

**Review of the manuscript:**

**”Estimation of the terms acting on local surface one-hour temperature variations in Paris region: the specific contribution of clouds”**

**by Rojas et al.**

## **General Comment**

In the paper ”Estimation of the terms acting on local surface one-hour temperature variations in Paris region: the specific contribution of clouds” by Rojas et al., the authors develop an observation-based linear model to predict hourly temperature changes at SIRTa near Paris, France, to analyze the drivers of short-term temperature variability. The model uses surface energy budget terms to estimate temperature changes, and in an evaluation is in overall good agreement with observations. The authors have performed a detailed analysis of the contributions of individual surface energy budget terms (i.e. radiation, ground heat exchange, atmospheric heat exchange, and advection) for different times of day/year. A random forest model is applied to further study the influence of the individual terms. Finally, the influence of clouds is analyzed with more detail, using e.g. lidar observations.

Overall, this is a well written paper that could present a valuable contribution to the field, and the topic is of interest to the readership of ACP. The authors’ conclusions are supported by the results displayed in the figures. In some parts of the manuscript, the descriptions are very detailed and rich (e.g. section 3 and the appendix), in other parts important information is missing (random forest analysis). I suggest this manuscript should be published in ACP after the comments have been adequately addressed.

## **1 Specific comments**

- l. 55–56 Results should not be mentioned in the introduction. Clouds are well known to modify near-surface air temperatures, which is justification enough to study them in more detail in this analysis.
- l. 101 I suggest the authors use the higher-resolved ERA5 land (small differences in wind direction and the temperature fields may be relevant for temperature advection due to the vicinity of Paris). Also, it is not mentioned here that temperature data is also used from reanalysis (only in l. 915). Please add this information.
- l. 140 I am guessing T2m is the near-surface air temperature and not the ”surface temperature”. Please correct this throughout the manuscript and appendix.

- l. 270–289 There is nearly no information here on most aspects of the random forests model, which makes it impossible to reproduce the model, and hence the results, from the text.
- I am guessing that the model is trained to predict the observed temperature changes or is it the modeled temperature changes?
  - What are the settings of the model, are the hyperparameters tuned, if so how?
  - How is the data split up into training, testing and validation, what is the skill of the model in predicting temperature changes and is it overfitting the training data?
  - The validation skill of the random forests model would be interesting - it should exceed the linear model if a) relations between predictors and the predictand are nonlinear or b) feature interaction effects help explain variability as hypothesized in l. 276. This should be tested and discussed.
- l. 296–299 I don't quite understand this reasoning, as a) the authors use this approach to quantify the contributions of each term for all times of day in Fig. 2d), and b) the separate daytime/nighttime methods are used to calculate the individual terms used as predictors in the random forests model, right? Also, it is not clear to me how the authors derive the diurnal cycle of the feature importance during each season, this should be described in more detail in the manuscript.
- l. 327–330 It would indeed be interesting to see if the temperature advection is wind-direction dependent. Is there a way to analyze the contribution of advection as a function of wind direction?

Fig. A1 The figures show typical daytime and nighttime temperature profiles for this region. What about sunrise and sunset, though? What uncertainties do these temperature profile regime transitions introduce at these times? This needs some discussion in the manuscript as diurnal cycles are investigated.

all Figs I think the quality of the figures should be improved by storing them as vector images instead of raster.

## 2 Technical corrections

- l. 7 Maybe it would be good to clarify that you mean "Local short-term temperature variations".
- l.12 Do you mean clear sky and cloudy sky?

- 1. 27 Please specify: variability of what?
- 1. 28–32 I think it would be good to be more precise on the temporal scales here.
  - 1. 35 I suggest replacing "air advection" with "temperature advection"
- 1. 54–55 I suggest removing "whose maximal ... ones.", as random forests are used for many purposes and this statement is only true for some of them.
  - 1. 62 and by time of day
  - 1. 73 objectives cannot be answered
  - 1. 74 "consists of describing" → "describes"
  - 1. 86 "Southwest" → "southwest"
  - 1. 145 x and y are not defined here (also missing in the appendix).
  - 1. 307 I think you may want to change "modulate" to "dominate"
- 1. 340–341 This sentence needs to be corrected.
  - 1. 354 I think it would be useful to show this histogram in the appendix.
- 1. 395–397 This seems to be a bit of an oversimplification of cirrus formation.
  - 1. 489 This is speculative and a new aspect that should be discussed previously.
- 1. 494–497 This sentence is hard to understand.
  - 1.530 The download links for the data should be provided in the acknowledgements.
  - 1. 807 Please correct the grammar of this sentence.
  - 1. 848 "exchange" → "exchanges"