

The Validation Process



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The data sources!

Crops available with data: **Cotton, Sugar, Pasture and Vegetables**

What do we need?

- Continuous quality data

- Soil moisture data

- Leaf Area Index/Cover data

- Water on and off

- Yield

What sites do we have so far?

- Cotton data Narrabri ACRI

- Pasture data from Kairi NQ and Mutdapilly

- Sugar data from NQ

Narrabri Irrigated Cotton
ACRI 1985
Brian Hearn's experiments, CSIRO Plant Industry

- 12 treatments
 - 4 irrigation treatments with 3 replicates each
 - 1 group with 6 irrigations
 - 2 groups with 5 irrigations (different timing)
 - 1 group with 1 irrigation
 - Each replicate had a different variety of cotton (DP61, DP90 & Siokra)
- Planted early October - solid planting with 1m spacing.

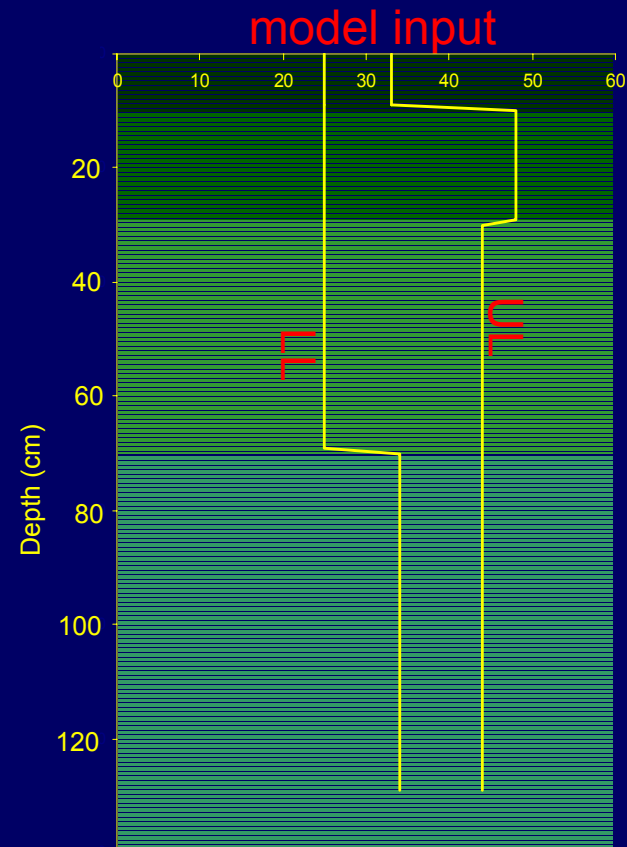
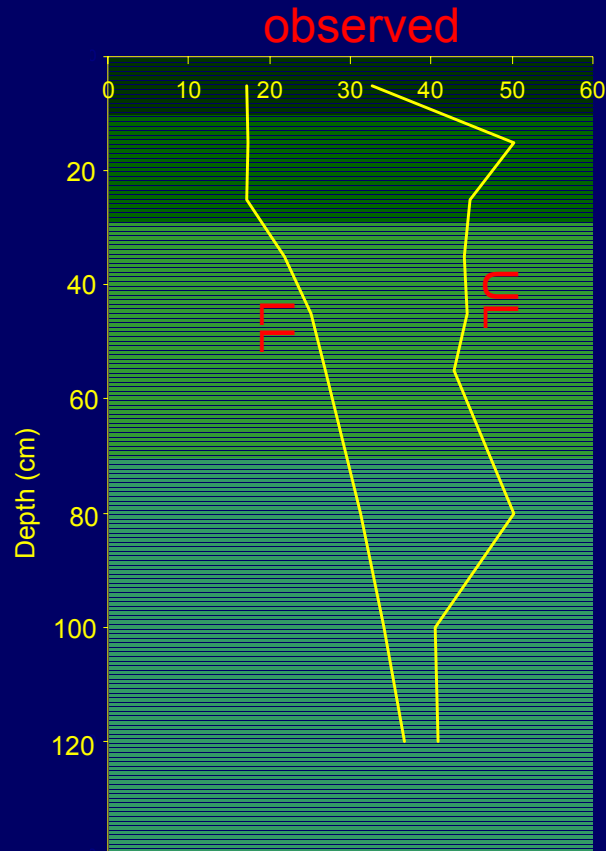
- Leaf area index and soil moisture were regularly measured.
- No water on or off measured.
- Yield measured, but data lost.
- Climate data recorded but not used because of errors in the data.

- The focus was on water balance validation.

Where did we obtain the model parameters?

■ SOIL PARAMETERS

- Uniform deep cracking clay parameters
- Soil moisture limits were obtained from the observations for each treatment
- 4 layers were used 0-10, 10-30, 30-70, 70-130cm



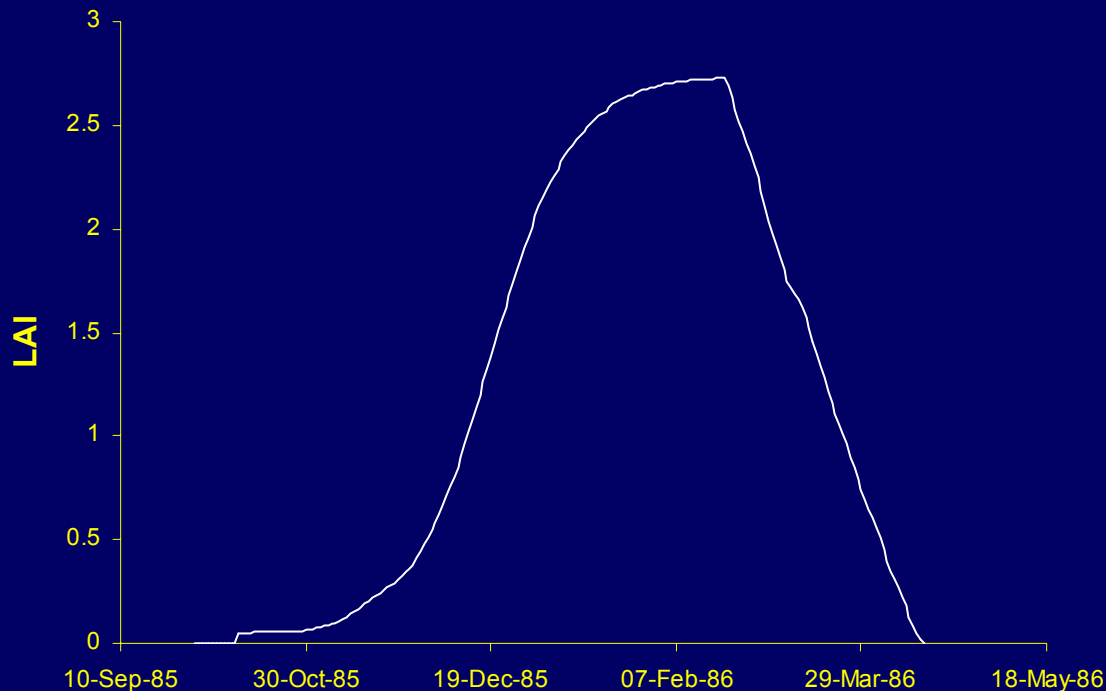
■ CLIMATE DATA

- Local climate file contained possible errors in rainfall.
- The meteorological data came from the SILO data drill.



■ CROP PARAMETERS

- Parameters were obtained by fitting the modelled Leaf Area Index (LAI) to the observed leaf area index from the fully irrigated treatment.

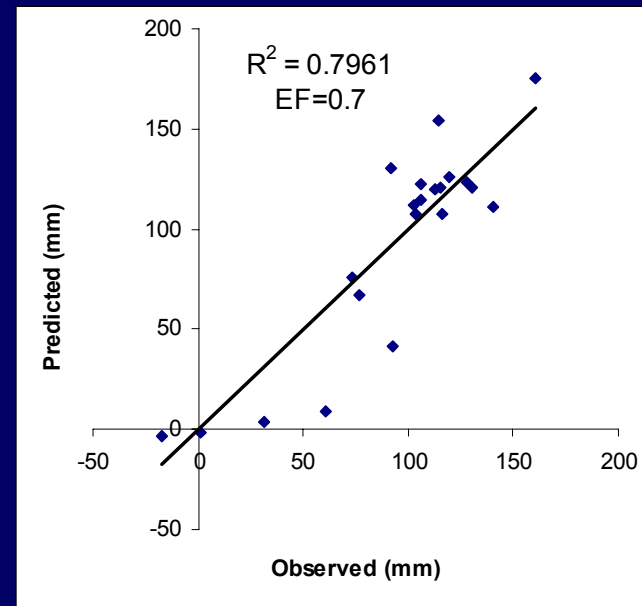
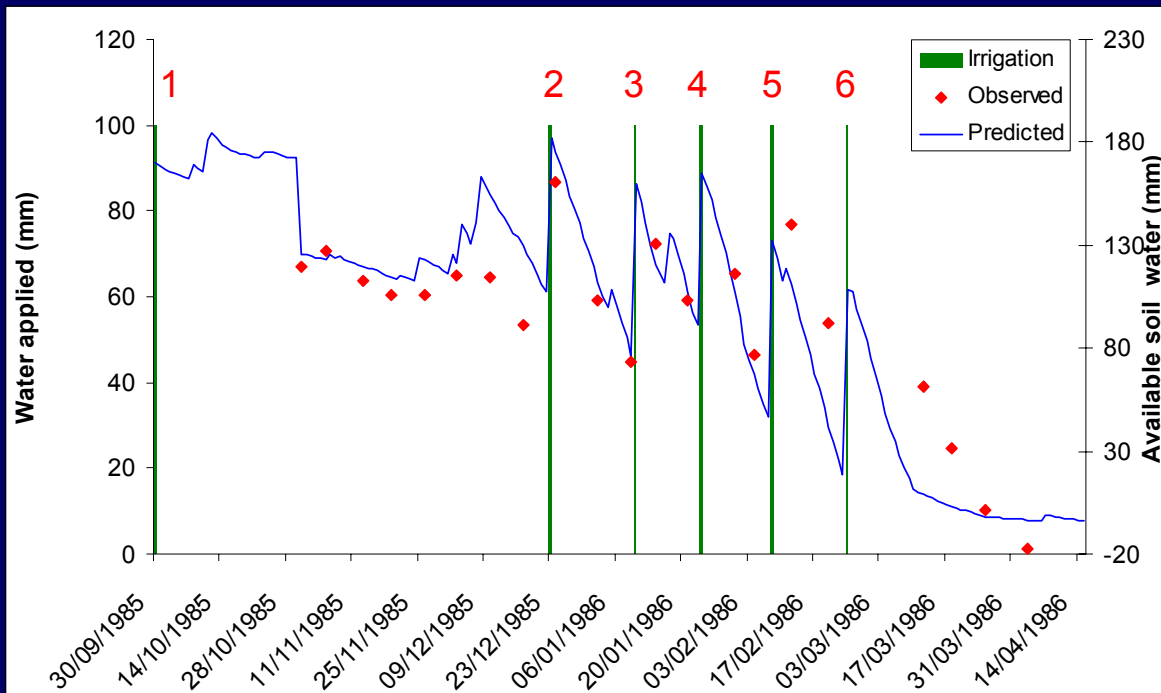


Simulations

6 irrigations treatment x 3 varieties

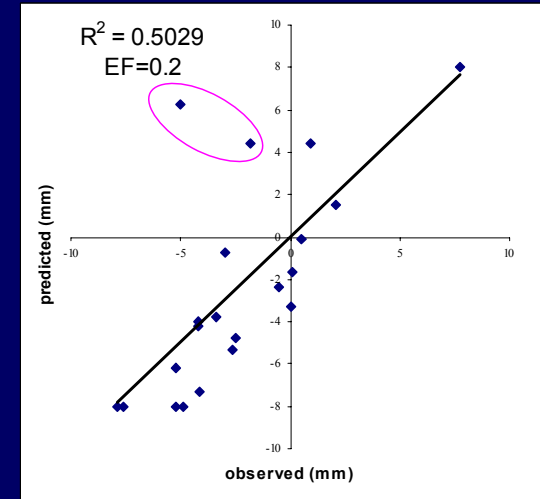
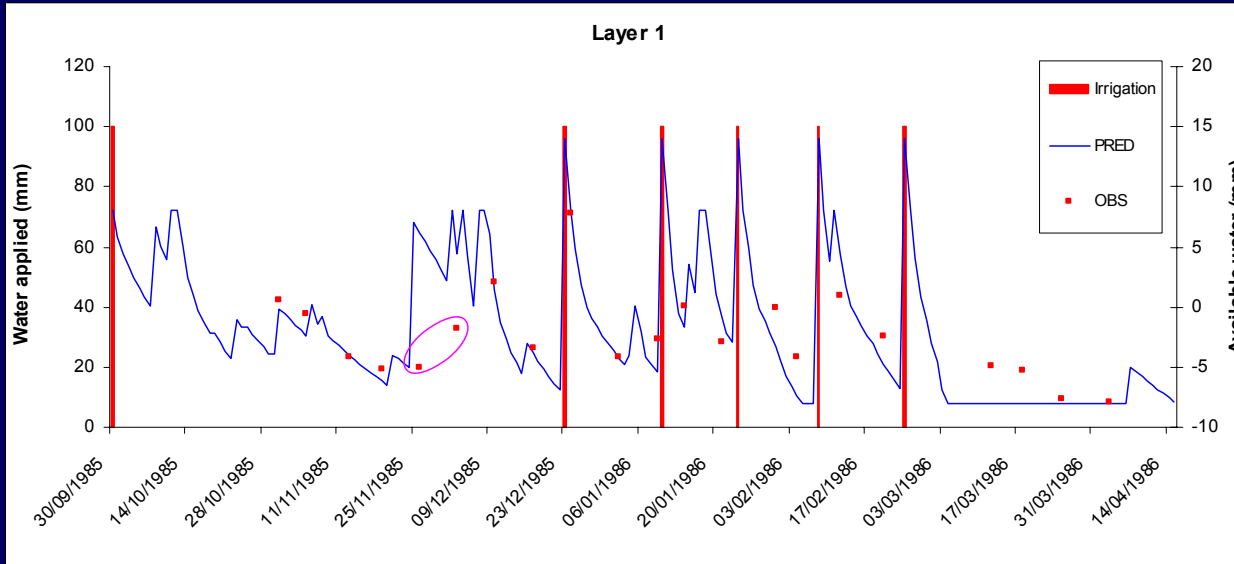
Example: T1 – DP61

Total soil moisture



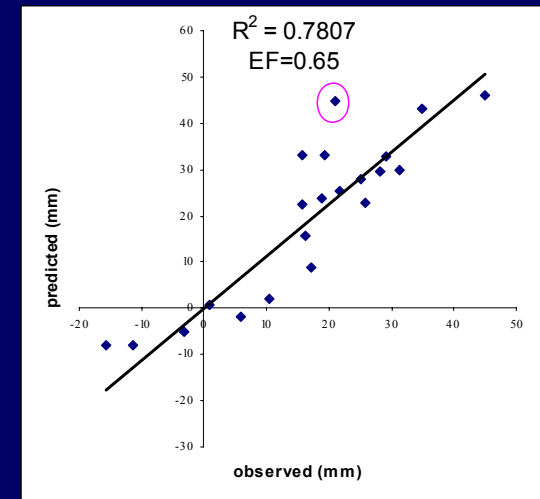
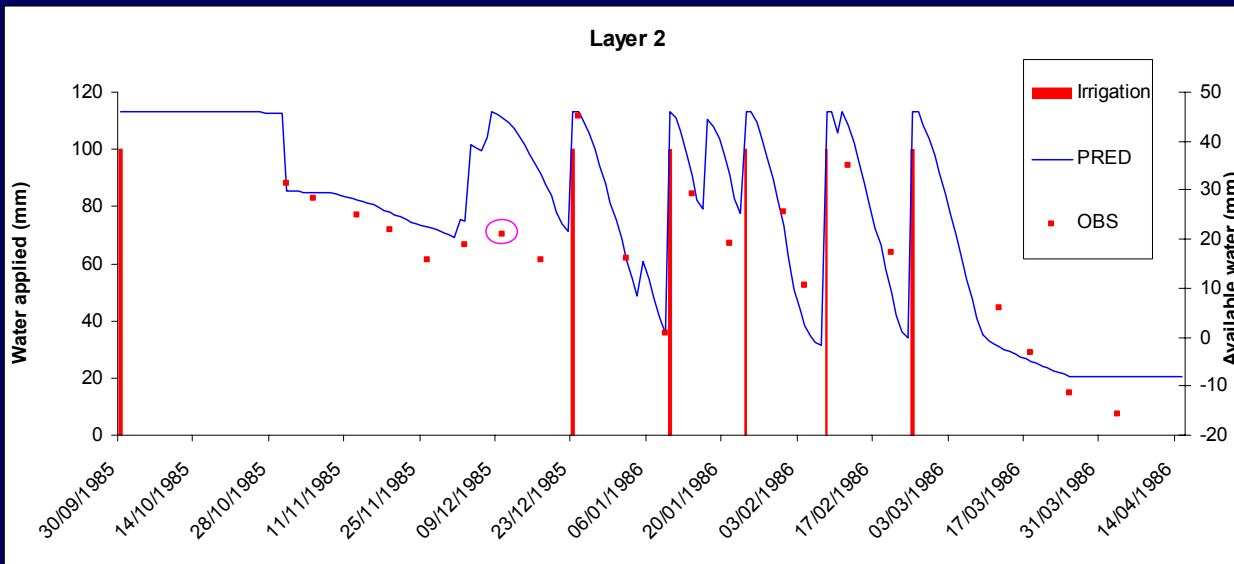
Captures a large amount of the variation in the observations.

Layer 1 (0-10cm)



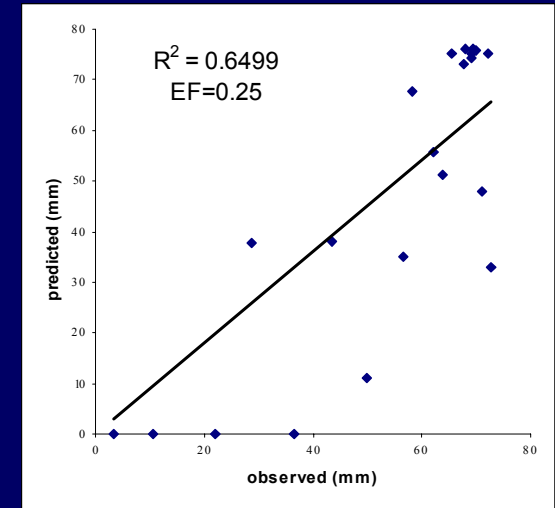
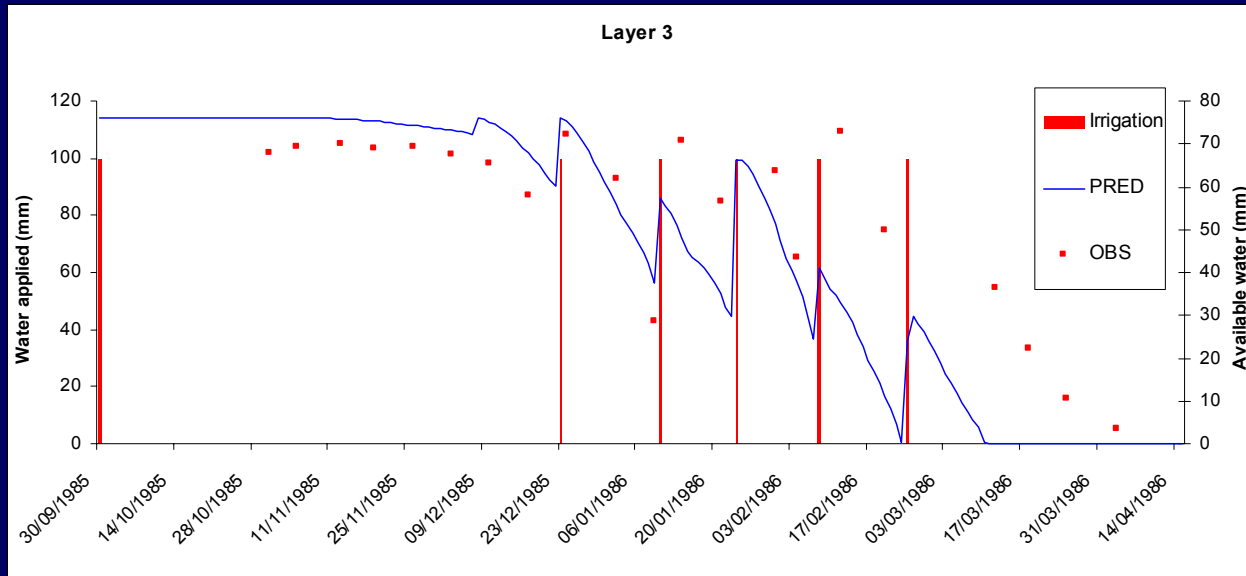
Outliers possibly caused by differences between climate file and actual rainfall

Layer 2 (10-30cm)



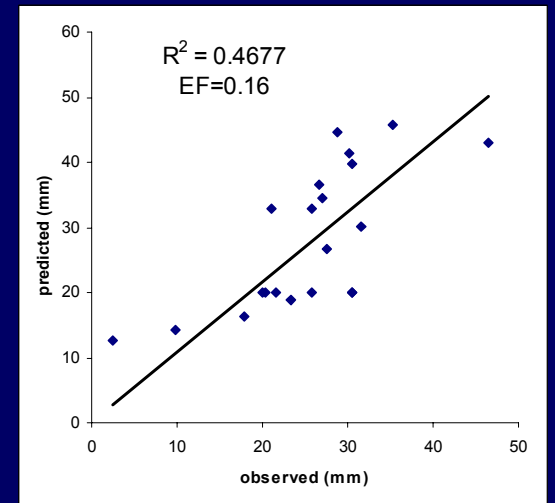
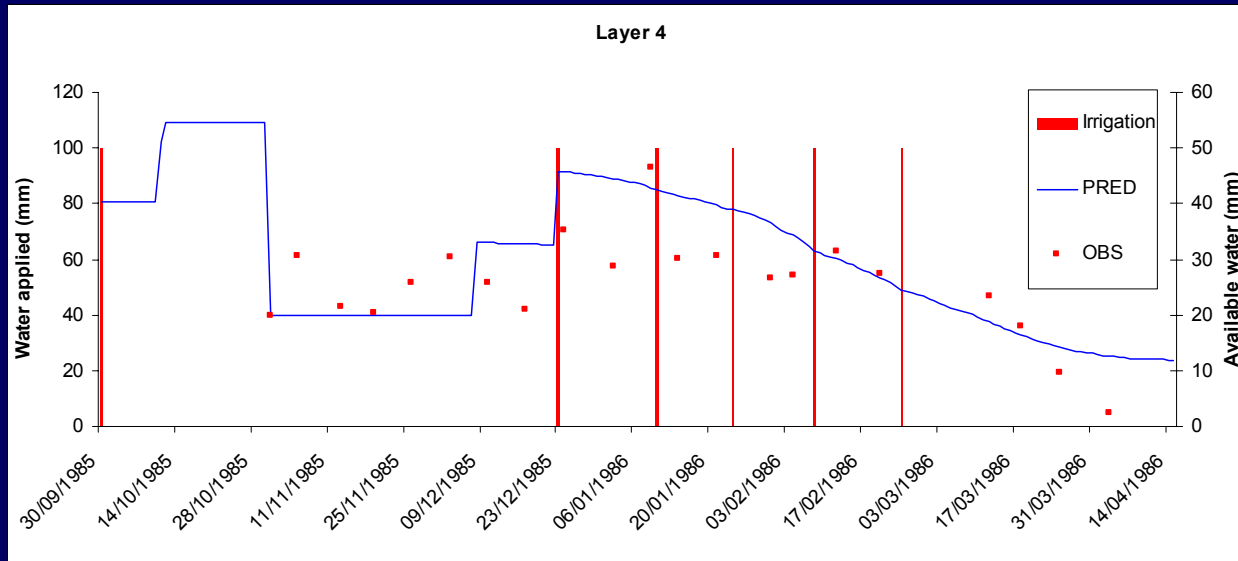
Captures most of the variation in layer 2

Layer 3 (30-70cm)



Using too much water from layer 3

Layer 4 (70-130cm)

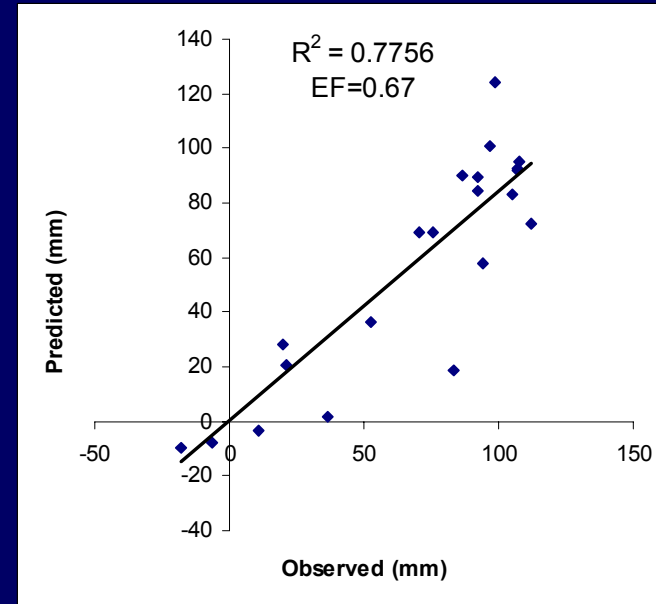
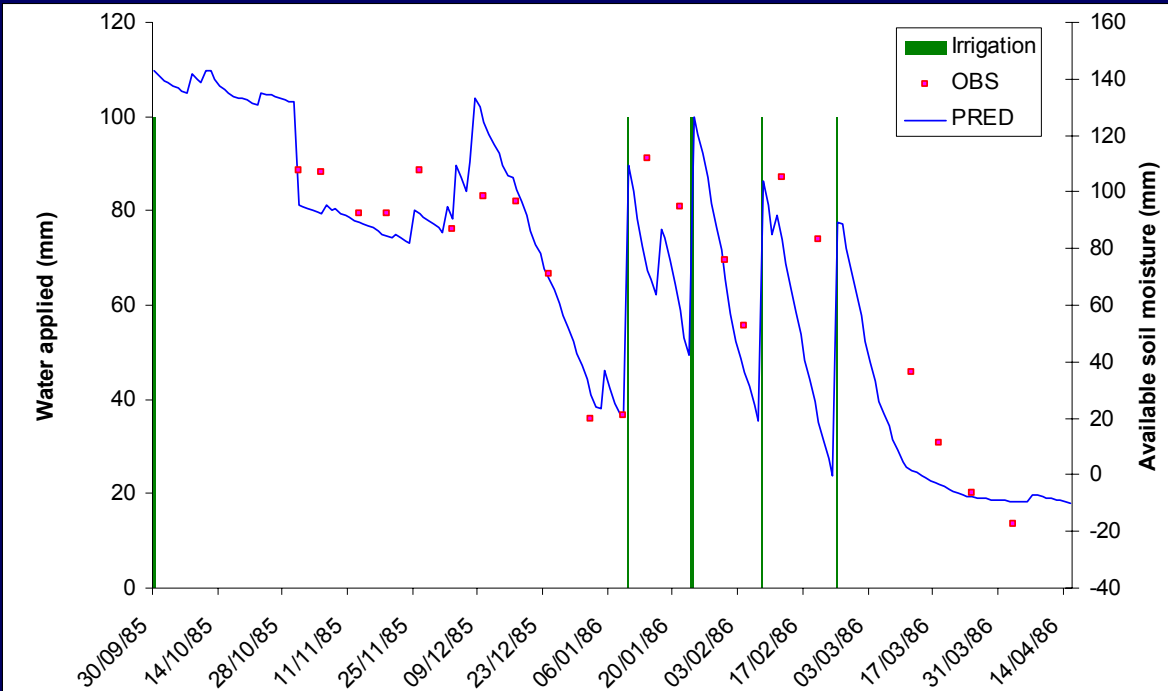


Not capturing the variation in layer 4

5 irrigations treatment x 3 varieties

Example: T4 – DP61

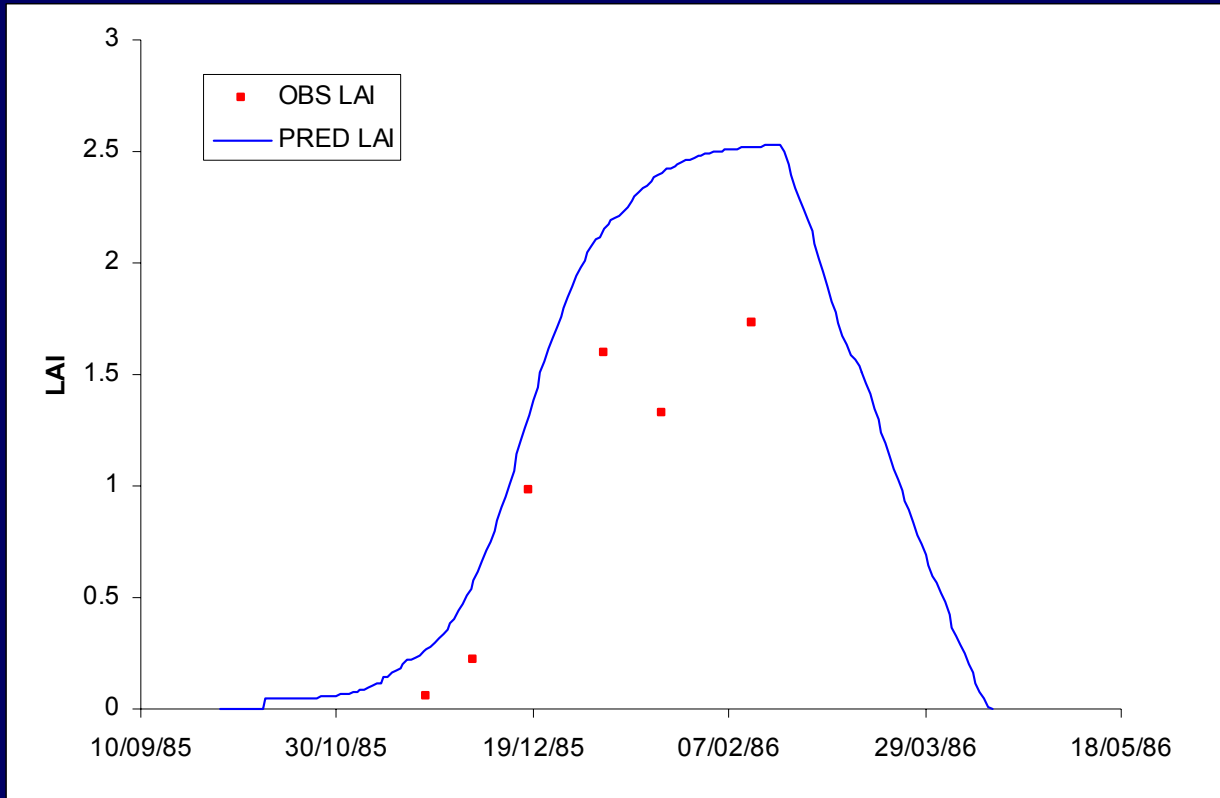
Total soil moisture



A large period during the maximum growth period with no irrigation and little rainfall.

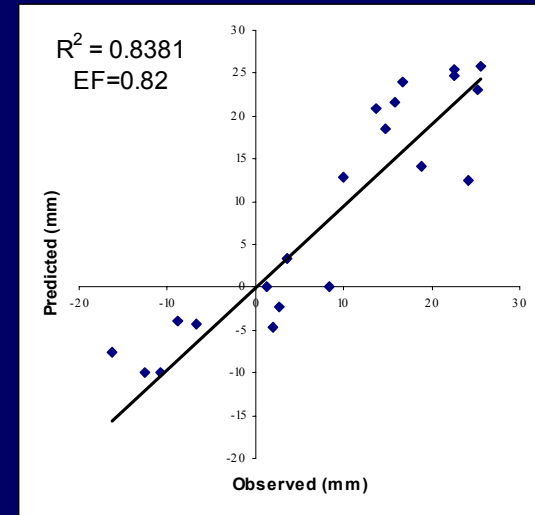
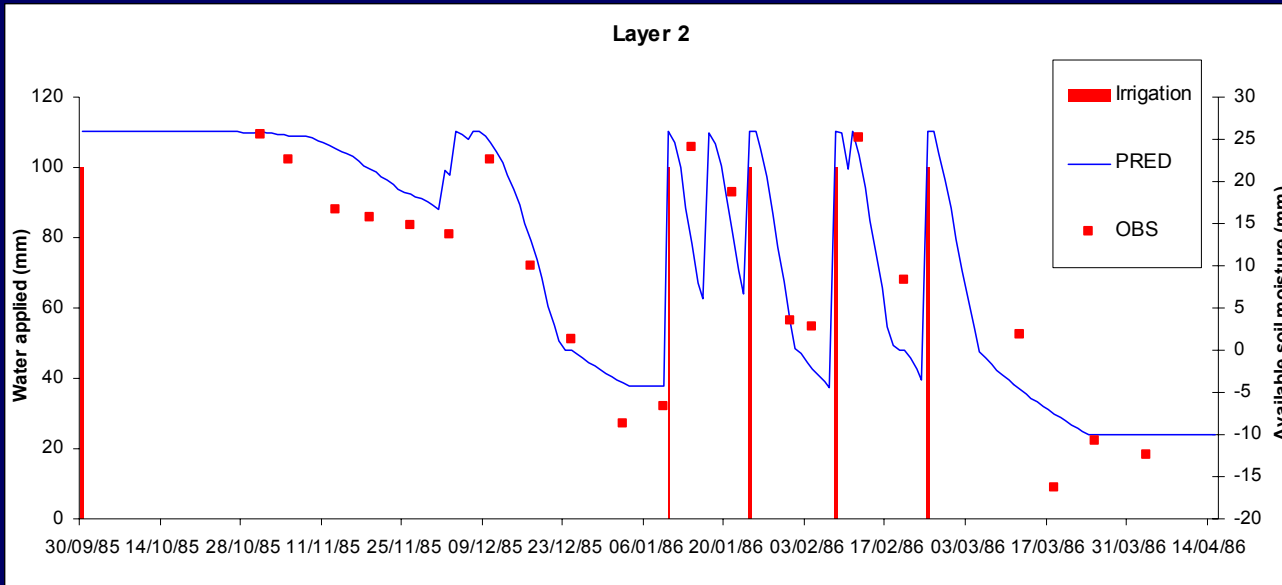
A good prediction of total soil moisture.

Reduced observed leaf area index

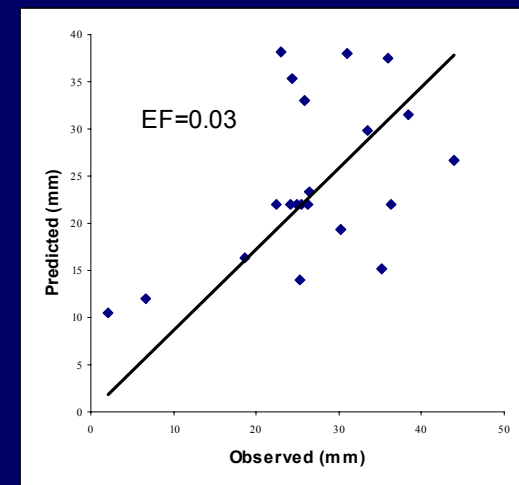
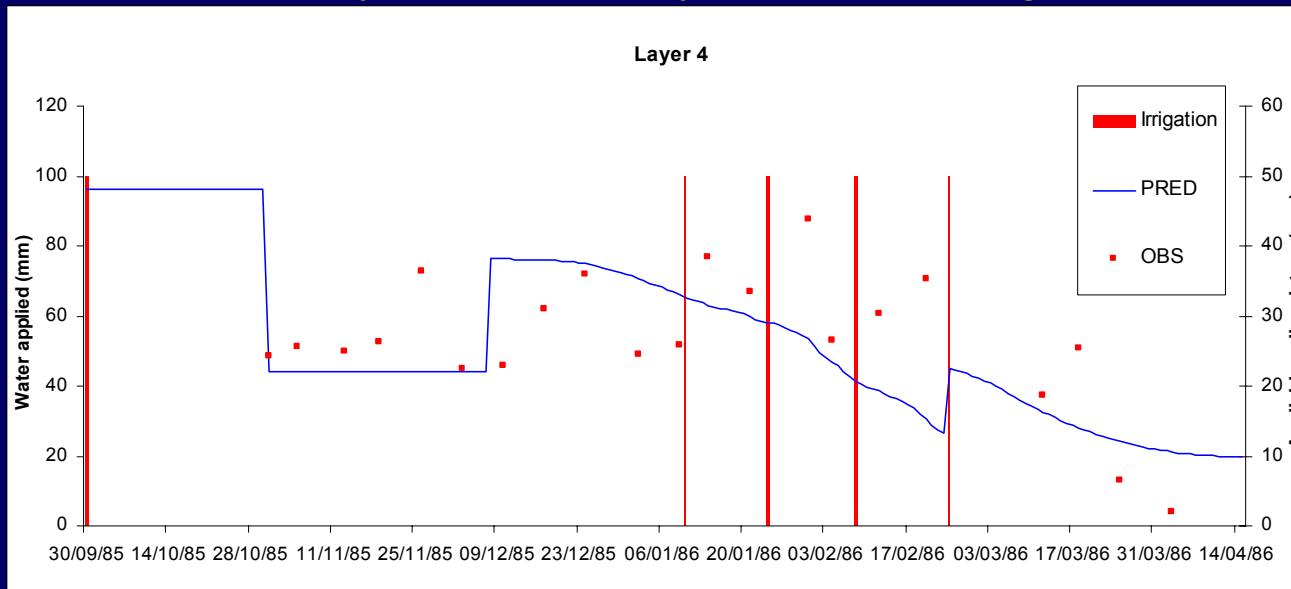


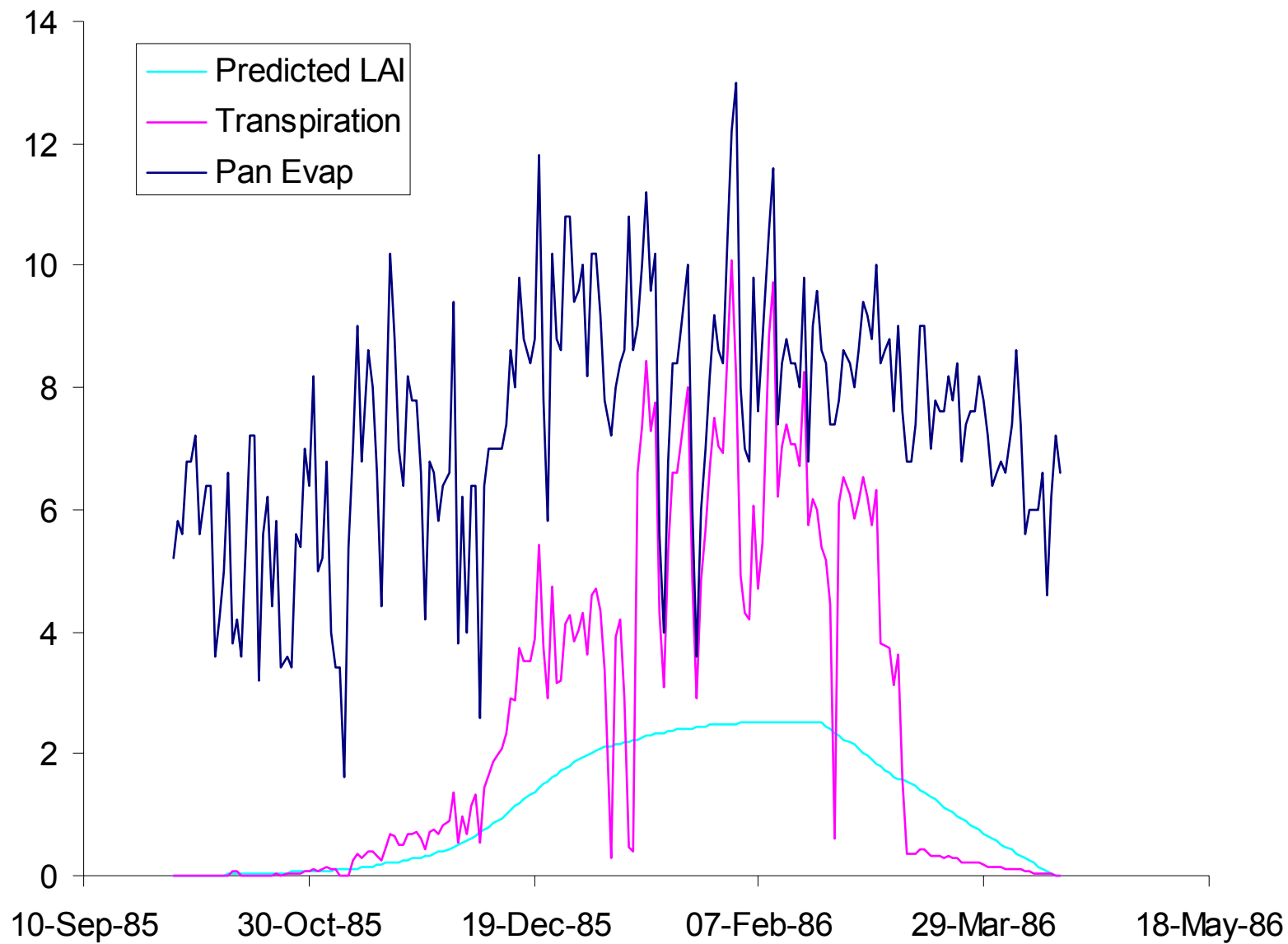
The only reduction in LAI that can occur in PERFECT is due to senescence.

PERFECT still predicting upper layers well, for example layer 2:



Any variation in layer 4 is not being predicted by the model.

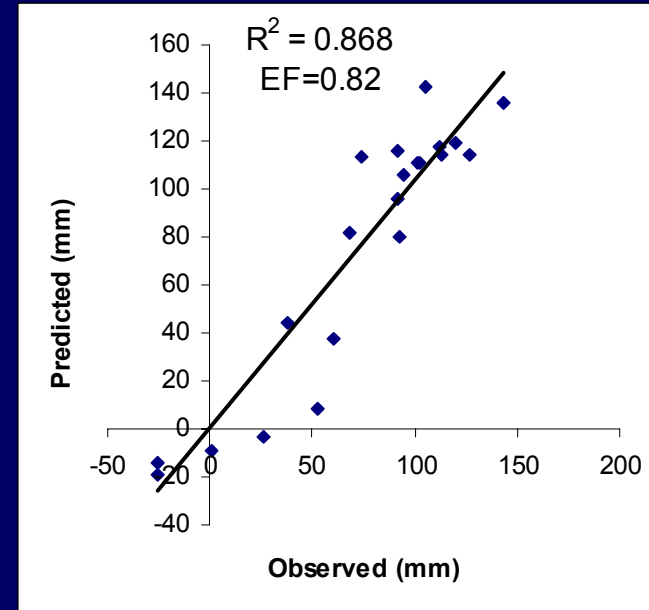
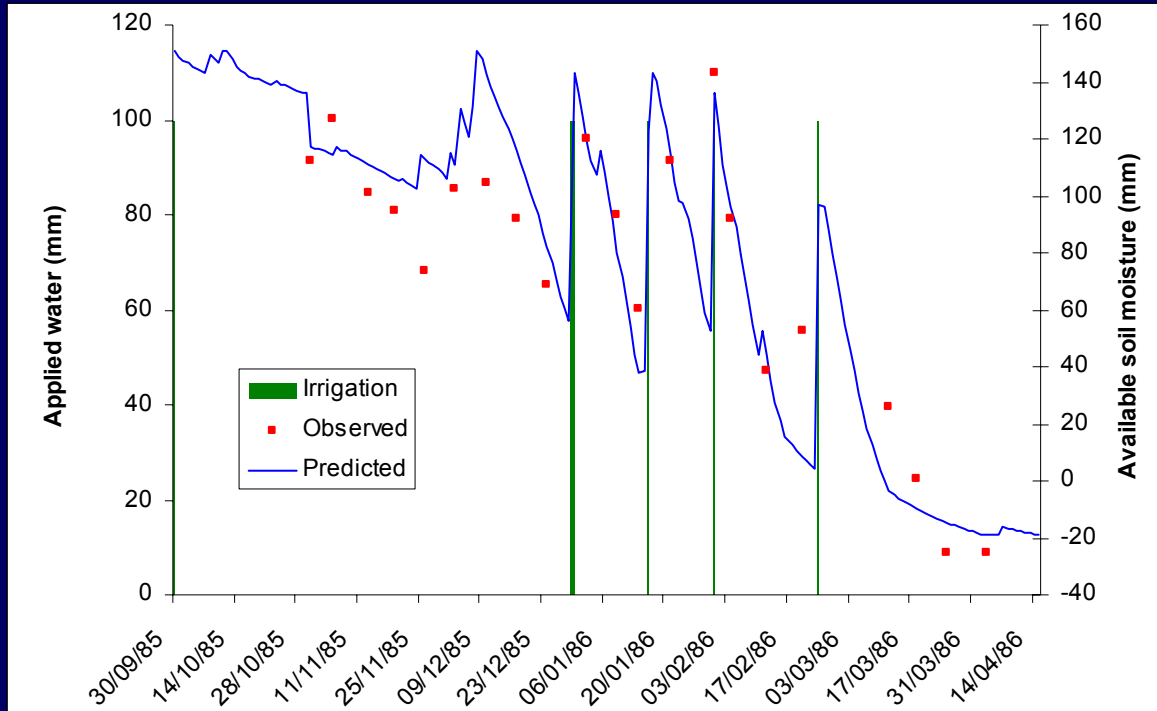




5 irrigations treatment x 3 varieties

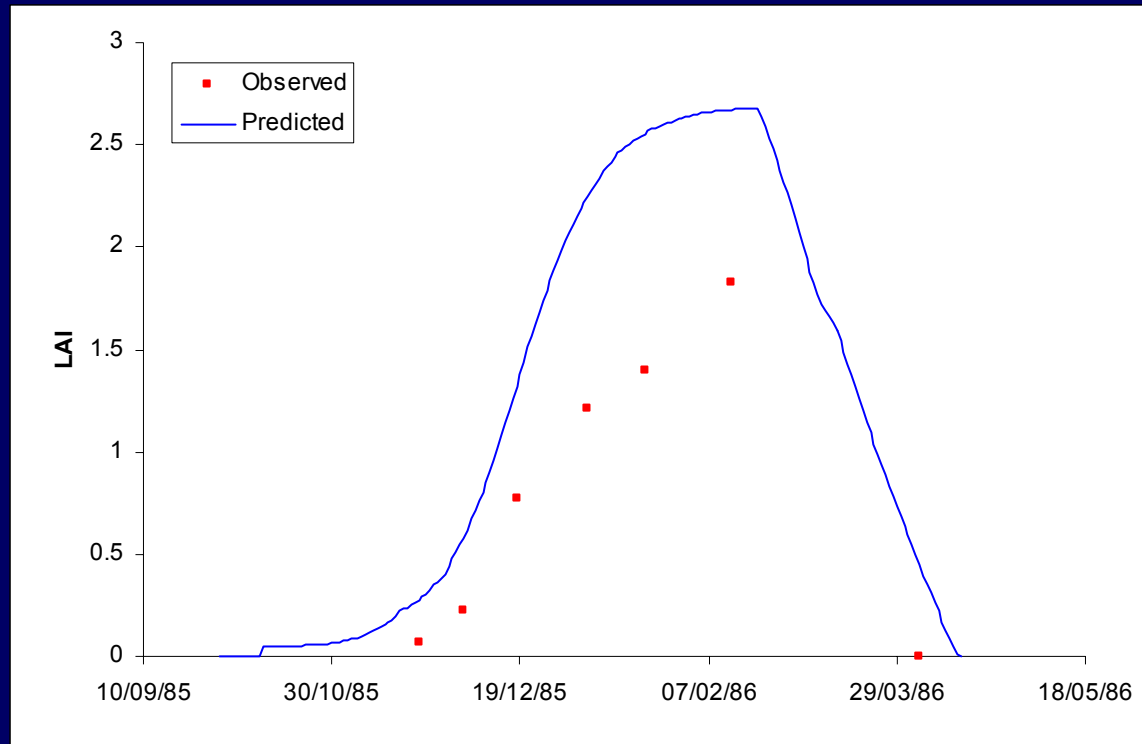
Example: T7 – DP61

Total soil moisture

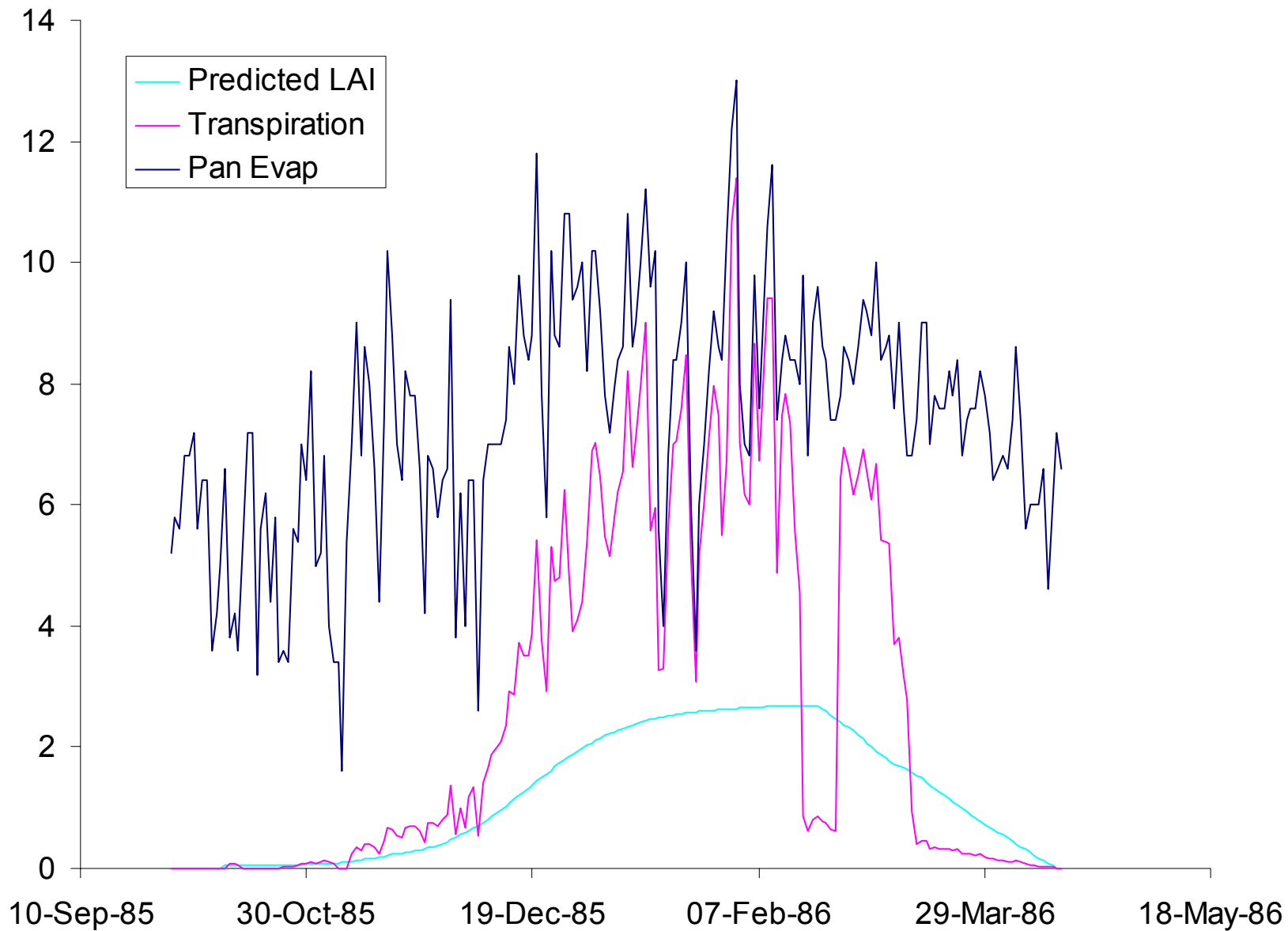


A higher R^2 than treatments 4-6 with the same number of irrigations.

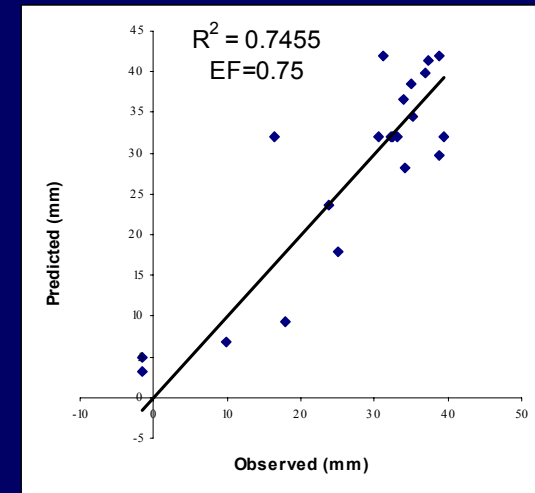
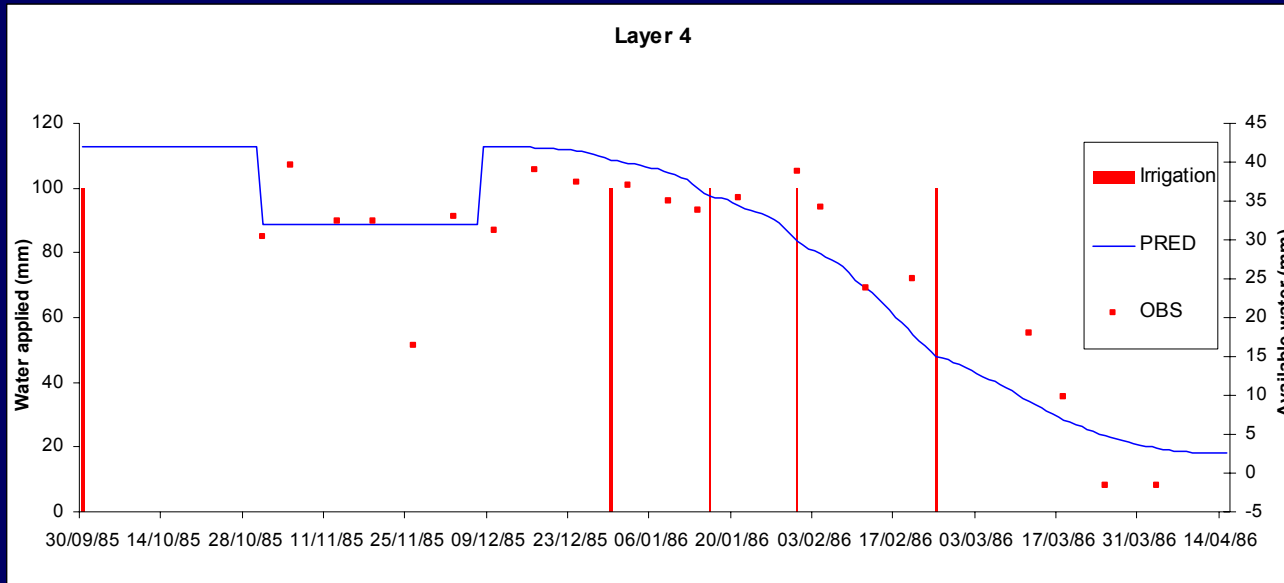
Better prediction of soil moisture due to LAI not being reduced to the same extent as the last group of experiments.



The LAI is not as reduced as the last group of treatments.



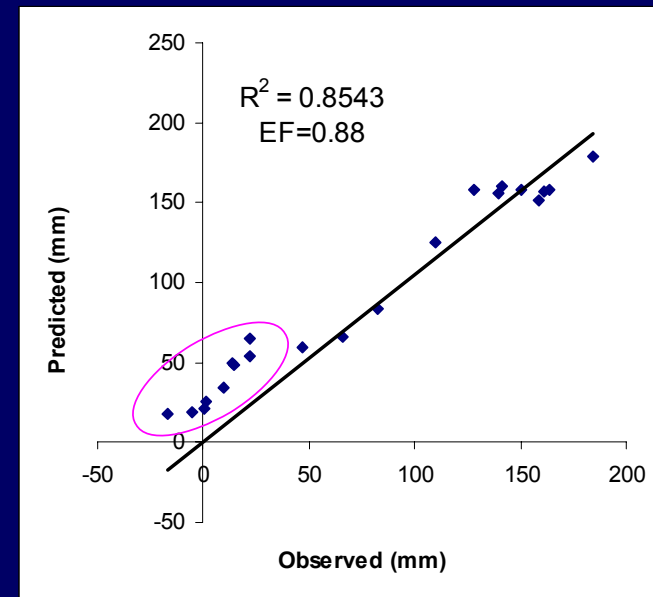
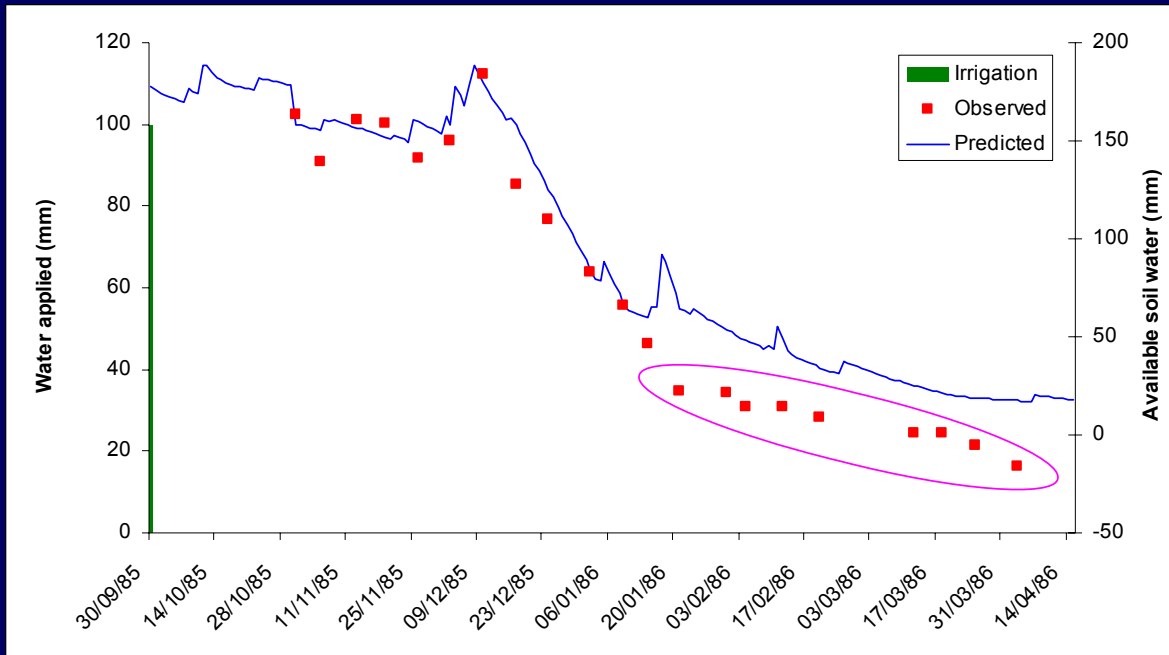
Again a lack of prediction of the variation in layer 4.



1 irrigation treatment x 3 varieties

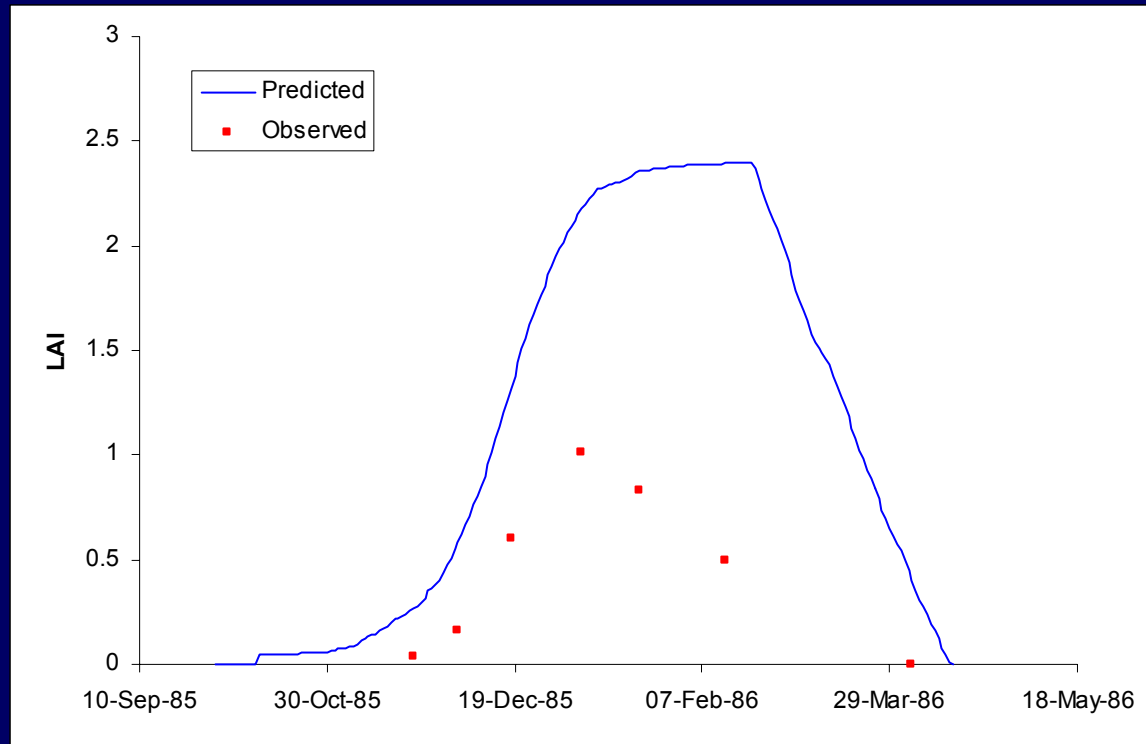
Example: T7 – DP90

Total soil moisture

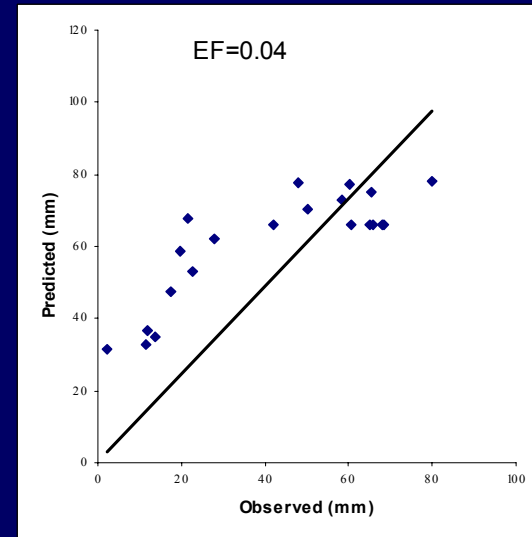
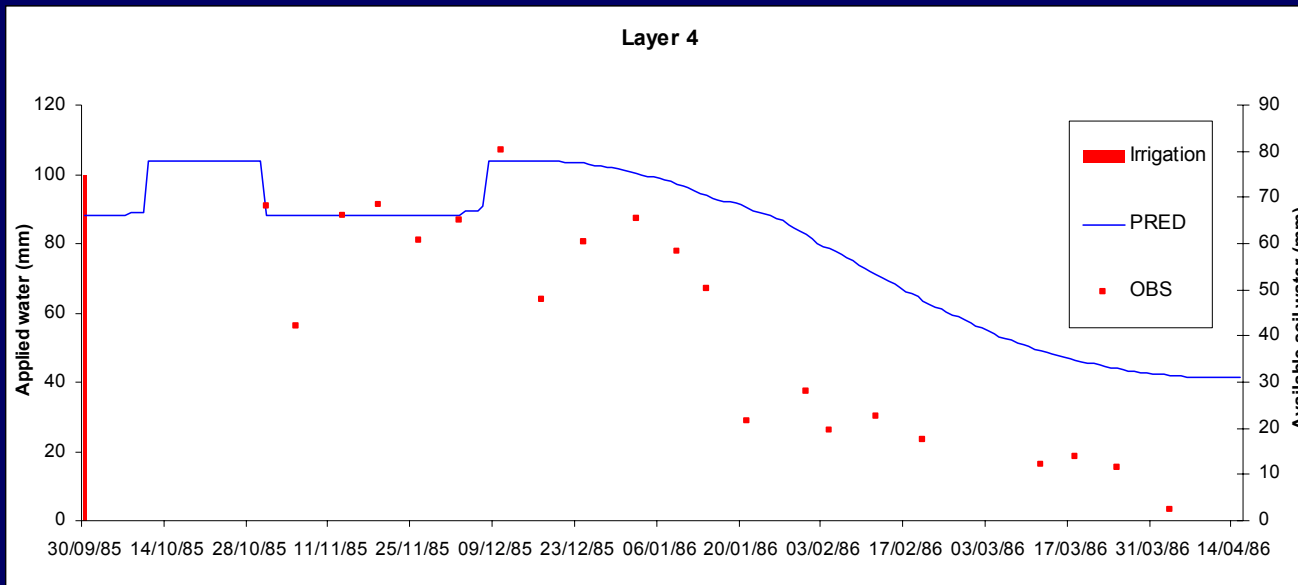


In group 4 the model under predicts water use later in the experiment.

The LAI has become greatly reduced compared to the earlier treatments.

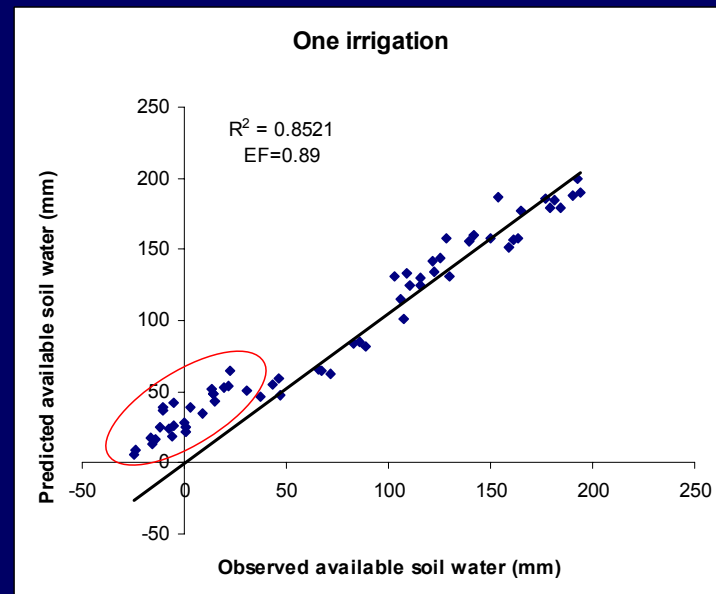
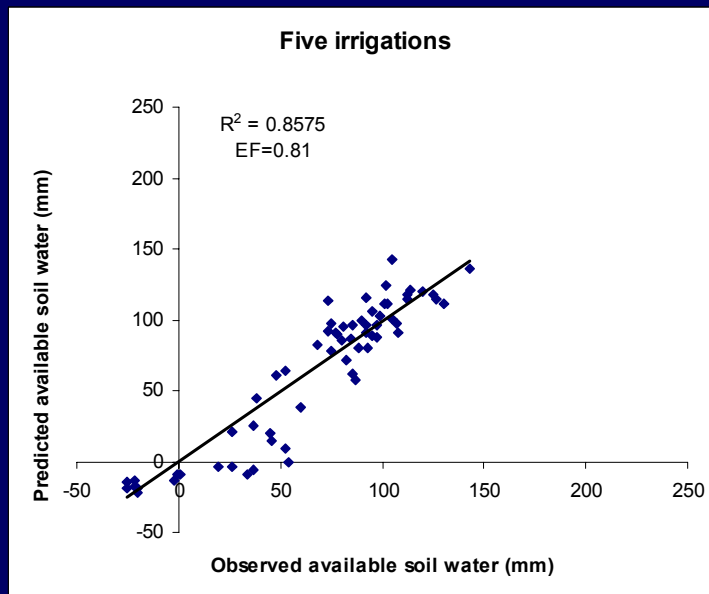
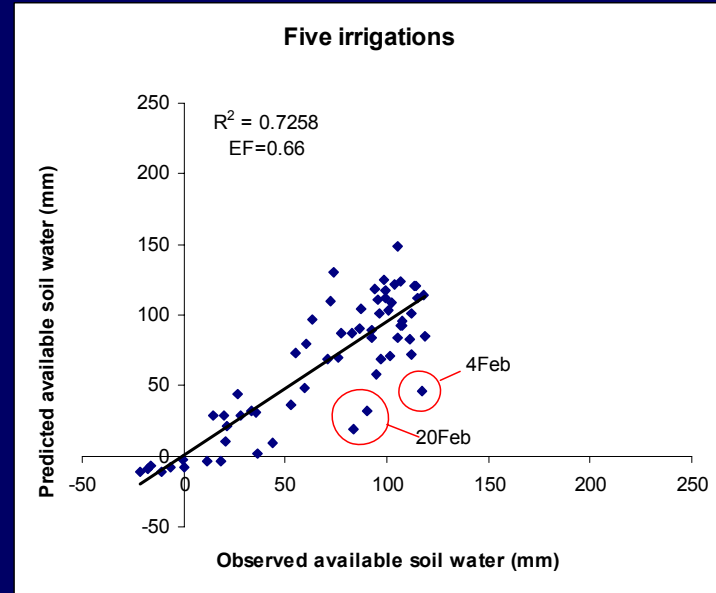
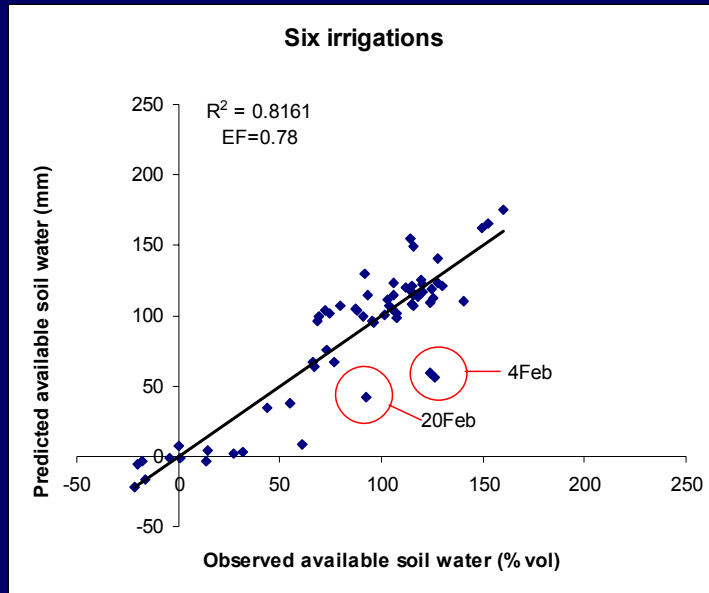


Again a lack of prediction of the variation in layer 4.

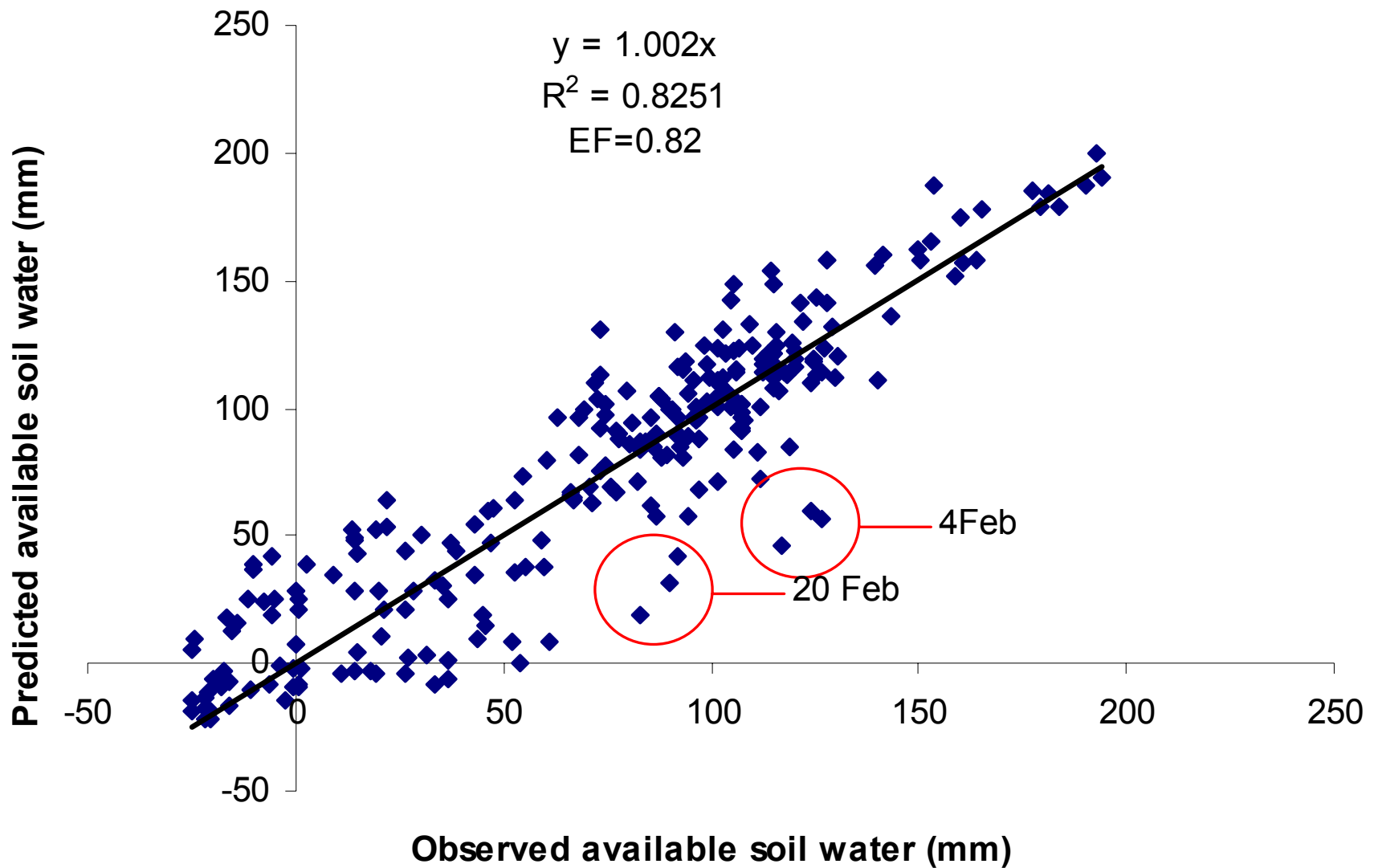


Now the model is under using the water available in layer 4.

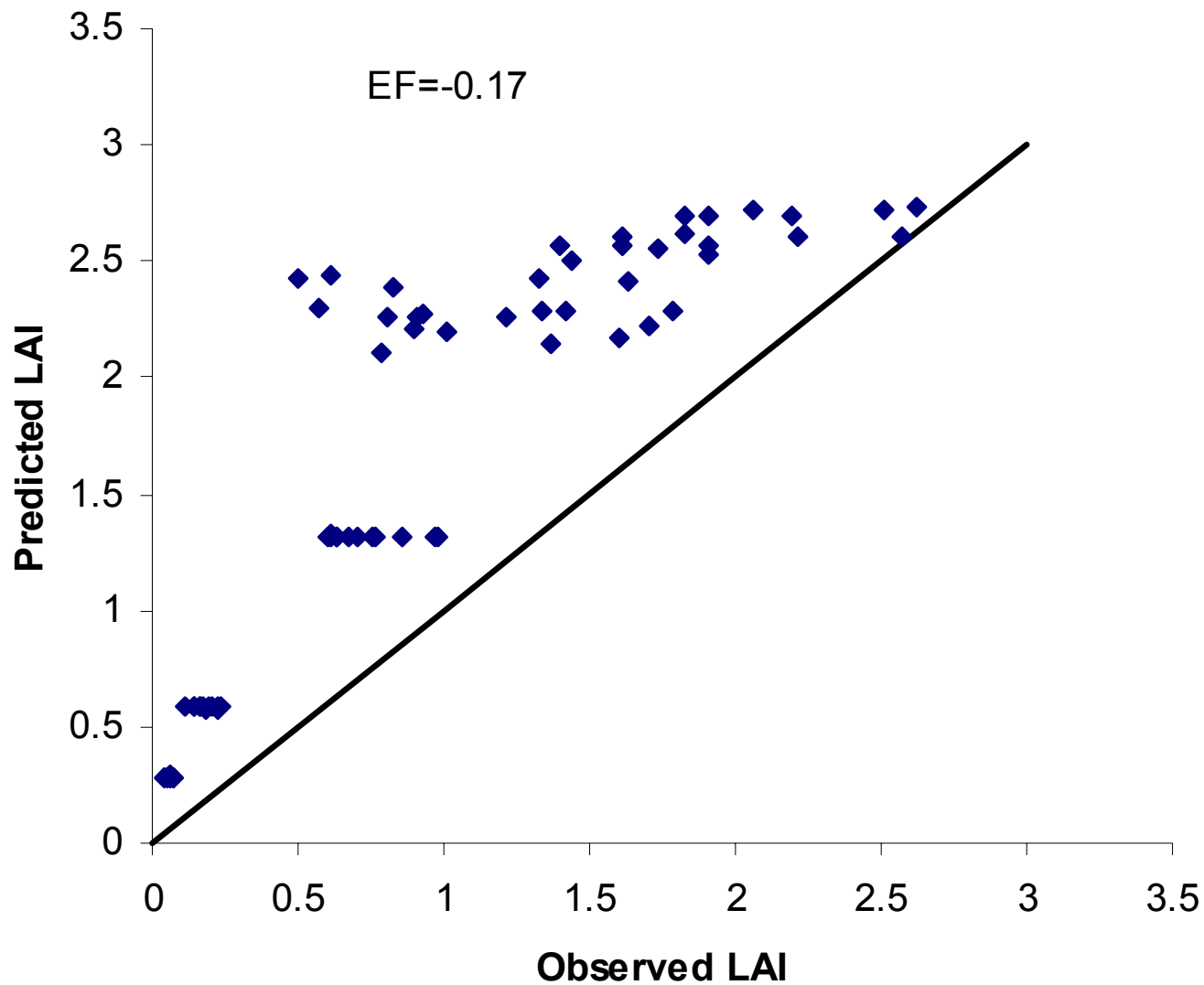
A Summary of Observed v Predicted



All Treatment Data



All Treatment LAI Data



Has PERFECT captured the relevant processes?

Positives:

- Fairly high correlation between observed and predicted for total soil moistures.
- Using crop parameters calibrated for fully irrigated crop PERFECT accurately predicted soil moisture for crops with water stress.

Negatives:

- Possibly not picking up differing root dynamics between irrigated and non-irrigated crops.
- The Leaf Area Index model is not responding to stress as the field crop does.

What we need for a good validation?

1. Water on and water off
2. Local meteorological data
3. Soil moisture measurements at different layers
4. Leaf area index or crop cover measurements
5. Soil moisture upper and lower limits
6. Biomass and economic yield
7. Root activity measurements