Response to Referee2's comments

This paper describes the development of the TEB model to include integrated vegetation. The new model is evaluated with data collected in Israel. This is an interesting contribution but some issues need to be clarified

Major issues

1) Discussion of scale is needed. The model is a local scale model but the evaluation data are micro-scale.

The TEB model has been historically developed for mesoscale modeling applications. But, it has been improved in the last years (SBL version, mixing length parameterization, vegetation, street orientation…) so that the description of the physical processes inside the canyon is detailed enough to be compared with the microscale measurements that are presented here. More especially, taking into account the specific orientation of the street for radiative calculations allows now to be closer to the real configuration of the experimental site.

Moreover, we chose this experimental dataset to evaluate the model because their morphological characteristics are simple and comparable to the TEB's assumptions (urban canyon, flat roof, …).

2) More detail is needed about the observations – several parts not clear

The experimental site and the measurements are described in details by Shashua-Bar et al. (2009), so that it did not seem necessary to present at length these aspects in this paper. However, we modified and completed some parts of the text in accordance with the reviewer's comments (see next comments about measurements).

3) Notation – there are number of inconsistencies that need to be clarified
a. Fractions – two different symbols are used

The symbols used for the fractions have been clarified : f is used for the fractions at the grid-mesh scale. δ is used for the sub-fractions (for snow covers).

b. Humidity – Q & q. Q – is the same as turbulent heat fluxes (p12 l6)

This has been corrected

4) English in a few places make it difficult to actually determine what is meant. In other places just needs to be tidied up.

We tried to improve English and clarify the text when necessary.

Detail

1) P4 top – not clear what this refers to

We did not understand what the reviewer was referring to. This part of the text seems rather clear.

2) P5 22/23 – tense

OK

3) P10 l4 – explain why the two SVF are equal.
Already explained in Section 3.1.

4) P11 l3 original version rather than 'initial'
OK

5) P14 – need clear statement about the scale of the observations –and their applicability to the scale of the model. It is not clear from the description how extensive each treatment is (what areal extent?).
See response to (1) in the "major issues". We added a comment in the text (in Section 5.2).

6) P14 – English need work
We tried to improve English and clarify the text when necessary.

7) P14/13 - local microclimate – scale need to be made clear
We added a comment to specify that we refer to the meteorological variables inside the urban canopy.

8) P14/15 – not clear - what is meant by the 3-4 day of the landscaping strategy. Was the grassed rolled out etc? i.e. the areas changed or is the equipment being moved between sites for the 3-4 days.
The experiment was conducted in two adjacent courtyards which were similar in their material attributes and geometry, except for trees growing in one of them only, while the other was initially devoid of vegetation. Pre-grown grass sod tiles were introduced at different stages in each of the courtyards, planted over a waterproof polyethylene sheet to isolate the grass from the underlying soil. The courtyard without trees was intermittently covered with a fabric mesh. Thus, six configurations were established in the two courtyards to study the effect of trees, grass and shade mesh in different combinations. Each configuration was allowed a period of several days to reach equilibrium, then monitored for a period of 3-4 successive days. The difference between the measured periods were normalized relatively to the meteorological station for each measured climatic variable (See Shashua-Bar et al, 2009).

9) P14 l22/23 – what is the method for evapotranspiration determination – what scale/area does it represent.
Evapotranspiration from the sod grass was measured using custom-made mini-lysimeters, which are assumed to be representative of the area covered with the imported sod. The transpiration from each of the three trees was measured individually using the Granier sap flow method (See Shashua-Bar et al. 2009).

10) P15/l28 plan area (and elsewhere)
This has been corrected everywhere

11) P15/29 – rather than 'town' -> 'built'
"built" has been removed

12) P16/l7 – need proper reference for soil map
The reference has been added

13) P16/l8 – basis for aerodynamic resistance – why is this prescribed in TEB – veg?

We removed this sentence that is confusing. The dynamical roughness lengths for bare soil and grass are already listed in Table 2. These lengths are used in ISBA in order to compute the aerodynamic resistances.

14) P16/13 – external disruption – clarify
The sentence has been modified to clarify this issue.

15) P16 – need to know if the sites are permanent – is the soil moisture and temperature known prior to the model simulations?
All of the external meteorological forcing parameters are available for a period of several days prior to the actual days selected for evaluation. Initial soil moisture was extremely low - there was precipitation at Sde Boqer for several months prior to the experiment, and no other source of moisture except for localized drip-irrigation units introduced next to the trees at the beginning of the experiment. Deep soil temperature is assumed to be the same for both courtyards and the meteorological station (where it is continuously measured).

16) P17/section- 5.4 – scale issue again needs to be discussed
See response to (1) in the "major issues". We added a comment in the text (in Section 5.2).

17) P18 – how do these results compare with other previous evaluations?
We did not understand what the referee was referring to.

18) P19 – English - several place difficult to understand what is actually meant
We tried to improve English and clarify the text when necessary.

19) P19 – implications of observational error to forcing data – to assessment. What is the size of the measurement error?
For this experiment, the humidity measured at the meteorological station is unusually dry between 06 and 16 LST (less than 6 g kg-1). Normal values for summer with wind from the northwest are about 10-12 g kg-1, that corresponds to the values recorded for the other experiments. We cannot explain the sharp drop in specific humidity at the meteorological station except possibly as an error in measurement.
In order to assess the sensitivity of the model to the humidity forcings, we also rerun the experiment by forcing the model by using the specific humidity measured inside the courtyard. There is not significant differences in the results of the model (surface temperatures, air temperature, and wind).
We added a comment in the text.

20) P20 need discussion linked about scale and evaporation
The monitoring experiment, and hence the modeling exercise, refer to conditions inside the small courtyards only. These are taken to represent generic urban spaces, for example street canyons or courtyards. The landscaping strategies, such as irrigated grass or artificial shade were limited to the courtyards only, and their effects were not felt outside of the spaces manipulated during the experiment.

21) P24 – A4 – is that defined? – i.e. one sunlit and one shaded
This is defined a little further in the text

22) P24 – l20 – what is the impact of the non-isotropic sky - or state assumption.

We assume that (1) for clear sky (= non-isotropic sky), the radiation budget is mainly driven by the direct radiation, and consequently by the shadow effects ; (2) for cloudy sky, the assumption of an isotropic sky can be done.

23) P31 – Halstead coefficient – needs reference
We added the reference to Noilhan and Planton 1989

24) P31 – link needs to be made to the windfield assumptions and the aerodynamic resistance
The aerodynamic resistance for vegetation is calculated differently according to the version of ISBA that is used. We added in the text a reference to the general paper about SURFEX (Masson et al. 2012) that presents the different versions of ISBA.

25) P33/l3 Journal wrong?
OK

26) Table 1 – needs sources – e.g. reference in caption
The references have been added in the caption (Source: Shashua-Bar et al. 2009; 2011).

27) Table 2 – why does the roughness length stay constant despite the change in urban form? Would that happen normally in the previous version or is that forced here?
This roughness length represents the roughness of the whole canyon. For this reason, we usually prescribe it as equal to Zbld/10.
We finally removed this parameter in Table 2 because we run TEB-SBL version that does not use this parameter but a drag force approach (as described in Sections 4.2 and 4.3)

28) Plane> plan
OK

29) Roughness length assumptions are quite different between upper and lower part of the table.
The roughness length in the upper part of the table is the one of the whole canyon, whereas the roughness length in the lower part is the one of the soil (bare soil or grass according to the experiment).
We finally removed the first parameter in Table 2 (see comment 27)

30) Figure 4- plan and cross sectional views to scale would be better.
We did not modified this figure that we find clear enough.

31) Figure 5- lines are hard to distinguish
We increased the width of the lines.

Editorial

1) Large number of places English needs work as it is not clear (I have not identified these) OK
2) Reference order needs to be sorted out (Chronological then alphabetical) OK
3) Explicitly (no 'e' in the centre) OK
4) Parameters – should be 'variables' OK
5) Type of coatings – surface materials OK

6) What are all the extra numbers at the end of the references? This corresponds to the page numbers where the references are cited in the text