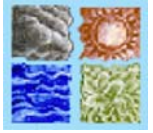


Soil Heat Flux and its Role in the Energy Balance of the Yatir Forest



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1 Objective

Quantitatively assess the relative contributions of different soil layers to the total soil heat flux at diurnal and annual timescales, and its effect on the Yatir forest energy budget.

2 Yatir afforestation site



The Yatir forest, consisting mainly of *Pinus halepensis*, is located in a transition between arid and semiarid zones of Israel.

3 Methodology

A flux tower (19-m high) was used in conjunction with surrounding measurements to obtain half-hourly data of the energy balance components: net-radiation (NR) and soil- (SHF), sensible- (H), and latent- (LE) heat fluxes.

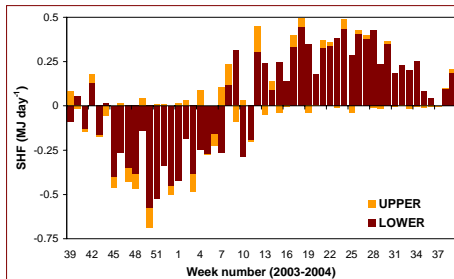
More specifically, SHF at 5 locations was measured using the *combined method*:

- SHF plates at depth of 8 cm – to obtain SHF of the LOWER layer
- Thermocouples at 6 & 2 cm – to compute SHF of the UPPER (0-8 cm) soil layer according to the calorimetric method.

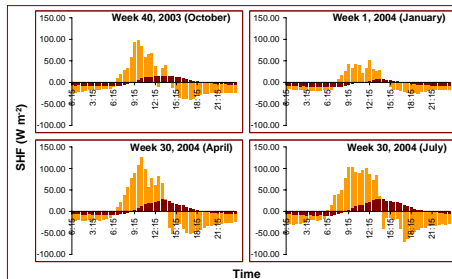
On diurnal timescale – weekly averages of the half-hourly data were computed; on annual timescale – half-hourly data were first summed to obtain a daily sum, and then the weekly averages of the daily sums were computed.

4 Results

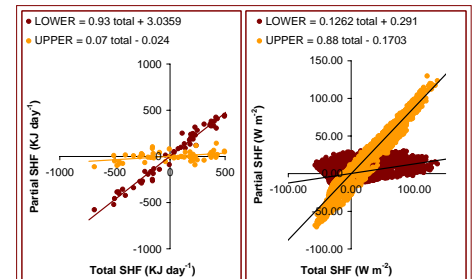
The contribution of the UPPER and LOWER soil layers to the total SHF in the two timescales



Annual Timescale

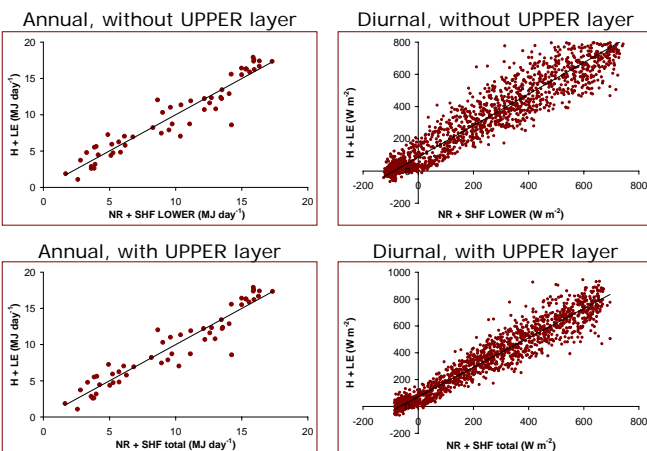


Diurnal Timescale (representative week for each season)



Quantitative assessment of the contribution of the layers, reflected by the slopes of the fitted lines

The contribution of the UPPER layer to the energy closure



		Annual timescale		Diurnal timescale	
		SHF total	SHF LOWER	SHF total	SHF LOWER
R²		0.91	0.91	0.95	0.93
Intercept	Value	0.012	0.031	72.644	86.271
	Significance	N.S.	N.S.	**	**
Slope	Value	0.998	0.996	1.096	0.978
	Significance	**	**	**	**
	Slope=1	Yes	Yes	No	No

5 Conclusions

The results show contrasting contributions of the UPPER soil layer (top 8 cm) to the total SHF on the two time-scales:

Annual timescale

The UPPER layer contributed only 7% to the total SHF and showed no annual trend. Its contribution to the closure results of the energy balance is negligible. It is, therefore, concluded that on annual timescale **the additional SHF of the uppermost soil layer can be neglected.**

Diurnal timescale

The UPPER layer contributed 88% to the total SHF. On this timescale, this layer is of greater importance than the lower layers. Moreover, its contribution to the energy closure results is large. It is, therefore, concluded that on diurnal timescale **the SHF of this layer must be taken into account.**