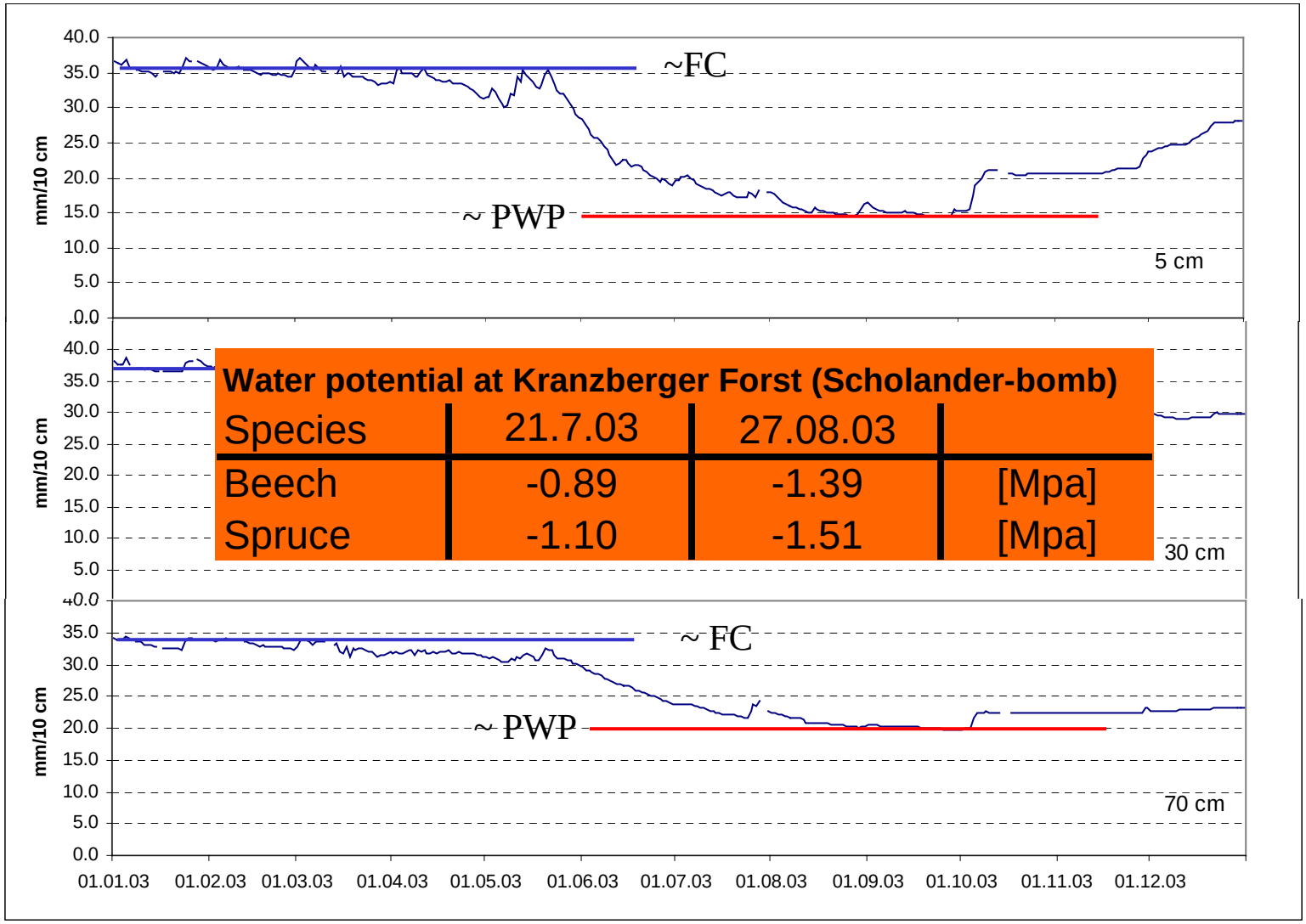
Measurements

- Meteorological data at 22 level II plots
- Soil physical data at 22 level II plots
- Water content measurements at 6 Level II plots
- Retention (pF) curve at Level II plot Freising

Drought 2003: Water Content at Level II plot Freising



Drought 2003: Water Content at Level II plot Freising



Water potential at Kranzberger Forst (Scholander-bomb)

Species	21.7.03	27.08.03	
Beech	-0.89	-1.39	[Mpa]
Spruce	-1.10	-1.51	[Mpa]

Determination of soil water balance parameter

- Direct

  Measuring of soil water balance parameter (retention (pF) function and conductivity function) in the field or laboratory

  ⇨ Time and cost consuming

- Indirect

  Measuring of soil physical parameter, like texture, size fraction, bulk density, organic carbon, etc.

  ⇨ Easier and faster to determine

  Using pedotransfer functions to determine the water balance parameters (retention (pF) function and conductivity function, Field capacity, Wilting point)

Pedotransfer functions

Soil water balance parameters

=

Function (Soil physical parameters)

Pedotransfer functions

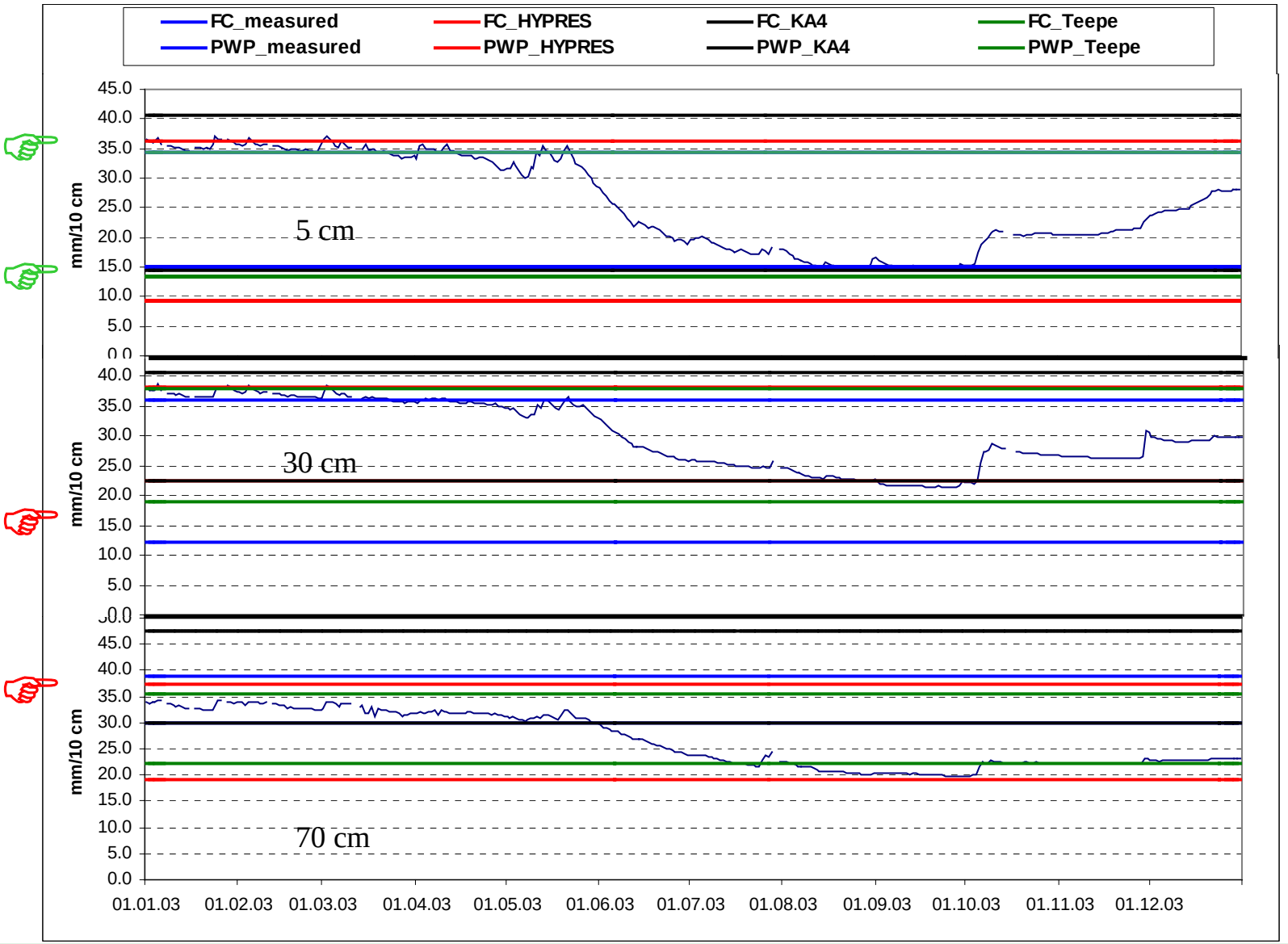
Some examples:

- Texture Class (Schaap and Leij, 1998)
  - Texture, database: agriculture soils
- HYPRES **(Hy**daulic **PR**operties of **E**uropean **S**oils) (Wösten et.al, 2001)
  - Size fraction, Bulk Density, Org. Carbon, database: agriculture soils
- Bodenkundliche Kartieranleitung 4. Auflage (AG Boden, 1996)
  - Texture, Density, Humus, database: agriculture soils
- Teepe (Teepe et.al, 2003)
  - Texture or size fraction, Density, Org. Carbon, database: forest soils

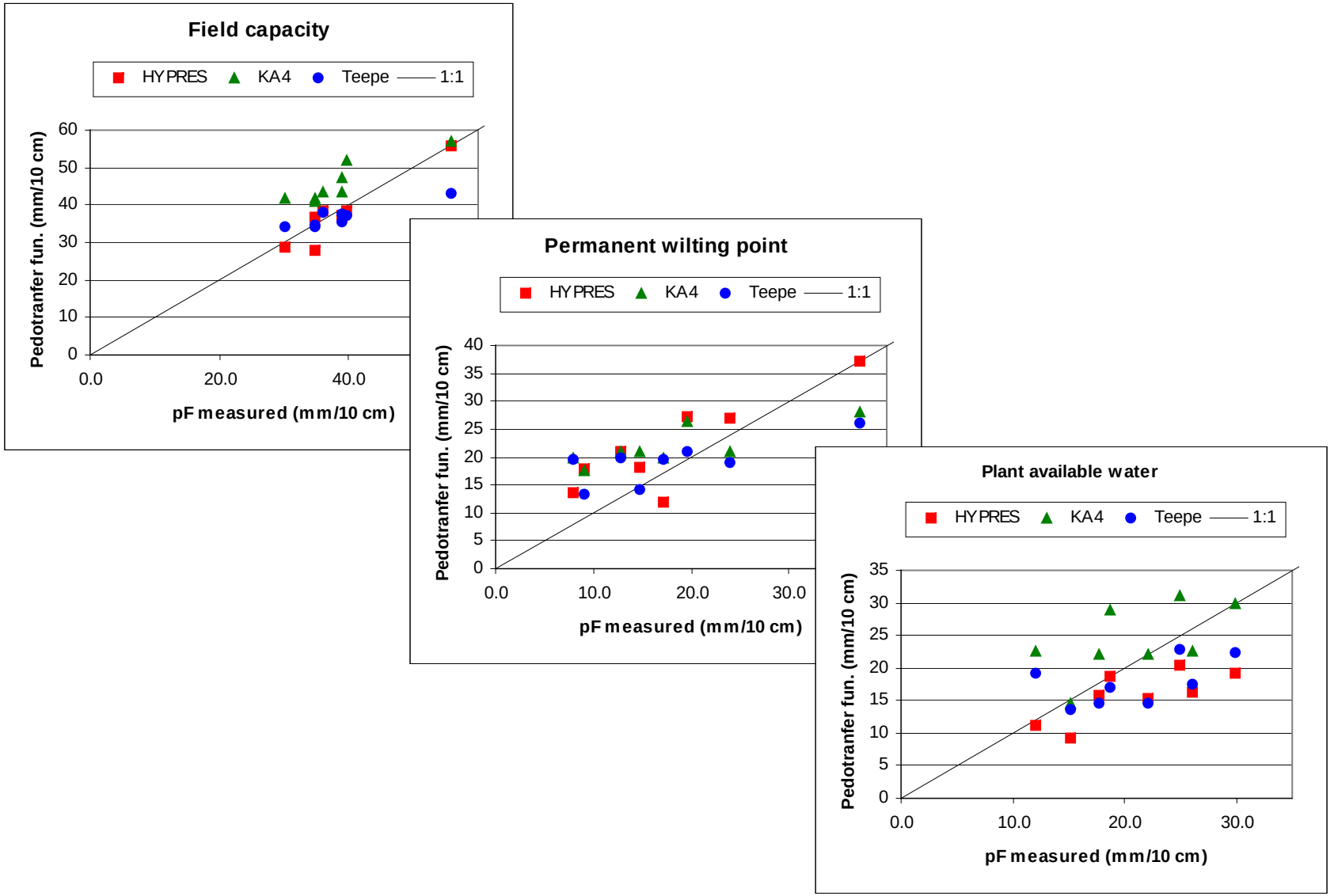
Pedotransfer functions

Does they supply the correct parameters?

Pedotransfer functions for Level II plot Freising



Pedotransfer functions for Level II plot Freising



Result:

Different Parameters from different pedotransfer functions

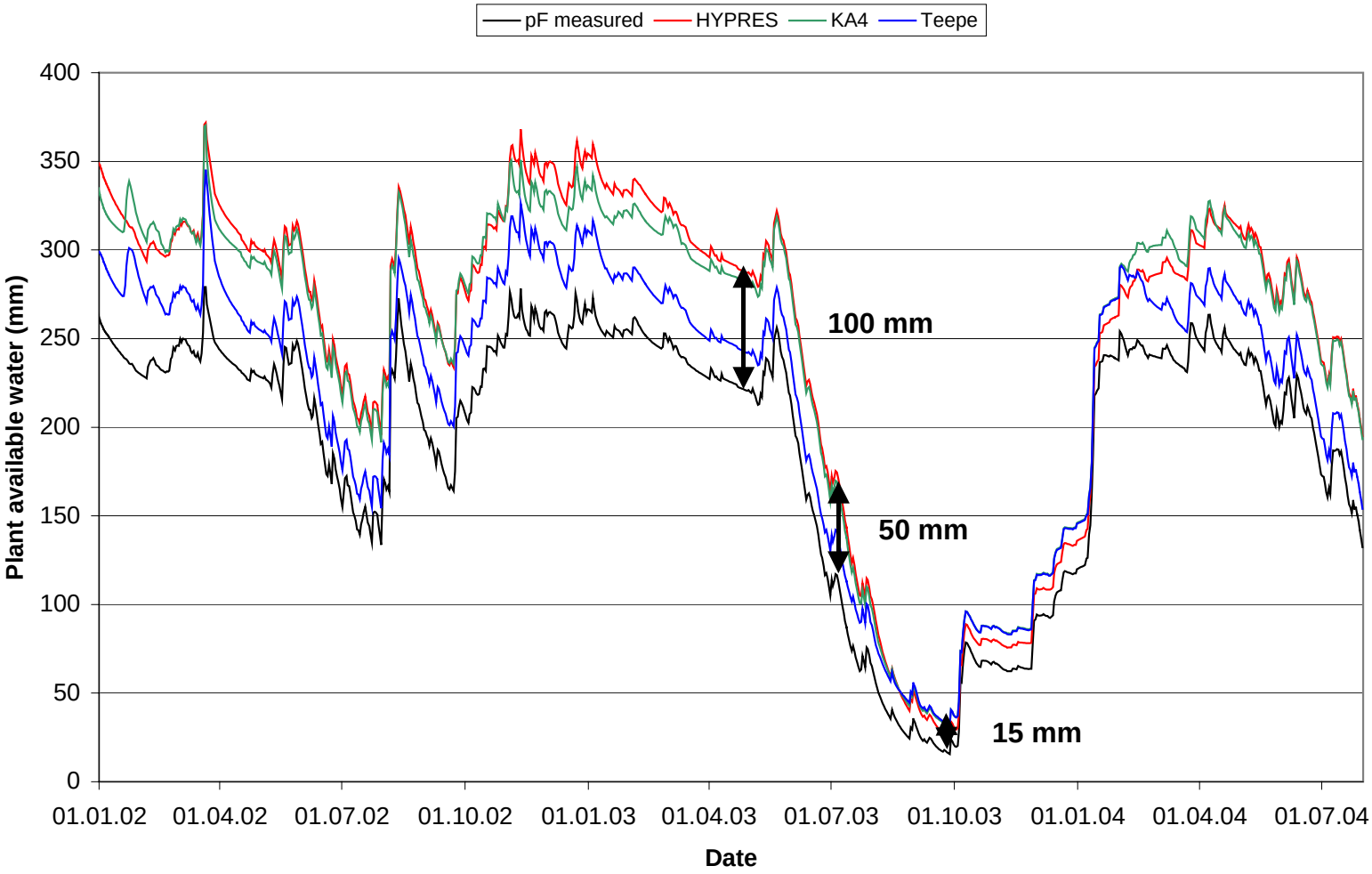
Plant avaiable water varies between:

In 5 cm:	19.5 - 27.2 mm/10 cm
In 30 cm:	18.9 - 27.0 mm/10 cm
In 70 cm:	9.0 - 18.0 mm/10 cm

Similar results at the other Level II plots!

Effects in modelling water balance

Freising, simulated with LWF-BROOK90



Conclusions

- Different pedotranfer functions result in very different water balance parameters.
- Thus we get also different simulation results for the modelling of the water balance.
- The new pedotranfer function from ***Teepe et al. (2003)*** for forest soils is not valide for all soils at the level II plots in bavarian.

Further Investigations

- Brought together of measuring data of the soil water balance at level II-sites as basis for the execution of purposeful soil-physical investigations.
- Additionally necessary field and laboratory measurements, to extend the data base of forest soils.
- Structure a data base with soil-physical and soil-hydraulic base data as basis for the improvement of pedotransfer-functions
- Improvement and completion of pedotransfer-functions for forest stands for application and quality assurance of water balance models and their purposeful use in the forest environmental monitoring and on the regionalization of water balance information.

Summary

- Pedotransfer functions were useful tools to determine the water balance parameters in a simple way.
- Most pedotransfer functions base on the data of agricultural soils.
- Therefore the specific water balence parameters in many cases are not valid for forest soils.
- The new pedotranfer function from ***Teepe et al. (2003)*** for forest soils could not intend the correct parameters for the most soils at the level II plots in bavarian.
- The improvement and completition of the pedotransfer functions for forest soils needs further investigations