Modification and testing of a Land Surface Scheme as adopted by the RCM RACMO

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Co-workers

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- KNMI, de Bilt, The Netherlands:
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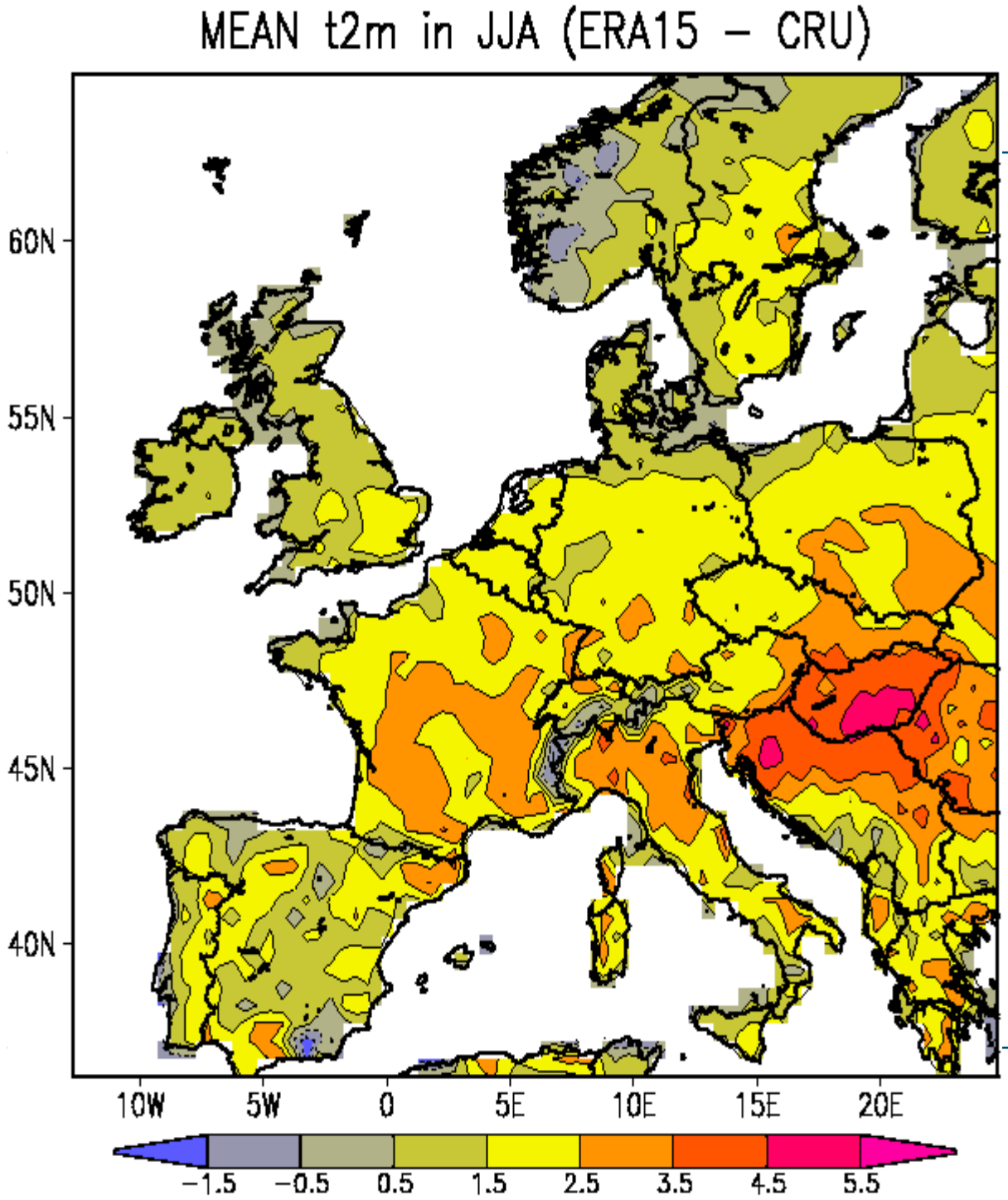
  - Bert van Ulft
  - Bart van den Hurk



Skill meso-scale model

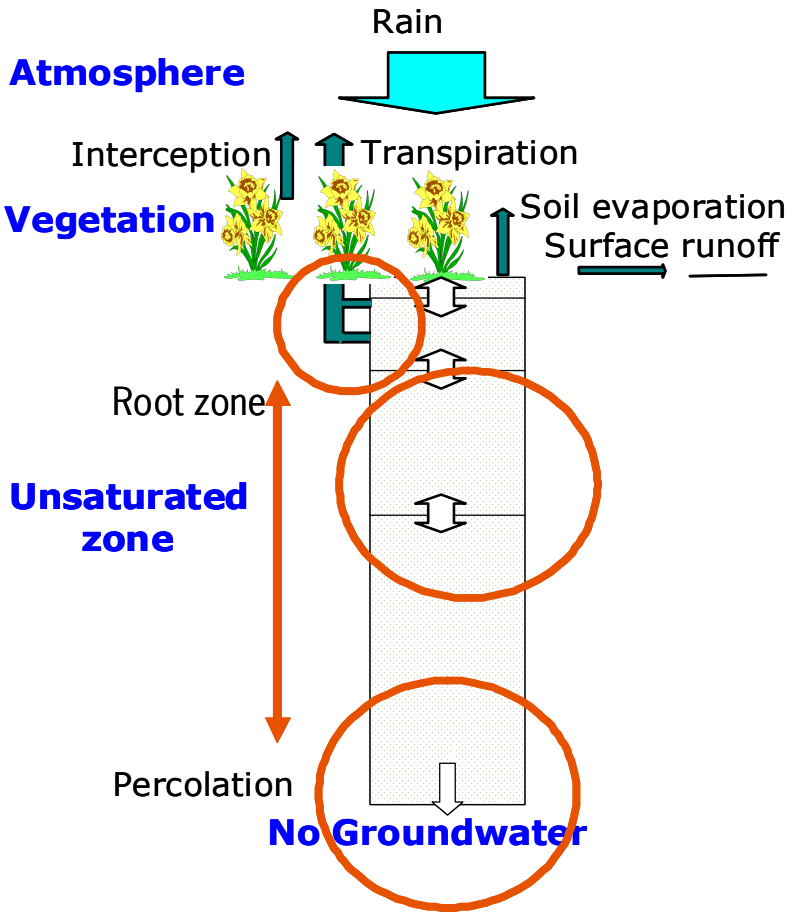
Average summer
2 m temperature

Difference between
RACMO and ERA15

Courtesy:
Geert Lenderink

Modifications to the land surface scheme: HTESSEL

1. Discretisation from 4 to 8 soil layers,
2. Variable soil depth,
3. Groundwater effect included,
4. Root water uptake reduction function changed



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- Special interest: spatial distribution of the latent heat fluxes
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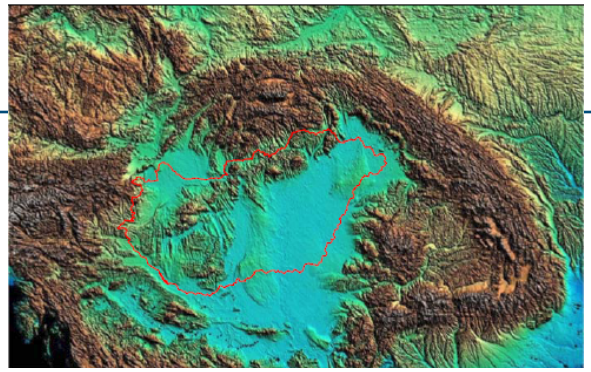
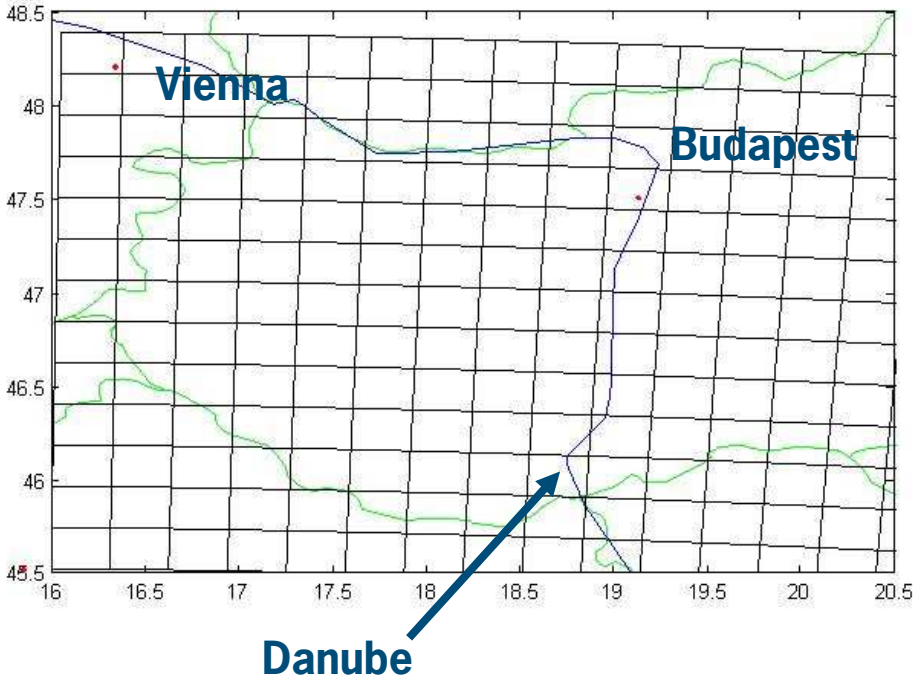
- Region: Hungary, 2005
- Run offline (no feedbacks): forced meteorology from previous RACMO run, nested in ECMWF operational analysis.
- Spatial resolution: 25 km

Grid and test region



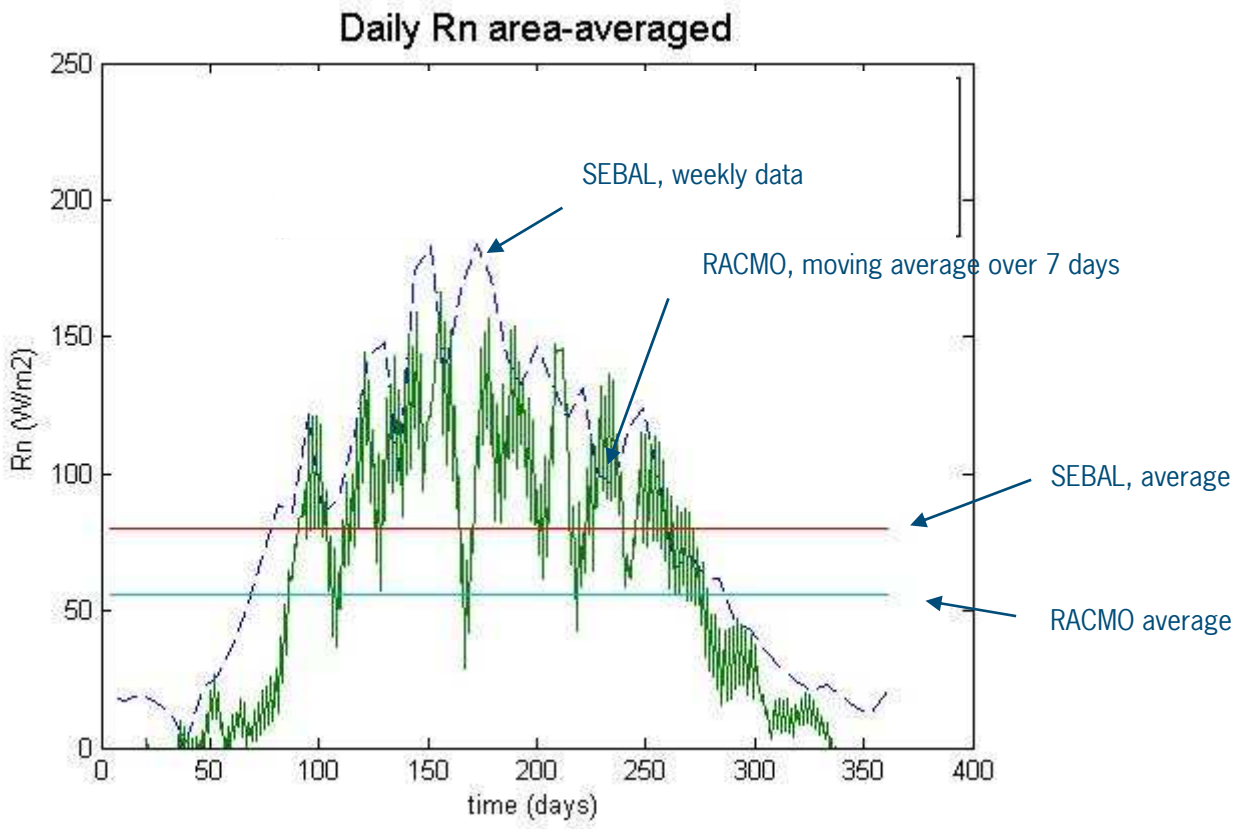
Source: Geological Institute of Hungary



Sources of variability

- Meteorology: Rainfall and incoming radiation
- Variable soil characteristics (orography, vegetation, soil texture, etc)

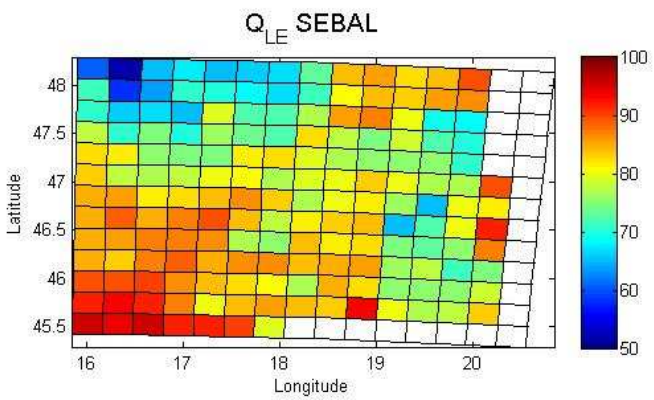
RACMO and SEBAL daily net radiation

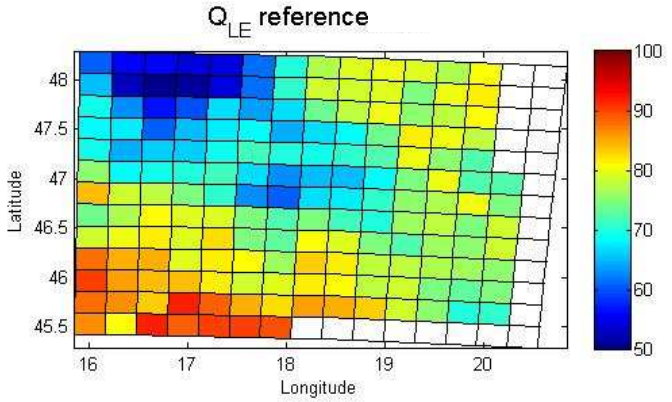


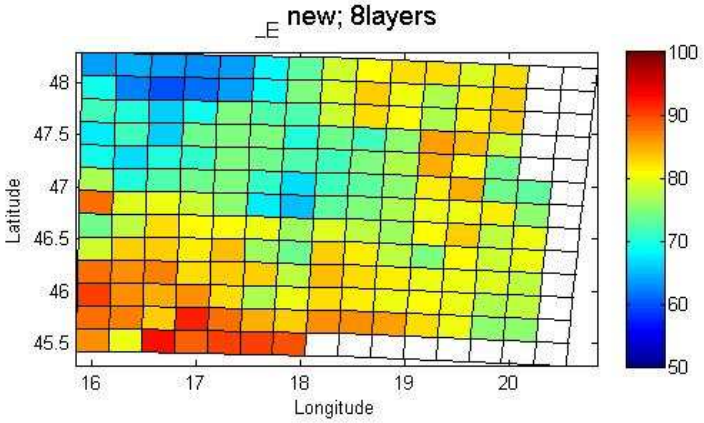
Cases

	Reference model	8 layers	8 layers, groundwater	8 layers, soil depth classes	8 layers, root function	8 layers, all
Soil layers	4	8	8	8	8	8
Root function changed	-	-	-	-	yes	Yes
Ground-water effect	-	-	Yes	-	-	Yes
Variable soil depth	-	-	-	Yes	-	Yes

Results: daily latent heat flux SEBAL and HTESSEL (W/m2)







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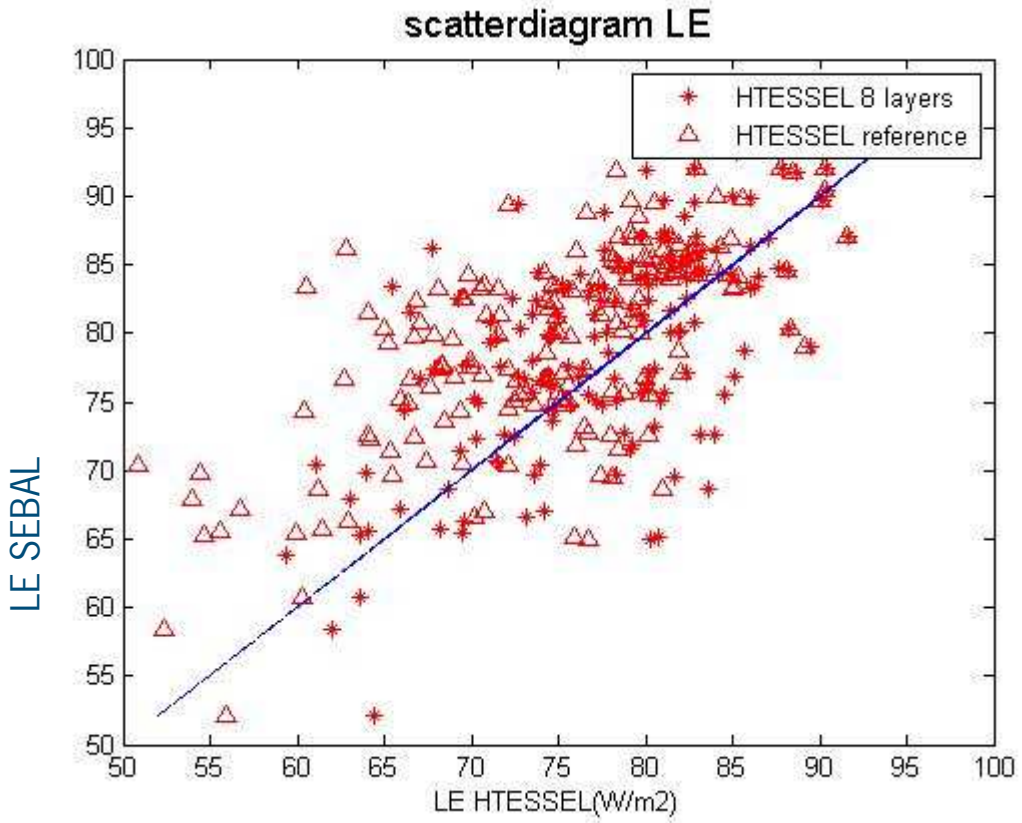
Scatter LE


scatterdiagram LE
HTESSEL 8 layers
HTESSEL reference
LE SEBAL
LE HTESSEL(W/m2)
100
95
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85
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75
70
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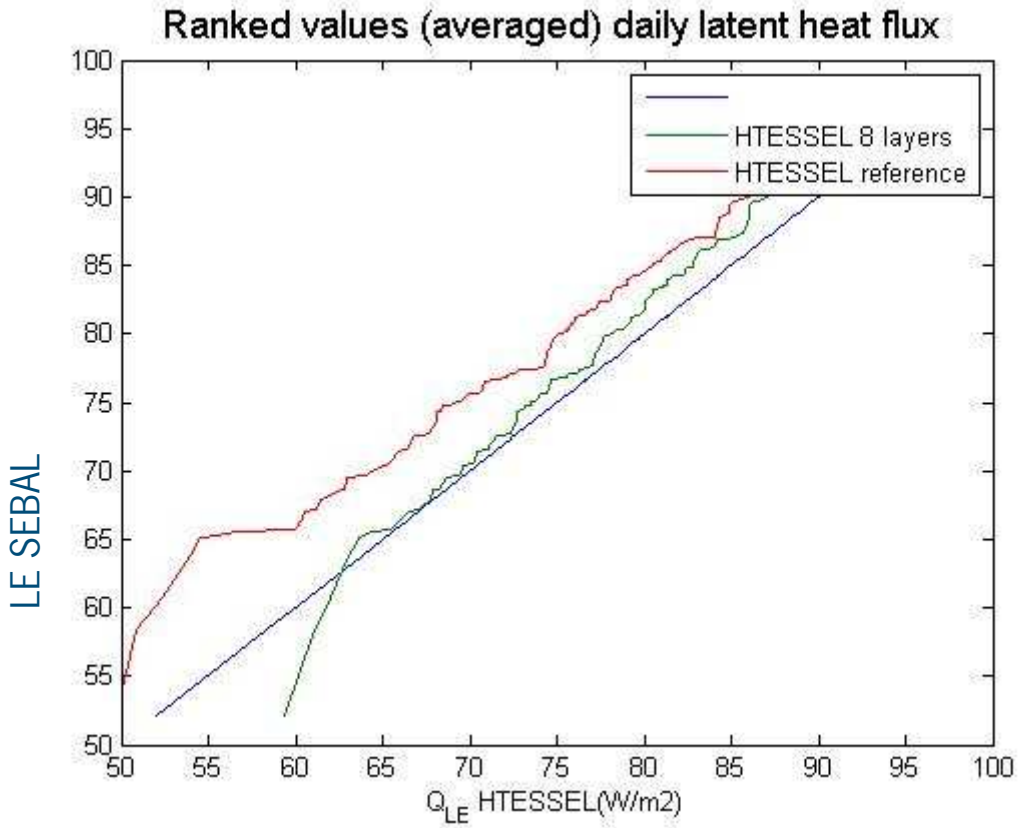
Ranked values (averaged) daily latent heat flux
HTESSEL 8 layers
HTESSEL reference
LE SEBAL
Q_{LE} HTESSEL(W/m2)
100
95
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80
75
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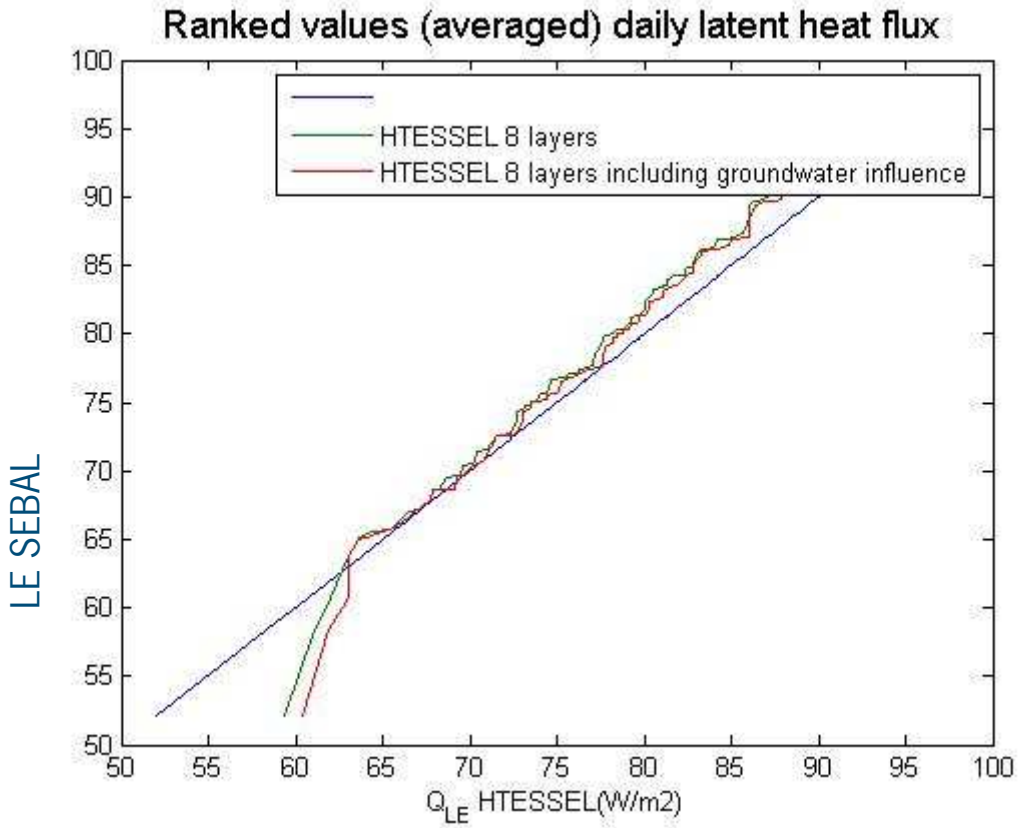
Ranked values (averaged) daily latent heat flux
HTESSEL 8 layers
HTESSEL 8 layers including groundwater influence
LE SEBAL
Q_{LE} HTESSEL(W/m2)
100
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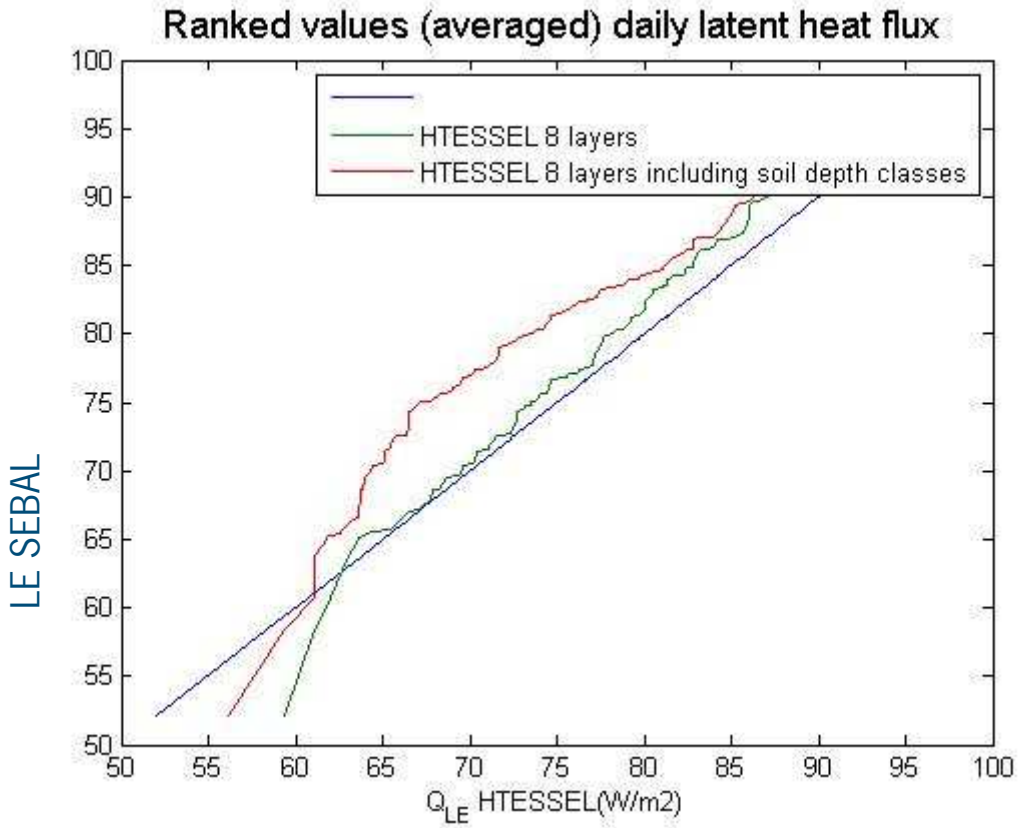
Ranked values (averaged) daily latent heat flux
HTESSEL 8 layers
HTESSEL 8 layers including soil depth classes
LE SEBAL
Q_{LE} HTESSEL(W/m2)
100
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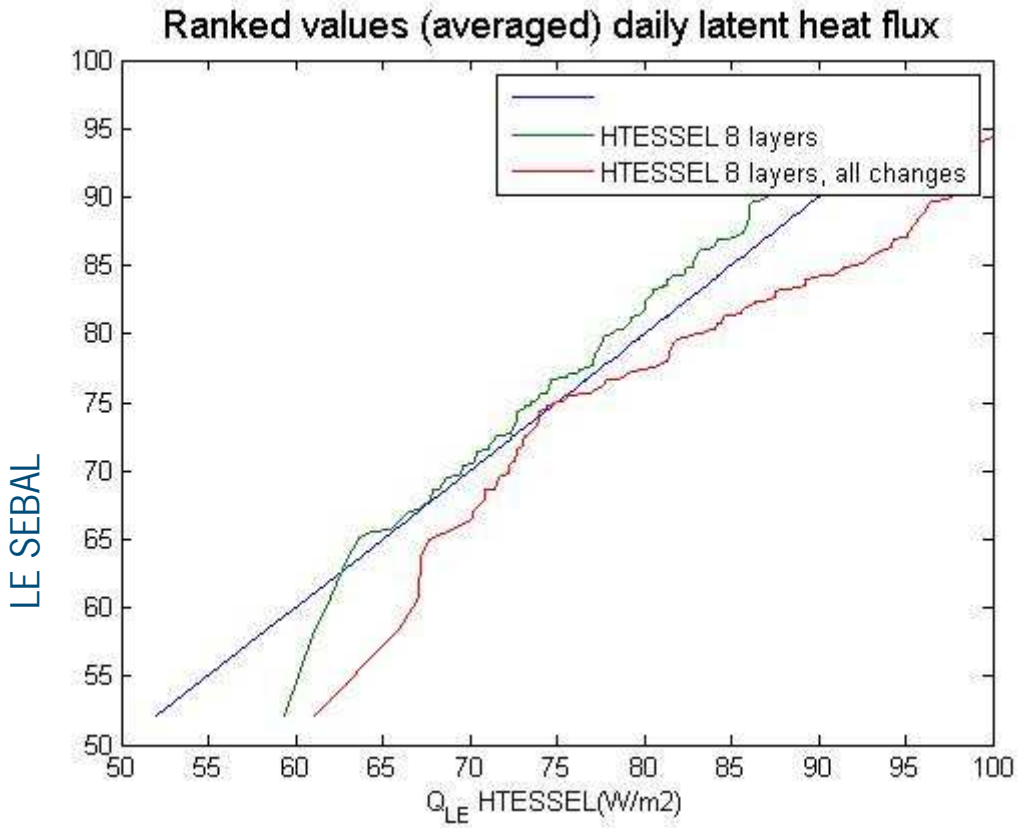
Ranked values (averaged) daily latent heat flux
HTESSEL 8 layers
HTESSEL 8 layers, all changes
LE SEBAL
Q_{LE} HTESSEL(W/m2)
100
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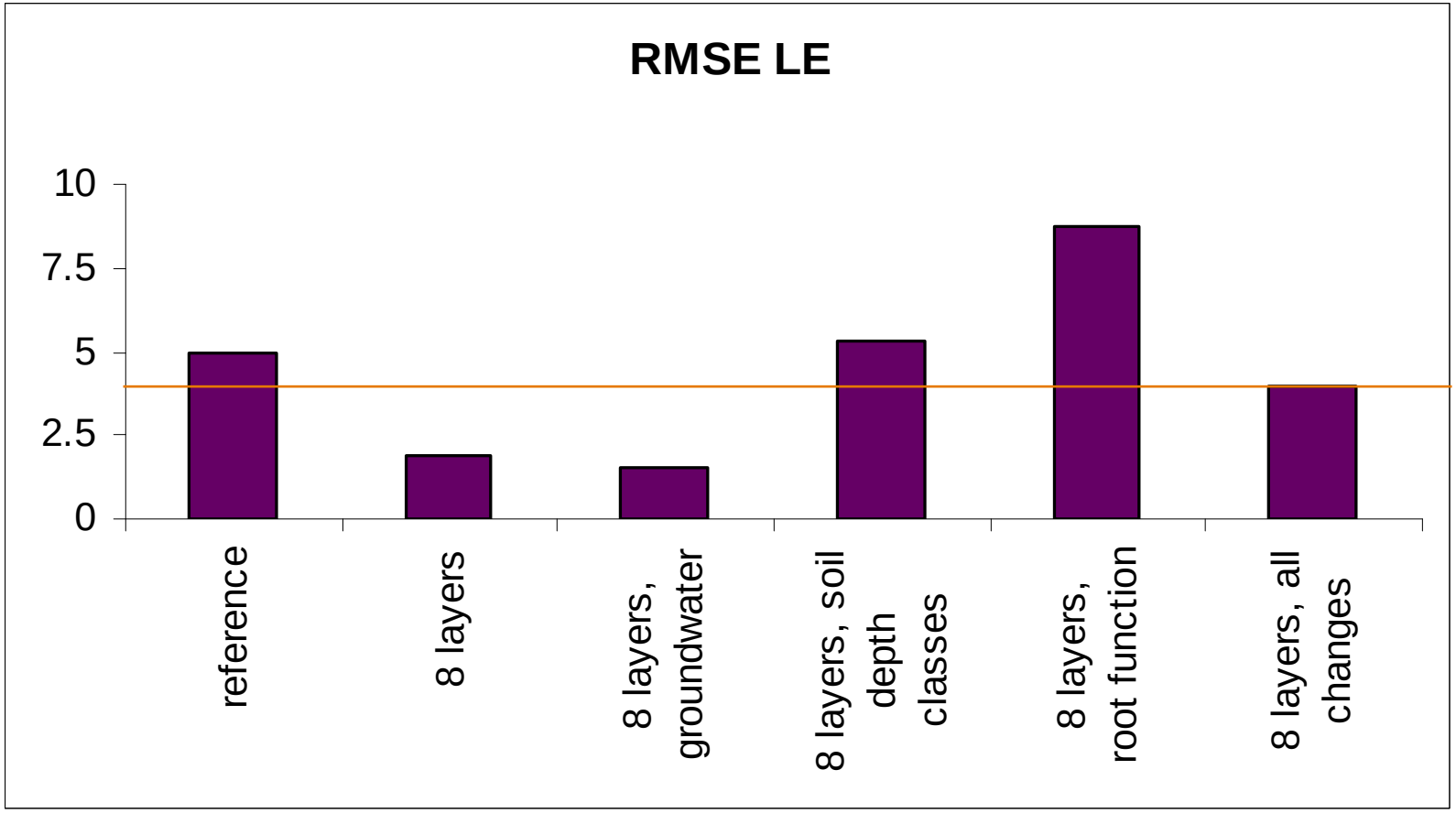
100

RMSE of ranked latent heat fluxes



Conclusions and future work

- RS data that cover a larger area are useful to test the performance of Land Surface Schemes
- Some of the modifications lead to a better performance of the scheme on a seasonal basis
- longer time series are needed
- Spatial correlation of the data should be considered, e.g. by variograms
- In addition to seasonal behavior also the monthly behavior should be considered