

Interactive comment on “Weak and intense katabatic winds: impacts on turbulent characteristics in the stable boundary layer and CO₂ transport” by Jon A. Arrillaga et al.

Anonymous Referee #3

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General Comments: The manuscript investigates katabatic flows on the basis of 40 occurrences observed during one summer season at the foothills of the Guadarrama Mountain Range in Spain. The data set has been split up into weak, moderate and intense events, based on the observed maximum wind speed observed during each individual case and is then analyzed under various aspects. The study shows distinct differences between the different classes of katabatic flow, the number of intensive katabatic flow cases is, however, very low (3) and rises thus questions on the statistical significance of the reported results. The paper is in general well structured and includes a good literature overview on the subject. The figure layout is in general rather inhomogeneous over the paper and should be reworked. Several of the figures are in

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addition hard to read, mainly due to small labels and legends. Finally, the manuscript requires a thorough makeover by a native English speaker. Main points in this context are rather complicated sentence structures, unconventional wording obviously taken from the dictionary (e.g. emplacement instead of site/location), missing commas, the improper use of prepositions and articles, and grammatically incomplete sentences. I have marked a quite a few, but far from all, instances in my specific comments.

Specific comments:

- 1) P1, L1: “on the dynamics” instead of “in the dynamics”
- 2) P1, L5: insert comma after “moderate and intense”
- 3) P1, L9: insert “flow” after “katabatic”
- 4) P2, L26: “at contrasting” instead of “in contrasting”
- 5) P2, L28: insert comma after “model”
- 6) P2, L33: “In contrary” instead of “At contrary”
- 7) P3, L8 and 11: “emplacement” is rather uncommon, better “site or location”?
- 8) P3, L15-16: “on the concentration” instead of “in the concentration”
- 9) P3, L16: remove “the” before “CO₂”
- 10) P3, L16: “in coastal areas” instead of “at local areas”
- 11) P3, L27: sentence incomplete; “the role of., in CO₂ mixing ratios” ; should be “in controlling/affecting CO₂ mixing ratios”
- 12) P3, L34: insert “concentrations” after “CO₂”
- 13) P4, L23: “a relatively” instead of “an relatively”
- 14) P4, L23-24: “immediately besides” is quite strange; better “close to”?

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- 15) P4, L29-30: “needleleaved evergreen tree cover”, sounds complicated; isn’t it just “coniferous”?
- 16) P4, L34: replace “inexistent” by “absence of”
- 17) P5, L8: formatting error “CO₂” subscript
- 18) P6, L5: insert “concentrations” after “CO₂”
- 19) P6, L7: “Forty were selected as days.” The sentence is grammatically poorly formulated and hard to read. Please rephrase
- 20) P7, L2: insert “the criteria” after “meet”
- 21) P7, L2 (and other instances): replace “minutal” by “minute”
- 22) P7, L4: replace “weak” by “low”
- 23) P7, L29: there is no Figure 5a)
- 24) P8, L34: Why are you presenting a 4th-order polynomial fit; any physical reasoning for this? A simple trend could also be seen from a linear regression, and the two peaks resulting from your fit seem to be rather arbitrary; Thus I see a big danger of an over-interpretation of non-existing features in the corresponding paragraphs on page 9, L1-13 (see also my comment on Figure 7)
- 25) P9, L17-18: “. . . . , the shear associated with the katabatic flow increases, and the downslope flow strengthens progressively.” I do not understand the direct link between this two statements; How can increase in shear strengthen the downslope flow? Might also be a misunderstanding from my side, but then the sentence should be rephrased
- 26) P9, L20: insert “the” before “surface”
- 27) You should define the calculation of VTKE already here, and not two lines under
- 28) P10, L2: insert comma after the parenthesis with the wind speed

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- 29) P10, L10: “increases linearly”; I could also see a square root dependency here
- 30) P10, L29: replace “on” by “for” or “during”
- 31) P10, L32: insert comma after “night”
- 32) P11, L17: Sentence has to start with an upper case letter; “Van Hooijdonk. . . .”
- 33) P11, L25-26: “intense and weak katabatics cluster into two clearly distinct regimes”; at 8 m I still see a considerable amount of black and red data points for SC<3 with distinct elevated VTKE levels; can you explain/comment on this
- 34) P12, L4: put “by definition” between commas
- 35) P12, L17: replace “related with” by “related to”
- 36) P13, L7-8: start the sentence with “In contrary, U remains. . . .”
- 37) P13, L12: insert comma after “takes place”
- 38) P13, L25: replace “so doing” by “doing so”
- 39) P14, L9: insert comma after “SBL”
- 40) P14, L20: insert comma after “nearly 0”
- 41) P14, L21: insert comma after “assumption”
- 42) P14, L22: insert comma after the reference
- 43) P14, L25: insert comma after “equation”
- 44) P 15, L8-10: this sentence has to be rephrased, maybe even better split in to or three! In particular complicated is the part “. . .by the presence upwind of a land use component of forest.”
- 45) Some small inconsistencies in the references
 - a. Boundary Layer Meteorol. vs Boundary-Layer Meteorol.; I believe the latter one is

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the usual b. A few journal abbreviations are not terminated by a period; e.g. Borge et al. and Plaza et al.

c. Presentation of doi or not for articles

46) Page 22, Table 1; inaccurate caption, I suggest: "Specification of the values measured and the devices"; the specification of a value is not technical!

47) Page 24, Table 3; add number of occurrences for each class in the table; maybe also an idea to place the measurement frequency directly in the table for each sensor instead of using the footnote solution

48) Page 25, Figure 1a; the location names are difficult to read; use larger fonts and bold style; in addition have the degree symbols in the axes labels an underscore that should be removed

49) Page 27, Figure 3: I suggest to split this figure in 3 separate ones for the weak, moderate and intensive cases; as it is presented now you loose a lot of information by the averaging; I would also like to see the 40 individual profiles in this plots, e.g. as grey lines in the background

50) Page 31, Figure 7: I cannot see that the applied 4th-order fitting makes any sense; do you have any physical reasoning for your choice

51) Page 34, Figure 10: labels/legends too small

52) Page 35, Figure 11: a) use different line styles for 4 and 8 m (in particular important for the intense event in red); why have you selected 21:00 as last time you present; from the time series it looks like that is more a transition phase, while e.g. 22:00 appears to be a more stationary situation; b), d), f): I suggest to use a common x-axis span at least for the wind speed

53) Page 36, Figure 12: axis labels too small!

54) Page 37, Figure 13: use different line styles for 4m and 8 m

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-944>, 2018.

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