Interactive comment on “Ship plume dispersion rates in convective boundary layers for chemistry models” by F. Chosson et al.

Anonymous Referee #2

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General Comments

This paper examines the dependence of ship plume dispersion rates on initial buoyancy fluxes at ship stack height in convecting atmospheric boundary layers. The authors find that the initial buoyancy fluxes have little effect on dispersion rates even though the simulated plumes themselves look strikingly different given different initial buoyancy fluxes. They also relate the turn-over timescale of the convective boundary layer to the dilution timescale of the plume.

The paper is well-organized and the figures support the central arguments. Experiments are well-designed and the results increase our knowledge of the behavior of ship plumes in convecting boundary layers, which brings us closer to better parame-
specific comment: 1. although it makes sense that the vertical acceleration can be related to the temperature difference in eqn (7); it is not clear how that vertical acceleration relates to the definition of \( w_b \) in equation (4). could you make it clearer?

2. figure 2: at first glance, the color scale having white as the maximum (0.27 K) is confusing because the background color is white. the contour which represents the plume envelope encloses a huge white section which is not (i think) intended to be the max. temperature difference.

technical comments: 1. variable names for the buoyancy flux \( F \overline{\text{overbar}} \) and the dilution rate \( F(t) \) are both capital \( F \). might want to change one of them for clarity.

2. following list is typo. errors:

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- (line 4) on the early stage of the plume
- (line 6) proved the chemical modeling community
- (line 9) effects of the plume
- (line 10) have a minor effect on the plume
- (line 18) the world fleet
- (line 22) politicians
- (line 24) scales.
(9) biases arise especially from the
(13) simulations have been
(14) descriptions
(15) layers are still lacking
(22) propose a simple
(24) simulation set-up
(29) initial buoyancy fluxes

(3) transport models;
(12) The spatial and temporal evolution of a ship plume is simulated
(25) in the MBL, and ... for cloud studies

(7) as in the case of a
(10) processes that must take
(12) most of the
(14) formulae
(11) of the others

(3) modelling
(29) simulations can be identified by

(14) All of these
(16) combinations
(22) different times

(18) independent of

(24) mixing is

(7) of time)
(9) which diffuses
• (14) depend on
• (23) boundary layer situations
• (25) flux acts

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• (24) sections
• (26) at a well-mixed... (but biases..

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• (4) that the early stage
• (17) impact of the plume rise

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• (7) more effort
• (9) left for future work.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 6793, 2008.