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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling the chemical effects of ship exhaust in the cloud-free marine boundary layer" *by* R. von Glasow et al.

Anonymous Referee #2

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This paper explores the chemistry associated with ship plumes as they mix into the cloud-free marine boundary layer. The goal of the study is to assess the extent to which the consideration of plume dynamics and chemistry alters the simulated effects of ship emissions on the chemical composition of the marine boundary layer.

The goal of the paper is laudable, and the paper attempts to address an important gap in our understanding of marine boundary layer chemistry. However, the paper falls short on some points which I discuss in more detail below:

(i) A 'brute-force' analysis approach is taken throughout the paper. Too many sensitivity runs are presented, without enough thought given to carefully distilling the results and presenting a few cases which would highlight the important issues. As a result, the the paper is very hard to read, and the graphs are very hard to decipher. More importantly,

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given the constant background, isn't it obvious that the differences between the plume and the background will go to zero on the time-scale associated with the plume mixing into the background. Thus, isn't the relevant issue what happens to the background reservoir?

(ii) If the relevant issue is what happens to the background reservoir, then a focus on this question should be the central theme of the paper. In this context, the upscaling procedure discussed in the paper seems to be extremely contrived and again is very difficult to comprehend. There are a number of seemingly artificial assumptions throughout the construction of the upscaling procedure. For example, is it implicitly assumed that all ships in any 1730 km x 1730 km cell have been emitting for 2 days into this cell? It would seem so, but again it very difficult to tell. A clearer an dsimpler upscaling procedure should be the goal of the paper.

(iii) To the extent that upscaling is presented in the paper, direct comparisons to observations (not just with means and medians, but with various percentiles) should be presented to give a clearer indication of the extent to which the consideration of plume dynamics and chemistry closes the gap in our understanding of the effects of ship emissions on the chemical composition of the marine boundary layer.

One other minor point -

I do not understand the explanation on the SO2 lifetime at the end of section 3.1. The S(IV) oxidation in cloud drops is referred to - but isn't this paper dealing with the cloud-free marine boundary layer?

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 525, 2002.