Palma (Mallorca), 21st April 2016

Dear reviewers of paper acp-2015-1051

Thank you very much for reading our manuscript and for the improvements that you propose. Find below our answers point by point and the actions that we propose to do in the modified version of the manuscript. Proposed modified figures are also included in the supplement.

Yours sincerely, on behalf of all co-authors,

Joan Cuxart, corresponding author

**Reviewer 1**

***Request:*** Reviewer 1 asks that Table 1 is modified giving the total error, which is the sum of the standard deviation and the sensitivity error of each of the methods.

***Comment:*** This request raises interesting considerations. If we assumed, for the discussion, a typical instrumental error of 1 K to be added to sigma, the value of the estimation of the advection term would increase for all the considered sources due to the instrumental indetermination. However, this contribution is already taken into account in the SEB equation (2) in the term Ot, so there is the risk of double-counting this source in two terms (Adv and Ot). So we must, take both issues into account.

***Actions on the manuscript:*** To satisfy the well-justified reviewer request, the corresponding uncertainties of each method will be added in table I, the double counting issue will be mentioned, and the percent of the imbalance will be slightly increased, all of it not changing substantially the conclusions reached.

The suggested changes in the manuscript are, all in Section 5 (Discussion):
1) Add a paragraph, just after the first two in the section, that would read:

"An important issue to mention is that the uncertainties inherent to each method should be added to the value of the standard deviation. They are already conceptually taken into account in the term "Ot" of equation 2, but it is necessary to include this contribution to the variability of the measure in our estimations. The model, as seen in Figure 3, has an error for our case not larger than 1 K, as it is also the case for most remote sensing determinations of the surface temperature (see, e.g., Coll et al (1995) for MODIS). Thermal cameras report uncertainties of the order of 0.1 K. This fact is taken into account in Table 1."

2) Modify Table 1 as follows, for columns 1,4,5,6,7:
model D1 and MSG: sigma(T)_day=3, O(sigma/r)=0.00075, O(Adv)=2, %(imb)=1
model D1 and MSG : sigma(T)_night=2, O(sigma/r)=0.00005, O(Adv)=1, %(imb)=4
model D2 and MODIS; sigma(T)_day=2, O(sigma/r)=0.0002, O(Adv)=5, %(imb)=3
model D2 and MODIS; sigma(T)_night=2, O(sigma/r)=0.0002, O(Adv)=5, %(imb)=10
model D3, sigma(T)_day=1, O(sigma/r)=0.005, O(Adv)=10, %(imb)=5
model D3, sigma(T)_night=1, O(sigma/r)=0.005, O(Adv)=10, %(imb)=30
sumo, sigma(T)_day=2, O(sigma/r)=0.02, O(Adv)=50, %(imb)=25
sumo, sigma(T)_night=1, O(sigma/r)=0.01, O(Adv)=25, %(imb)=80
multicopter, sigma(T)_day=1, O(sigma/r)=0.1, O(Adv)=250, %(imb)=125
multicopter, sigma(T)_night=1, O(sigma/r)=0.1, O(Adv)=250, %(imb)=800
thermal cameras, sigma(T)_day=0.5, O(sigma/r)=0.5, O(Adv)=1250, %(imb)=600
thermal cameras, sigma(T)_night=0.2, O(sigma/r)=0.2, O(Adv)=500, %(imb)=1600

***Reference:*** Coll, C., Caselles, V., Galve, J. M., Valor, E., Niclos, R., Sánchez, J. M., & Rivas, R. (2005). Ground measurements for the validation of land surface temperatures derived from AATSR and MODIS data. *Remote Sensing of Environment*, *97*(3), 288-300.

***Impact on the manuscript***: None of the new values alters the comments and the conclusions stated, which indicate that the estimation is relatively small for scales above the kilometre, too high for scales around the decametre or lower and potentially significant for scales around the hectometre.

**Reviewer 2**

*A) Answers to comments in the opening part*

***Reviewer's point #2:*** Are substantial conclusions reached? Partly. The conclusions are important from a methodological point of view. but there are not sufficiently many concrete results. I suggest giving more quantitative results.

***Answer:*** The paper is intended to be a first step to the evaluation of the order of magnitude of the advection with the available data. Given the actual distribution of stations in BLLAST it would be perhaps too bold to go further. Currently a new experiment is running on Majorca to provide better estimations of this term using a display of ten stations in a 1 km-squared, to develop the methodology further.

***Action on the paper:*** The argument above will be stressed in the Introduction and in the Discussion

***Reviewer's point #3:*** Are the scientific methods and assumptions valid and clearly outlined? Yes. The principle of estimation of the scale-dependent advection term with the standard deviation of temperature fields is new but requires more detail explanations. How do you estimate the standard deviation of temperature in case of no advection? How does the advection depend on the standard deviation of temperature? I think it is not really a linear assumption. Is there any intercept?

***Answer:*** The standard deviation is estimated independently of advection by inspecting the variability of the recorded temperature in the area of interest. The increment of temperature is substituted by sigma(T) based on the data provided by the SUMO UAV, that shows that both magnitudes behave comparably and have similar orders of magnitude.

***Action on the paper:*** See answer to DC21 below.

*B) Answers to detailed comments*

***Reviewer detailed comment #1 (DC1):*** Abstract :Please give information about the eddy flux calculation methodology, uncertainty (for example in %) of calculation of energy budget components. Please give concrete results (numerical values) connected with the scale dependent effects of advection included surface heterogeneities.

***Answer and action on the paper:*** In the abstract we will add that *turbulent fluxes are computed using the eddy-correlation method*. The estimations of the uncertainties will be given in Section 3, where the SEB is discussed (see also answer to DC15 on how uncertainties of turbulent fluxes are introduced in that Section).

***DC2:*** Line 25-30: Conceptually it is computed for a layer of infinitesimal depth across the interface in a horizontally homogeneous area, therefore no storage or source terms are considered and, formally, the budget is expressed ...

R: Please clarify the sentence. I think the so called storage terms exist above horizontal homogeneous surfaces but negligable in many cases as you mention later. Please give the order of magnitude for additional terms in the energy budget equations above the short and tall vegetations (see for example photosynthesys, storage, etc.) Please give the estimation of order of these terms above the short and tall vegetations. (See for example Moderow et al., 2009 Theor Appl. Climatol 98. 397-412. for tall vegetation.)

***Answer:*** most of these comments have been made in the JGR paper by Cuxart et al (2015) and a similar discussion is given in the recent book by Moene and Van Dam (2014).

***Action in the paper***: add a short line refering to the subject and leading the reader to that paper and the reference therein: *"Conceptually, as described in Moene and Van Dam (2014) or Cuxart et al (2015), it is computed ..."*

***Reference:*** Moene, A. F., & van Dam, J. C. (2014). Transport in the atmosphere-vegetation-soil continuum. Cambridge University Press.

***DC3:*** Line 40-45: These terrain heterogeneities may induce turbulent eddies and change the values of the turbulent heat flux compared to a completely homogeneous area.

R: If it is possible please give a sentence about the underestimation of the available energy (H + LE) in the practice. The heterogeneity gives the reason of the changing the turbulent heat flux, but not enough explanation for the frequent underestimation of the fluxes.

***Answer***: We will add a short line commenting the loss of flux by the sensors and refer again to Cuxart et al (2015).

***Action in the paper:*** Add in line 45 "*Nonetheless, errors in the determination of the turbulent fluxes must be kept in mind, very often implying an understimation of their value, due to the non-capturing of certain scales by the measuring devices (Foken 2008a)*."

***DC4:*** Line 45-50 ... the advection terms can be computed using the divergence of temperature across the volume limits and the missing terms can be accounted for explicitly if the information is available (see Figure 1 in that paper).

R: How do you interpret the effect of thermals and coherent structures in the inbalance (underestimate the fluxes in daytime)?

***Answer:*** in fact, one of the conclusions of the paper is that coherent structures lasting longer than the averaging time may be partly behind the lack of closure through the advection term. We will stress more the idea in the Conclusions section.

***Action in the paper***: In line 50 add *"For instance coherent structures lasting longer than the averaging time used to determine the averages and the fluxes may be contributing to the advection term"*

***DC5:*** Line 57R: Please give a few relevant citations.

***Answer and action in the paper:*** As mentioned, we will include the reference of Moone and Van Dam and refer to the references therein.

***DC6:*** Line 55-60 : … not considering the internal variability of the volume (in the air and in the soil) ...

R: Please give more concrete information. What is meant by the variabilty of the volume air? Is it the form of the profile for example?

***Answer and action in the paper:*** it is meant the material variations of the media, for instance objects over land, or soil heterogeneity. We will change that expression to *"... internal variability inside the volume, such as presence of objects over the ground or soil heterogeneity."*

***DC7:*** Line 55-60 : … such as water pumped up from below by the plant roots, ..

R: Please clarify the effect and give a few citations.

***Answer and action in the paper:*** it means that roots may bring water, and therefore transpiration, from depths outside the volume of interest. The sentence will be modified as *"...such as water pumped from below the volume of interest by plant roots (Moene and Van Dam, 2014)..."*

***DC8:*** Line 60-65 R: Please use the same order as in equation (2).

***Answer and action in the paper:*** It will be changed.

***DC9:*** Line 85-90, 135-140 : Hartogensis, (2015) Wrenger et al, 2013. R: Please give also the peer reviewed citations from the last few years.

***Answer:*** Unfortunately, peer-reviewed papers have not been produced yet for these works, they are in process.

***DC10:*** Line 160-165: Lafore et al, 1998. R: Please check the year (1997 or 1998).

***Answer and action in the paper:*** It is 1998. It will be changed in the reference list.

***DC11:*** Line 160-165: The run was from June 29th at 0000 UTC to July 3rd at 0000 UTC,

R: Why didn't you used a spin up period for the mesoscale NH model? Please give more information about the data assimilation methodology: do you use any direct measurements in addition to the ECMWF model output? Please give information about the differences of the turbulence parameterizations on the grid resolutions of 2 km, 400 m and 80 m. How many grid points were used in Domain 3?

***Answer:*** The model is solely initialised with ECMWF analysis, and the first 6 hours are usually discarded for analysis, since they are considered to be in the spin-up phase of the simulation. All domains use the same turbulence parameterisation, that is a 1d-parameterization. This is legitimate for D2 and D3 because the runs are for the nighttime and the turbulence is of smaller size. than the grid mesh. D3 domain has 250 times 250 points.

***Actions in the paper:*** I) add "*...to July 3rd at 0000 UTC, considering the first six hours as the spin up period*"; ii) in line 170 add " *The model uses a standard one-dimensional 1.5 order scheme in the three domains*..."; iii) in line 168 *" D3 (250 times 250 points)"*

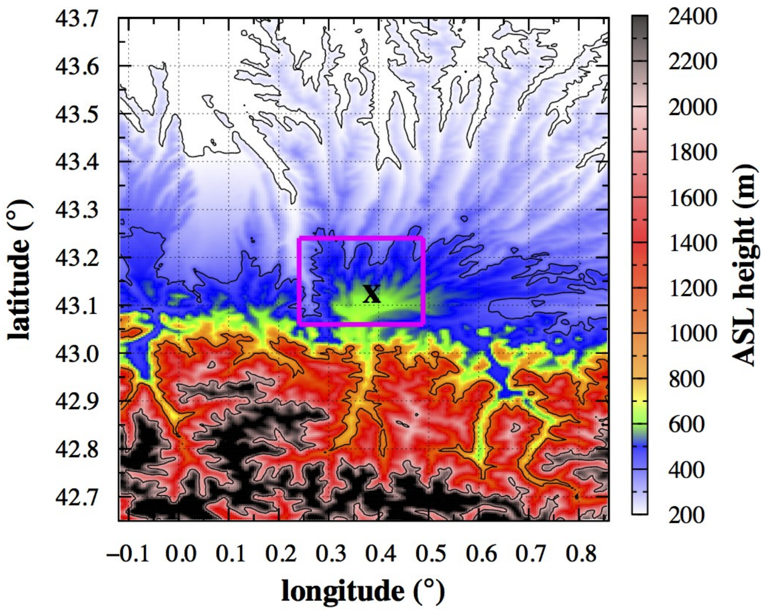
***DC12:*** R:Please check the manuscript very carefully: et al or et al.?

***Answer and action in the paper:*** we will write "et al." everywhere.

***DC13*** R: I) Fig 1.If it is possible please give a bigger map, for illustration of situation of D1 and please give also a more detailed map for D3 and surrounding. Please combine the 3 maps in one figure.

ii) "Areas for which the average LST and its standard deviation given in Figure 3 are computed for model domains D1 and D2." R: Please clarify the sentences. What is meant by 'are those in green?

***Answers and actions in the paper:*** I) we will rename Figure 1 as Figure 1a and add the figure below as Figure 1b, with caption *"Extension and topography of domains D2 and D3 (inside the purple rectangle). The position of Lannemezan is indicated with a cross"* ii) Areas coloured in green are those between 50 and 700 as for which standard deviation of LST is computed, as explained at the beginning of Subsection 4.1. This information will now be added in the caption of Figure 1.




***DC14:*** R: Please give the uncertainty of the estimation (in %) for (rho Cp Delta(z) approx 2500 J/K/m/s)

***Answer:*** the uncertainty is very large, this is why we use the symbol "approx". Taking a fixed (arbitrary) Delta(z) it lies mostly on the value of the wind speed. For clear days with weak winds, these values are usually between 1 and 2 m/s at a height of two meters above the ground. Therefore the uncertainty would be of the order of 100% and this is the main reason to work with orders of magnitudes instead of approximate values, since uncertainties would become too large.

***Action in the paper:*** add in line 194 "*... of the advection* *-with large uncertainties of the order of 100 % due to the broad assumptions made-:* "

***DC15:*** I) Line 200-205 (Pietersen and De Coster, 2011) R: Please check the citation. I can see only De Coster and Pietersen, 2011.

***Answer and action in the paper:*** You are right. It is De Coster/Pietersen. It will be changed in line 201.

ii) R: Please give more detailed information about the flux calculation methodology (of the application spectral corrections, instrument specific corrections etc.) and the quality control of the fluxes.

***Answer:*** We do use fluxes from the standardized flux data base of BLLAST as described in that reference. We already list the basic methods that they use through a list of relevant references by Wilczak et al. (planar fit) and Webb et al, for the density correction. They also proceed to check correctness of record timing, they de-spike and make quality-control of the data. They also provide estimations of the error of the fluxes, usually circa 10%.

Action in the paper: add in line 203 " *...(Webb et al, 1980). Errors in the values of the turbulent fluxes are estimated to be in the order of 10%. Furthemore, correctness of the record timing is checked, and de-spiking and quality control are made in the ensemble of the BLLAST data set"*

***DC16:*** Line 200-205 R: Why didn't you calculate directly the heat flux into the soil for each 30 min periods knowing the soil temperature profile, soil moisture and the soil heat flux at a depth of 5 cm?

***Answer:*** the temperature measurement in the upper part of the soil was providing strange results and we decided not to use it.

***Action in the paper:*** we will include in line 205, *"and, due to unrealistic recorded values of the upper soil temperature, corrected to the values at the surface using..."*

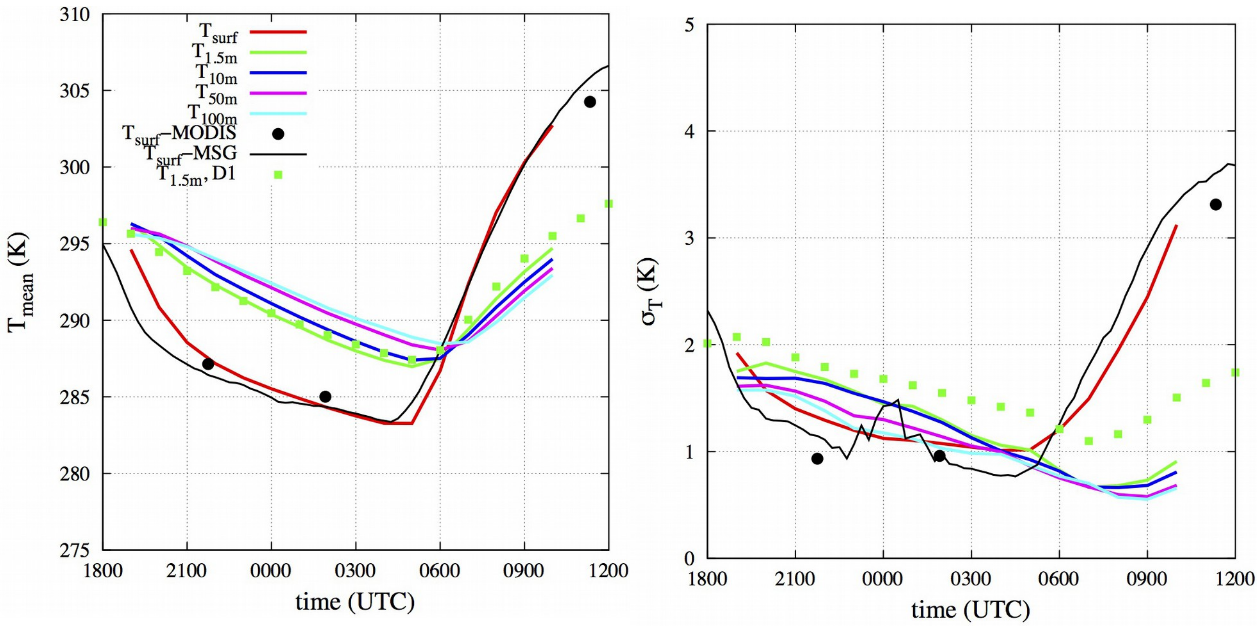
***DC17:***.Fig 3 Top left: evolution of the average air temperature for some levels of the model ... R: Please clarify the sentence. For which model domain?

***Answer and action in the paper:*** it is mentioned in the caption that it is for D1. We will add "model domain" after "D1" to improve clarity.

***DC18:*** Line 240-245 R: I) Please give an explanation to the high standard deviations of $T_{surf\_MSG}$ 29 and 30 of June (upper right panel on Fig 3). ii) Please give information about the comparison of model runs in D1 and D2 domains. What were the average temperature differences on the D2 model run using the 2 km and 400 m space resolution? If it is informative, please give a new figure.

***Answers:*** I) these large values were due to the presence of cloudiness that part of the day; ii) a new line (green dots) has been included in figures 3 bottom corresponding to the average and the sigma values for domain D1. No significative differences are seen in the averages and sigma is larger at D1 than at D2

***Actions in the paper:*** I) add in line 239: *Large puntual values of sigma(T) are due to cloudiness in June 29*, ii) The figures 3 bottom will be substituted by the ones below and in line 246, *"No significant differences are observed between D1 and D2 averaged values, but the standard deviation is higher at lower resolution, indicating that finer resolved scale motions may contribute to relax surface temperature variability"*




***<u>DC19:</u>*** Line 245-250: *"Therefore, for scales larger than 1 km the expected contribution of the advection term to the SEB would be of the order of 10 W m$^{-2}$ in the daytime and of 5 W m$^{-2}$ at night".* R: Please give information about the sign of the estimated advection in daytime and nighttime.

***Answer:*** the sign of the advection largely depends on the sign of the wind, which, to our effects, is arbitrary and we decide not to discuss about it. In 95% of the cases (see Cuxart et al, 2015), the imbalance misses energy, and we assume in this study that the advection effects will be a contribution trying to explain part of it. A short line is added in the manuscript about this issue.

***Action in the paper:*** Add in line 248 "*The sign of the advection term would result of the inspection of the wind direction between heterogeneities. We do not have detailed information at this stage and we restrict ourselves to discuss the order of magnitude of the term, expecting that normally it will be a contribution tending to reduce the imbalance."*

***<u>DC20:</u>*** Fig 4. R: i) Please give also the measurement interval. How did you calculate the temperature field for the given time?; ii) "The red rectangle indicates the position of the small square", what is meant by the small square? Please clarify the sentence; iii) If it is possible please give the scale in km in the figure of 1 and 4. This makes the analysis of the information easier.

***Answers and actions in the text:*** i) SUMO typically sampled at 1 Hz, meaning an effective LST resolution near 100 m when combined with the field of view of the camera from a height of 70 m; ii) the "small square" as introduced in section 2, is the flat 160m *160 m area where the surface based measurements were made; iii) figure 1 is better in lat/lon because of Earth's spherical form; for figure 4 equivalence to kilometres will be provided in the caption.

***<u>DC21:</u>*** Line 270-275 R: How do you estimate the temperature differences depending from Delta(x) distance? How do you estimate the mean horizontal temperature gradient in equation 4? Please give more detailed information about the methodology of the advection calculation based on the SUMO measurements.

***Answers:*** SUMO flies over a standard heterogeneous area in the Lannemezan Plateau, passing also over the "small square" where surface data are taken, which is singular compared to its surroundings, because it is squared, covered by a mixture of recently cut grass and some spots of bare soil, whereas the surroundings include small wooden areas and many grown agricultural fields. We firstly estimate Delta(LST) as the difference between average LST in the small red square and the average LST for the whole SUMO square in fig 4. Then we compute sigma(LST) from all the measurements over the SUMO square and we see that it compares very well with Delta(LST) in terms of time evolution and proportionality (see figs 5 left and 6 left). This allows us to make the strong hypothesis that we can substitute Delta(LST) by sigma(LST), sustained also by the fact that we are only interested in orders of magnitude, not in accurate estimations of its effect. Later we divide sigma(LST) by the resolution of the device to estimate delta(LST)/delta(x) by sigma(LST)/resolution. The final strong hypothesis is to assume that LST is a good surrogate of T(2m). Obviously all these hypotheses make the results only a first guess that must be confirmed by further studies, more precise, currently under way. In principle all this information is already given in the paper, but we will try to make the rationale more clear.

***Action in the paper:*** substitute paragraph 273-277 by the above explanation, written more succinctly.

***DC22:*** Fig 5. i) R: What is Tsup? Please clarify the headline; ii) Please give the algorithm in more detail for the calculation of temperature differences in fig. 5. Do you use any weighing factor depending on the distance from the small square?; iii) If it is possible please give information about the wind speed at 65m during the SUMO flights.

***Answers:*** i) Tsup is LST. It is described in the caption; ii) see previous answer (21); iii) these points comprise all the days when SUMO could fly, typically wind varied at that height between 2 and 5 m/s, but we do not see the point, more than a variation of LST resolution, which is already estimated broadly.

***DC23:*** Line 300-305 R: How do you estimate the sign of advection?

***Answer:*** see answer to DC19

***DC24:*** Line 305-310 R: I) Please give the type of the soil. ii) Please clarify the soil moisture contents in%? What are the typical maximum and minimum soil moisture contents in this case?

***Answer:*** the type of soil is mostly clay, sometimes bare, more often covered by a layer combining dead and alive vegetation. The units of soil moisture are percent of volume. Saturation contents is the one shown in figure 8 top left (just after intense rain). We ignore the minimum value, but the upper part dried very quickly and took very low values.

***Action in the paper:*** I) In line 310 "*The soil is mostly clay, many times covered by a mixture of vegetation dead and alive";* ii) In caption of Figure 8 add:*"The soil moisture is given in percent of volume"*

***DC25:*** Line 325-330 *"The air temperature is sampled at 1 Hz, equivalent to a spatial resolution of a few meters."* R: Please give information about the estimation of hysteresis of the measurements and the methodology of corrections.

***Answer:*** Flights were made at very low speed and a delay correction was applied to compensate for the relatively slow response time of the sensor.

***Action in the paper:*** Add in line 328 "The slow response time can be compensated by a numerical correction scheme which assumes a linear response of the sensor for the difference between instantaneous measured parameter (here: air temperature) and the true ambient value of this parameter (Reuder et al, 2009)

***Reference:*** Reuder, J., Brisset, P., Jonassen, M., Müller, M., & Mayer, S. (2009). The Small Unmanned Meteorological Observer SUMO: A new tool for atmospheric boundary layer research. *Meteorologische Zeitschrift*, *18*(2), 141-147.

***DC26:*** Fig. 9. R: Please give the definition of Tsup 10m. I cannot see the abbreviation 'sup' in the text. Please give the explanation of the different colours in the top right figure. Please give the date and starting time for example. Nocturnal flight pattern and LST values (bottom left) and air temperature at 5 m a.g.l. (bottom right). Please give the date.

***Answers and action in the paper***: i) Tsup 10 means LST as sampled from a height of 10 m agl; ii) the different colors in fig 9 (top right) correspond to 4 different profiles made nearby in the small square, all made within a couple of minutes. Both issues will be described in the figure caption.

***DC27:*** Nocturnal flight pattern and LST values (bottom left) and air temperature at 5 m a.g.l. (bottom right). R: Please give the date.

***Answer and action in the paper***: the date is July 5th, 2011, 0325 UTC. We have realized that the figures 5 bottom left and bottom right were exchanged! We have now corrected this issue and given the data in the figure caption.

***DC28:*** Line 340-345 *"If we just take 0.5 K for the day and 0.2 K for the night, the corresponding advection values would be 100 and 40Wm* $^{-2}$*."; Line 345-450 : "up to 2 K variations"* ; Line 350-355 ; *"being a factor that may oppose to runaway cooling as it is experienced in some numerical models …"*

R: If it is possible please give more concrete results about the measurements and the small scale modelling. How do you estimate the sign of the advection?

***Answer:*** These values for the multicopter are estimated from figure 9 and other similar figures not shown, and are only broad estimations. As stated before, a campaign is currently underway trying to provide better numerical estimations of this factors. Concerning the sign of advection, see again answer to DC19, but just let us mention that this particular issue will also be addressed in the new campaign.

***Action in the paper:*** In line 342: *"If we estimate the values from Figure 9 and take Delta(x) as 0.5 K for the day and 0. 2 K for the night..."*

***DC29:*** Line 355-360: Garai and Kleissi (2013) R: Please check the name Kleissi or Kleissl.
***Answer:*** KLEISSL

***DC30:*** Line 361 R: Please give information about the soil (wet or dry). How do the measured inhomogeneities depend on the state of the soil? If it is possible please give a sentence?

***Answer***: Soil was experiencing consecutive drying episodes, because there were rainy events about every 3 days. Therefore availability of soil moisture was high, even if the upper layer was drying progressively and relatively fast.

***Action in the paper:*** In line 361 add *"The moisture contents at the upper part of the soil may modulate these variations, but in general there was good availability of water in the upper part of the soil due to recent rain events"*.

***DC31:*** Line 360-365 "We estimate the gradient of temperature $\Delta T/\Delta x$ as $\sigma(T)/r$, where r stands for the resolution. "

R: It is the key sentence. Please give more detailed explanation. How do you estimate the natural standard deviation of temperature? If the advection is negligible, $\sigma(T)$ goes to zero, is it true?

***Answer:*** the basic explanation has been given in answer to DC19. Your last sentence is unclear to us. We are assuming that if there are local variations of temperature, and there is some wind moving them around, the corresponding thermal advection may bring or take away heat from the volume of interest. We would therefore say that, if wind is negligible or if the terrain is thermally homogeneous, then advection tends to zero, which seems to be very rarely the case.

***Action in the paper:*** the one described in answer to DC19

***DC32:*** Table I. R: Please give the height of temperature in term $\sigma(T)$(K). (I think it is the surface.)

***Answer and action in the paper:*** we describe in the text that it is hypothesized that T of air in the volume and LST have comparable variances. We will indicate this in the caption of the table.

***DC33:*** Line 375-380: *"This is in agreement with the previous argumentations of Foken (2008) ..."* R: Please clarify the citations Foken 2008a or 2008b or both.

***Answer and action in the paper***: Both. We will add both references in line 378.

***DC34:*** Line 65-70 *"In this work we concentrate on the importance of the advection term A in the SEB which represents the effect of the motions of timescales longer that the turbulence-averaged ones. "*

R: Please clarify the sentence and the mean goals of the paper because based on the discussion (see line 395, Therefore the most relevant range of scales is the one comprising the hectometer and the decameter scales.) the most relevant scales are 10-100 m, which are smaller than the calculated scale from the 30 min time scale with 1 m/s characteristic wind speed.

***Answer:*** You are right. We must stress that we refer to semi-permanent hectometer scales structures that last longer than 30', meaning those linked to well defined terrain heterogeneities, such as adjacent fields with different thermal properties. It is already said (line 398 and line 416 and the following ones), but we will make it clearer.

***Action in the paper:*** revise wording of the last paragraphs of the Conclusions so that they read better.

***DC35:*** Line 400-405 "… very much in accordance with the picture provided by LES and DNS of the Convective Boundary Layer, ... " R: Please give citations.

***Action in the paper***: In line 404 we cite the paper on DNS of the CBL by van Heerwaarden et al. (JAS, 2014):

***Reference:*** Van Heerwaarden, Chiel C., Juan Pedro Mellado, and Alberto De Lozar. "Scaling laws for the heterogeneously heated free convective boundary layer." Journal of the Atmospheric Sciences 71.11 (2014): 3975-4000.

***DC36:*** Other minor issues (typos and similar): They will be all taken into account.