We like to thank the referee for taking the time to review our manuscript and provide the helpful comments. Our responses are detailed below (in blue).

C2.1 General Comment: The measurement of the vertical flux is essentially a measure of the concentration gradient of glyoxal. As such, a discussion of how elevated concentrations in the residual layer or in the lower free troposphere may impact these results would be of interest. Further, can the authors comment on whether known gas-phase chemistry occurring several meters above the ocean surface could explain these results (i.e. do we need to invoke a reaction at the air-sea interface?).

R2.1 Regarding known gas phase chemistry occurring between the ocean surface and the measurement inlet, this is very similar to the second comment from Referee #1 please refer to our response R1.2 for clarification, and appropriate text has been added to Section 4 to address this concern.
Our group recently has conducted first measurements of glyoxal vertical profiles over oceans from aircraft, and presented about this topic at conferences. However, we have not yet published these results. We note here, that any glyoxal in the residual layer could only contribute to the negative flux signals observed during the daytime. It would not help explain a positive flux signal at night, which only partially explain the observed change in the glyoxal VMR. As such, the conclusion that a gas-phase production mechanism is needed in order to explain these values (Section 4) is robust.

Specific Comments:
C2.2 P. 6245, title: Why is Fast capitalized?

R2.2 "Fast" is capitalized in the name of the instrument to distinguish this mode of operation (~2 Hz) from the normal operation of similar instruments (~few min time resolution).

C2.3 P. 6255, line 7: While the motivation to not degrade the wind data is understandable, I would have expected interpolation of data from 2-10 Hz to be more problematic. What type of interpolation was used and how does this potentially impact results?

R2.3 A linear interpolation was used for this data, but this is not expected to impact the results much; the correction for the high frequency attenuation was calculated to be at most 10% (Section 3.3.3).

C2.4 P. 6255: How did the determination of the phase correction by the N2 pulse agree with a lag time determination by autocorrelation analysis, as is often done in these types of measurements?

R2.4 The autocorrelation method is not a viable option for these particular measurements as that the flux signal for glyoxal is too weak, and only visible after significant averaging of data.

C2.5 P. 6256: The drop in O4 signal is a measure of the gas exchange time of the inlet (and response time of the instrument to O4). This technique has been used by others to compare inlet/instrument response for different molecules (those with high and low Henry's law constants for example). As such, it would be very interesting to show the decay in the glyoxal in addition to O4. I would expect glyoxal to be best fit by two exponentials (one for gas exchange in the inlet and the second for gas/wall interactions).

R2.5 An explicit time series has not sufficient signal-to-noise to provide a similar analysis as we show it for O_4, for glyoxal. The glyoxal signal is too weak to directly apply inlet characterization methods to these measurements.

C2.6 P. 6260, line 8: Was any attempt made at computing an O4, NO2, or H2O flux? I would expect this to nicely show no net flux for O4, but perhaps the H2O flux could be of use?

R2.6 The revised manuscript now includes calculations of the NO_2, H_2O and O_4 flux data, and a discussion in a separate Section 4.2.2. A separate Figure 10 has been added.