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Comment on acp-2022-49

Anonymous Referee #2

Referee comment on "Convective updrafts near sea-breeze fronts" by Shizuo Fu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-49-RC2, 2022

This study is looking at updrafts around Sea Breeze fronts. I find the topic interesting, but much of the work here could do with a little bit more in-depth analysis. Some of the figures seem to have little added value over some of the others, and as a result the paper seems to mostly get stuck in a qualitative description of SBFs that has been known for a while. I would hope that the authors could sharpen the paper up a bit, with some suggestions below. Most importantly, I would be interested to see where a different updraft definition could lead, especially for a more robust statistical sampling. I would therefore recommend major revisions to this paper.

Methodological questions:

*) Lagrangian particles without a subgrid scale model. As suggested by L104, this would be not necessary for “large collections”, but then the authors start tracing particles in a small single updraft

*) Only a small subset of the domain is initialized with particles, resulting in a depletion of the particle concentration and the need for a reset (together with the lack of subgrid model). Thus, particles end up being inhomogenously distributed across the updraft, and may cause biases.

*) The selection of updrafts purely based on their mid-BL w is a noisy way of doing it, with arbitrary tuning parameters, and assuming that a thermal extends through the boundary layer without tilt in this highly sheared environment (let alone a bubble vs plume discussion). What are the sensitivities to those parameters? And why not use buoyancy, or

better yet an emitting/decaying scalar like Couvreux et al (2010 or so)?

Content:

*) Fig 4: Not entirely sure what I am supposed to get out of this that isn't in Fig 3. Same for Fig 6: This seems to be the same information already in Fig 3 ?

*) Fig 5: I'm not sure how the separation in 4 different groups happens exactly. Is this by 25%ile initial location along the x axis? Please describe this better. Also, the most important conclusion of Fig 5 seems obvious if only qualitative. (Near SBF parcels have the SB circulation superimposed on them). Is there a way to quantify this, in a statistical approach over many different plumes?

*) Fig 7: What is the added value of the Lagrangian approach here? The buoyancy and pressure gradient terms are also possible to calculate over a conditional average of the plume – with the bonus that it could cover all plumes in the entire Near/Far region. Or are the particles necessary to offset the challenges in the updraft definition above?

*) Fig 9: If this is all dependent on very classical parameters, but not on the difference between those parameters (see for instance van Heerwaarden et al, JAS 2014)? Surely that should break at extreme values? Or is it because there simply was no ocean heat flux in this case?