

Interactive comment on “Breeze effects at a large artificial lake: summer case study” by Maksim lakunin et al.

Anonymous Referee #2

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This paper investigates changes in atmospheric variables in the area of Lake Alqueva, induced by the filling of this artificial lake in 2004. To identify the changes, two simulations were performed using a mesoscale atmospheric model, the Meso-NH model. In the first experiment, the lake is not present and in the second one, a lake model, Flake, is run in a coupled mode. The authors observed the formation of a lake breeze in the presence of the reservoir and identified impacts on the atmosphere.

This study is interesting as it quantifies the effects of a large lake on the weather of the region. The results are nice and innovative, in particular results presented in Fig. 11 and Fig. 13, but I think the author could go a bit further and relate their findings (in terms of simulations) with changes that have been observed at the weather stations. Did they also notice changes in the observed wind regime between 2010-2018 and

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year 1990-2000 for instance? Otherwise, the paper looks more like a first draft, which makes the reading quite painful. Some explanations are too vague, some acronyms are not defined, and many sentences are awkward. I highly recommend that an English speaker reads the manuscript before resubmitting.

Specific comments

- The formation of the lake breeze is not clearly explained.

- Some acronyms are given but they first need to be explained. For instance, in the introduction, you mention NH3D. What kind of model is it (ex: atmospheric model)? Same, when you mention Meso-NH model, SURFEX, Flake. As well, p.3: what is Csa? (Mediterranean climate) should appear in the text, and Csa should be in brackets (Csa according to the Köppen climate classification). Again, in p.6 ECOCLIMAP and SRTM. You need to clarify.

-P7. L34: You mention Flake results based on 2-4 months simulations. Did you perform these simulations? Which period did you choose to run these simulations? What is the correlation between simulated and observed data? I would like to see how well the model reproduces the surface temperatures. This is very important to assess the intensity of a lake breeze and the accuracy of the results.

-The discussion on the lake effects focuses on the southern part of the lake. Are the conclusions also valid in the Northern part of the lake?

-You mention that changes in relative humidity are mostly related to change in temperature. However, looking at Fig. 10 and Fig. 12, differences do not appear at the same place. It is maybe related to the fact that the hours on each subplot of figures 10 differ from those on figure 12. It would make sense to have something more homogeneous. Also, wouldn't it be worth adding a map, such as Figs. 10 and 12, representing surface specific humidity? Are there several descending branches of dry air over the lake?

-P.12 You indicate the maximum error in terms of temperature. My feeling is that a

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bias of 5° is quite a lot and especially when it last for several hours. I would expect a discussion on the impact of this bias on the turbulent fluxes or some hypothesis in order to explain why the fluxes are so well reproduced considering this bias. This could affect modelled lake surface temperature and the intensity of lake breezes.

The lake effect part is very interesting, but it is hard to follow the mechanism you describe. On Figure 11, you should draw circle where you identify “the upper-level convergent return circulation”. The figure needs to be bigger.

In the conclusion, I would expect some general comments on your findings. Are the conditions on July 22-24, representative of the conditions that prevail in this area in summer? What kind of experiments should be done in the future or is there anything you would like to investigate further? What are the limits to your conclusion? There are some biases in the atmospheric variables between modelled and observed data. How confident are you in your results?

The units are not systematically the same. Temperatures unit are for instance in °C in Fig. 5 but in K in Table 2.

P5: you mention 3 domains, A, B, and C, why don't you use these terms later in the text? For instance on P6: Domaine B required deep convection... It would make the manuscript easier to read.

Some figures are too small. For instance, Figure 5. Also use the same symbol for corresponding stations on each subplot. Figure 11 needs to be bigger.

Figure 10: you should name the cross section. For instance S1 and S2 and refer to them in the text. That would ease the reading.

Figure 13 and others: it is weird to have different scales for the windspeed. It is then difficult to assess the evolution of the windspeed throughout the day.

P8. You say twice that the domain B is used for validation with radiosondes.

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In the dataset section, try to gather the information per station. Also later in the text (p.11), you define the coordinates of the stations.

These sentences are unclear, please clarify:

- P1. Abstract: you say that two simulations have been done with the meso-NH model coupled to Flake. Only one was coupled, no?

- P1: L 25: daily air temperature near the surface is decreased in lake shore areas -> and above the lake?

- P1. L26: lake surface balances the atmosphere above ->clarify

- P2. L3: In autumn and winter it has the opposite effect due to the warmer air above lake surface: increase of evaporation and cloud formation -> not warmer air above the lake in summer?

- P2. L32: Simulation has been done for... -> which simulation are your talking about? A simulation performed within the ALEX2014 experiment?

- P4, L24: 3 stations of Instituto de Ciencias etc... -> what kind of stations? What kind of variables?

- ALEX and ALEX2014, is it the same database?

- P4. The two land stations your refer to, are they the weather stations you mentioned earlier? Gather the information and be consistent. Alqueva Montante and Montante, the same?

- You say that the choice of your study period is based on atmospheric conditions. But you also say that the project lasted for 3 days. Wasn't the choice more based on the availability of data?

- P. 9: the worse values are in the lower lever. What do you mean? Extremely bad?

- p. 9: patterns look similar. Are they similar or do they just look similar?

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- P.16: The first level of air above the lake is the most affected by its impact- > impact of what?
- P16: Need to clarify where you mention positive or negative anomalies. Over the lake?, over the land surface?.
- P.18, legend: what do you mean with projection of wind, same for figure 13.
- P.18: the fact RH is decreasing due to change in temperature is an important point. Remove "it should be noted"

Technical corrections

Here is a list of sentences that need to be rephrased :

- P.2 the using of coarse spatial resolution observations data
- On many pages: meteorological variables instead of parameters
- p.2, L20. Remove "in his PhD thesis also in Portuguese", not relevant
- p2, L 27. Surface models Masson et al used among atmospheric models by Meso-NH
- p2. L 29: allows to gain the results
- Many times, you use ":", make a sentence that includes what follows. For instance, you could replace the ":" by "such as "
- P4: L3: "on the surface level? -> at the surface
- P5: L10: For that, ->remove.
- P. 6:Longwave and shortwave radiative transfer equations are solved for independent air columns
- P6: A set of two numerical simulations were performed. . .
- P.9, L15: Temperature average bias is -0.13 K, RMSE 1.49 K, and correlation coeffi-

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cient is 0.99. Humidity average bias is 0.59% RMSE of 11.26 % and 0.87 correlation coefficient.

- P10. Scatter plots of air temperature, relative humidity, and wind speed shown on Fig. 5 -> verb missing
- P.10: The worse result are observed in comparison against Portalegre data
- P.11; Legend needs to be clarified. Comparison of modelled air temperature. . .with
- -p.11. L 7-8, suggestion: In the case the meteorological stations were located in a lake grid cell, the nearest land . . .
- P12. L2-3: Meso-NH underestimation of air temperature in the afternoon time is opposite of wind speed overestimation at the same period.
- P15, L3: is a 3 sets of -> consist of
- P15, L3: (for each horizontal resolution) > (one set per domain)
- P16, L14: which depth decrease (very clear seen on Fig.11). I don't know what you mean.

Typing errors and other mistakes

- p2. L20: a first attempt were done
- p3. L7: "if" instead of "of"
- p3, L8: 92 m instead of 92.0 m
- p4. L31: locaton
- p6. Table: convction
- p7: Flake were used
- p9, L5: accurace

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- p9. L11 et L15: supplementary
- p.9 Statistical results are following
- p. 11: meteostation
- p. 12, L19: minimums
- p.12, L22: are tend to
- p.20, L1: this zone -> This zone
- p.20, L4: midle
- P.10 L14: lesser
- P.10 L13. Verb missing
- P.16, L29: the teservoir
- P.16, L31: intensifies
- P.21: more wet
- P.18: Legend: cross-sections, at different times-> hours

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