Author Comments
Oct 12, 2009

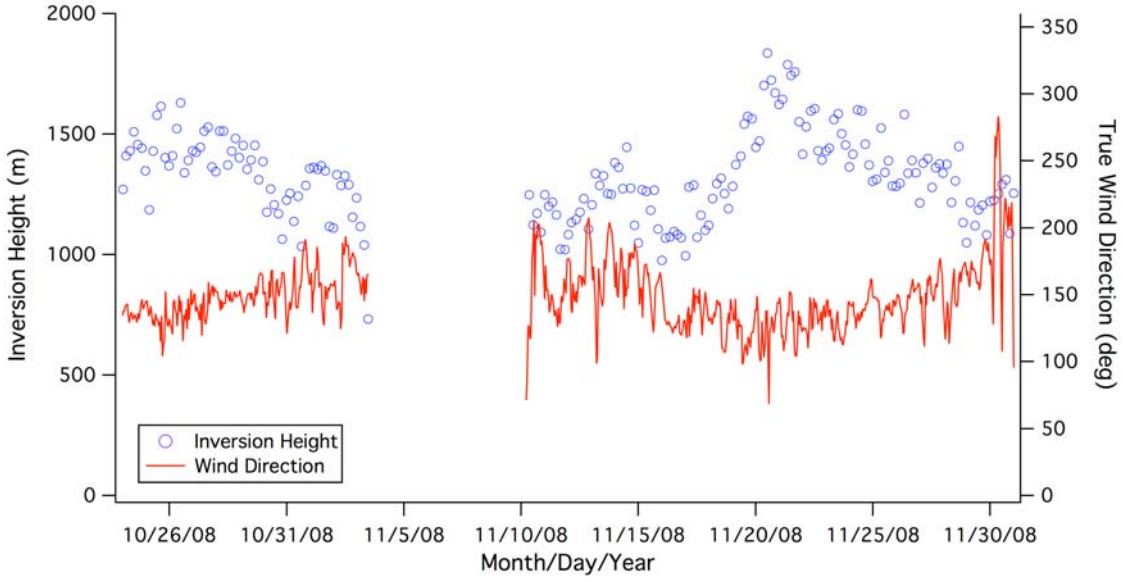
Much appreciation for the constructive *comments and suggestions from Anonymous Referee #1*. We agree that the method and results presented in this paper are likely applicable to only stratocumulus-covered marine boundary layers where mesoscale instabilities and horizontal heterogeneities are limited. Here are our replies to specific comments:

Specific comments: Abstract
Use of the term 'robust' is a bit too strong for this technique. Only under the near-ideal environmental circumstances such as in the VOCALS region could one use this approach. Suggest use of an adjective such as 'effective' in this context.

Suggestion accepted.

2.1 Surface flux of DMS
The wind direction history is critically important in your work, and I suggest that you include time series to demonstrate the predominance of open ocean winds in the region. Also, I agree with the review of Faloona that demonstration of the VOCALS region with a map (schematically showing predominant wind direction, gradient of the surface DMS concentration, etc) will be illustrative.

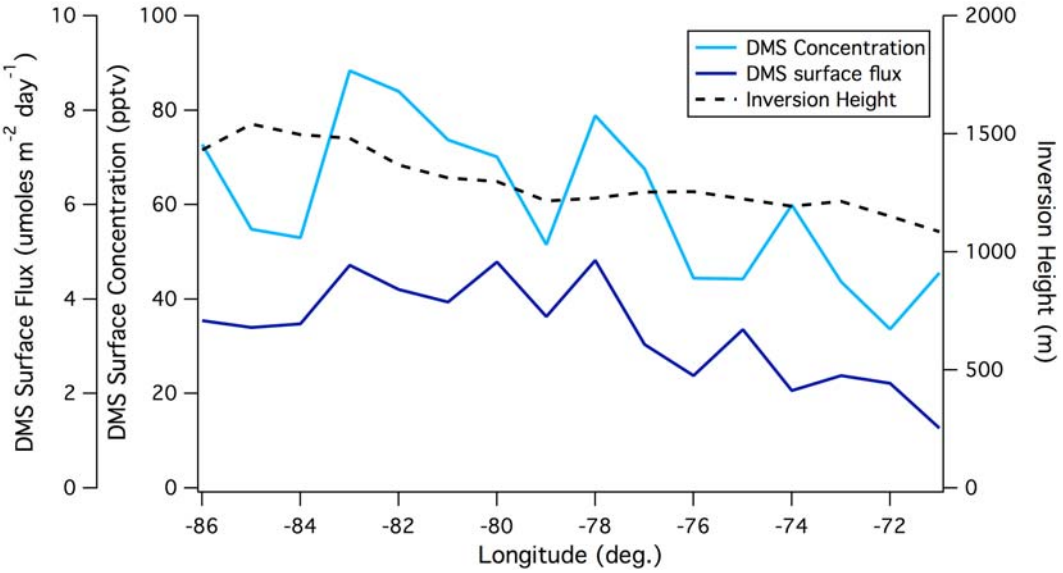
Thank you for the suggestion. We can include the following figure that shows the time series of wind direction (from a sonic anemometer) and inversion height (from radiosondes). The wind was consistently from the S/SE, with little variation in direction with height in the MBL.



2.2 Boundary layer structure
From the VOCALS website, it appears that there were regular radiosondings from the

ship. The profiles from the radiosondes will show boundary layer depth most effectively, and these data should be used in your analysis. The C-130 data are not sufficient, particularly when you have readily-available T/RH profiles every 6 hours. This will impact Figures 4-7. It may be possible to extend the analysis to develop an OH concentration time-series, as opposed to developing a composite diurnal concentration of OH for the 5 week period.

Due to the consistency in boundary layer structure in the stratocumulus region, boundary layer heights determined from the C-130 profiles, from the radiosondes, and from the W-band radar were nearly identical. It is true, however, that shipboard radiosondes and W-band radar measurements had better temporal coverage. The W-band measured at the highest frequency; however it wasn't functioning well enough to resolve the cloud top height during the first ~10 days of the cruise.
Here we have updated Fig. 5 from the manuscript, replacing inversion height determined from the C-130 with that from radiosondes.



For Fig. 6 and 7, cloud top height from the W-band was preferred because it had a better resolution for the 24 hours of the day than either the radiosondes or the C-130.

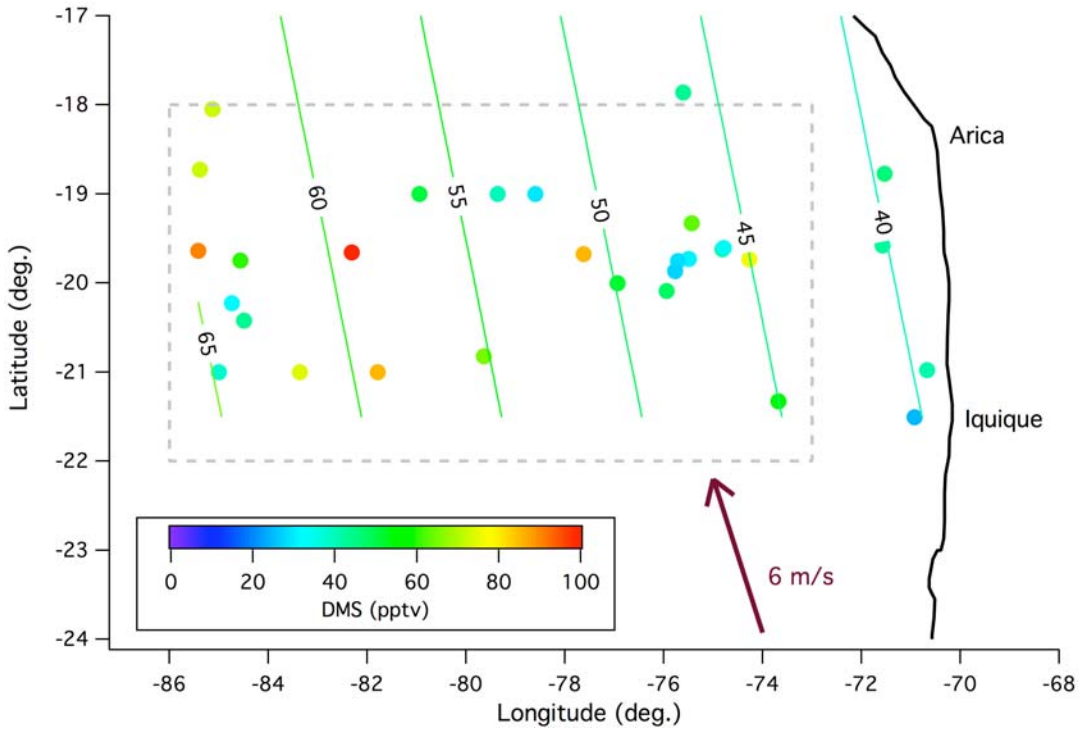
We agree that an OH concentration time-series will be even more useful than our current estimated month-long average. However, on short timescales, it is difficult to quantify the importance of the time-rate-of-change in DMS as well as the advective terms. It may be appropriate to defer such an endeavor to a later paper.

2.3 Advective flux of DMS
The designation 'DMS' in the text should be more clear whether it is the surface value, measured value, marine boundary-layer concentration, etc. For example, in the first couple of paragraphs of this section, it is mentioned that 'DMS is patchy', and that you are estimating the 'advective flux of DMS', which presents a degree of ambiguity. Suggest you be more specific.

Suggest you show the result of the lat/long regression of the DMS concentrations on a map.

Thank you for the suggestion. We approximate the atmospheric DMS concentration measured from the ship at 18 m to be the "surface" concentration of DMS (DMS_0). To be specific, we can use $\overline{DMS}$ to indicate the MBL average concentration, and DMS_{zi}- to indicate the concentration of DMS just below the inversion.

We average the surface DMS concentration to daily values to remove its diel variability, which is color-coded in the map below (filled circles). We have also overlaid contours from the multi-regression of daily DMS concentration vs. lat and lon. The gradient is clearly orthogonal to the mean wind vector, which is shown on the bottom right of the figure. The dashed line defines the "VOCALS averaging region."



2.4 Entrainment velocity

Again, there is some ambiguity as to whether the term 'DMS' refers to the surface concentration, near-surface atmospheric value, boundary-layer top value, etc. This is true for the legends in the figures (for example, in Figure 5, is this the 18-m DMS concentration, integrated through the BL, etc?).

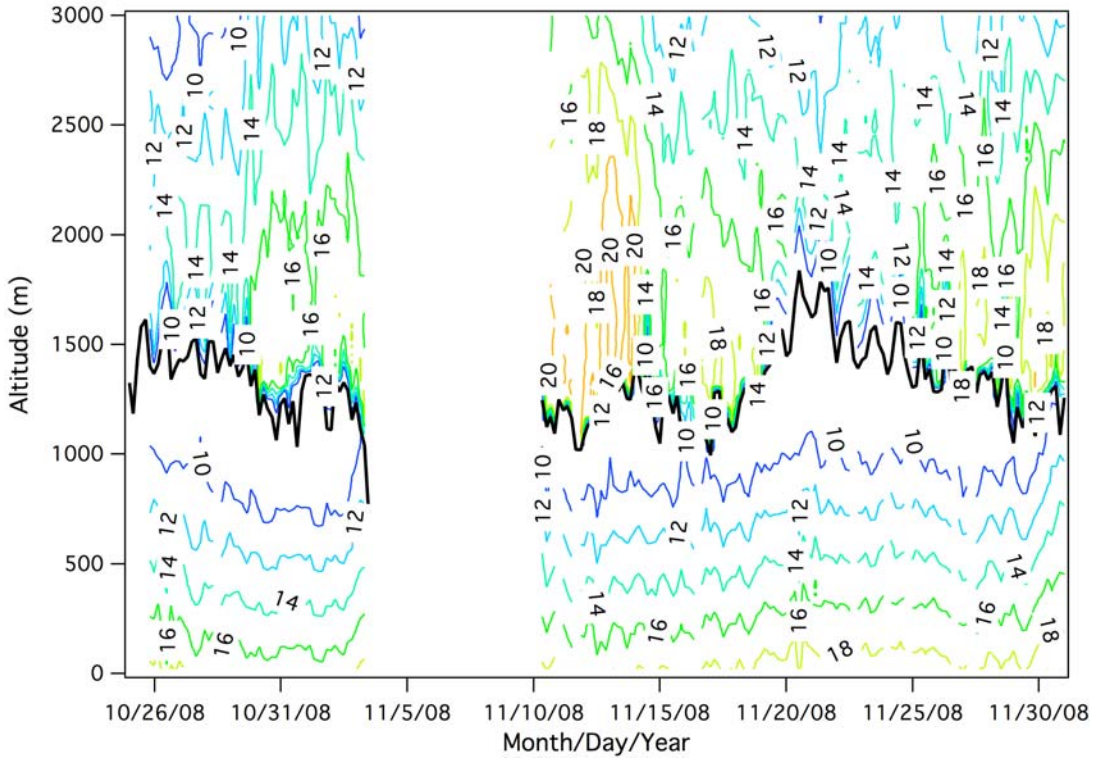
See our response above regarding the designation of variables. Fig.5 shows the measured DMS concentration at 18 m, not the column integral.

2.5 Estimating effective OH

What does it mean to have a 'mean MBL temperature' of 13 degC? The BL profile of

temperature is non-trivial and impacts the interpretation and relative weight applied to either Equation 1 or 2. An explanation should be made as to the importance of water vapor here. Again, BL heights from radiosondes will be instrumental here. The discussion of relative error is important here, and I suggest that this be extended to develop error ranges for the final result (such as Figure 7).

From the soundings, the boundary layer looked to be nearly adiabatic below the cloud, and moist-adiabatic in the cloud. The mean MBL temperature of 13 ºC in the current manuscript was determined from C-130 profiles. Radiosonde profiles showed the same temperature in the middle of the MBL. The figure below shows the temperature contour during VOCALS (in ºC) from soundings. The dark line defines the inversion.



Excellent suggestion to extend our error analysis to the final result. The uncertainty of the inversion height from the W-band (and soundings) is about one range gate, or 25 m (S. de Szoeke, personal communication, 2009). Assuming an absolute uncertainty of 2 mm sec^{-1} for the entrainment velocity and 0.1 for the 'decoupling parameter', the propagated absolute uncertainty for the equivalent OH concentration is about 0.2 molecules cm^{-3}, or 15%.

3.1 Diel variability of OH
Suggest addition of the word 'of ' between 'amount' and 'shortwave'.
4 Conclusions
Replace the word 'relative' with 'relatively'.

Suggestions accepted.